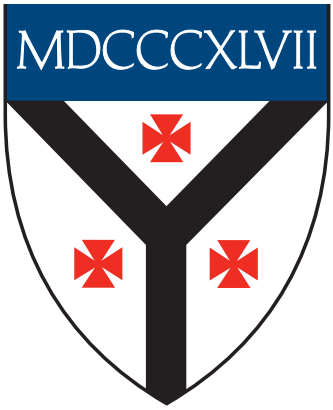
Graduate School of Arts and Sciences

Programs and Policies

2025–2026



BULLETIN OF YALE UNIVERSITY

Series 121 Number 6 July 15, 2025

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Managing Editor: Kimberly M. Goff-Crews
Editor: Steve Aitken
PO Box 208230, New Haven CT 06520-8230

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Graduate School of Arts and Sciences

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THE PRESIDENT AND FELLOWS OF YALE UNIVERSITY

President
Maurie Dee McInnis, B.A., M.A., Ph.D.

Fellows
Gina Rosselli Boswell, B.S., M.B.A., Columbus, Ohio (*June 2029*)
Michael James Cavanagh, B.A., J.D., Philadelphia, Pennsylvania (*June 2026*)
Maryana Felib Iskander, B.A., M.Sc., J.D., Round Rock, Texas (*June 2029*)
William Earl Kennard, B.A., J.D., Charleston, South Carolina (*June 2026*)
Frederic David Krupp, B.S., J.D., Norwalk, Connecticut (*June 2028*)
Carlos Roberto Moreno, B.A., J.D., Los Angeles, California (*June 2026*)
Felicia Norwood, B.A., M.A, J.D., Indianapolis, Indiana (*June 2030*)
Carter Brooks Simonds, B.A., M.B.A., Greenwich, Connecticut (*June 2031*)
Joshua Linder Steiner, B.A., M.St., New York, New York (*June 2030*)
David Li Ming Sze, B.A., M.B.A., Hillsborough, California (*June 2030*)
Jaime Brooks Teevan, B.S., S.M., Ph.D., Bellevue, Washington (*June 2031*)
Marta Lourdes Tellado, B.A., Ph.D., New York, New York (*June 2028*)
David Anthony Thomas, B.A., M.A., M.A., Ph.D., Atlanta, Georgia (*June 2027*)
Neal Steven Wolin, B.A., M.Sc., J.D., Washington, D.C. (*June 2029*)
His Excellency the Governor of Connecticut, *ex officio*
Her Honor the Lieutenant Governor of Connecticut, *ex officio*

THE OFFICERS OF YALE UNIVERSITY

President
Maurie Dee McInnis, B.A., M.A., Ph.D.

Provost
Scott Allan Strobel, B.A., Ph.D.

Secretary and Vice President for University Life
Kimberly Midori Goff-Crews, B.A., J.D.

Senior Vice President for Operations
Jack Francis Callahan, Jr., B.A., M.B.A.

Senior Vice President for Institutional Affairs and General Counsel
Alexander Edward Dreier, A.B., M.A., J.D.

Vice President for Finance and Chief Financial Officer
Stephen Charles Murphy, B.A.

Vice President for Alumni Affairs and Development
Joan Elizabeth O'Neill, B.A.

Vice President for Human Resources
John Joseph Whelan, B.A., J.D.

Vice President for Facilities, Campus Development, and Sustainability
Jack Michael Bellamy, B.S., M.S.

Vice President for Information Technology and Campus Services
John Patrick Barden, B.A., M.B.A.

Vice President for Communications
Jean Renee Kopkowski, B.A.

THE ADMINISTRATION OF THE GRADUATE SCHOOL

OFFICE OF THE DEAN

Lynn Cooley, Ph.D., Dean of the Graduate School
Maureen Farrell, M.S., Director of Communications
Leah Jehan, Senior Executive Assistant to the Dean

ACADEMIC AFFAIRS

Pamela Schirmeister, Ph.D., Deputy Dean, Graduate School; Deputy Dean and Dean of Undergraduate Education and Senior Associate Dean, Yale College
Michelle Nearon, Ph.D., Senior Associate Dean and Director, Office for Graduate Student Development and Diversity
John Alvaro, Ph.D., Associate Dean for the Biological and Biomedical Sciences
Jasmina Besirevic Regan, Ph.D., Associate Dean for Graduate Education
Allegra di Bonaventura, J.D., Ph.D., Associate Dean for Graduate Academic Support
Robert Harper-Mangels, Ph.D., Associate Dean for Admissions and Financial Support
Sarah Insley, Ph.D., Assistant Dean for Academic Support
Ksenia Sidorenko, Ph.D., Assistant Dean for Diversity
Suzanne Young, Ph.D., Assistant Dean for Graduate Student Professional Development

GRADUATE ADMISSIONS

Leah Phinney, M.B.A., Director of Admissions
Nick Drake, M.A., Assistant Director of Non-Degree Programs
Lisa Furino, Assistant Director of Admissions

FINANCIAL AID

Kerry Worsencroft, B.S., Director of Financial Aid
Kellie Webb, A.A., Assistant Director of Financial Aid
Matthew Regan, M.B.A., Assistant Director, Teaching Fellow Program

ADMINISTRATION

Mary Magri, M.B.A., Senior Director of Finance and Administration
Michael Pearson, Director of Financial Operations and Compliance
Theresa Pierson, M.B.A., Director of Staff Operations
Linda Reyes, M.B.A., Manager of Budgets and Financial Analysis
Eduardo Cienfuegos Fernandez, M.B.A., Financial Analyst

OTHER ACADEMIC OFFICERS WITH RESPONSIBILITIES IN THE GRADUATE SCHOOL

Maurie McInnis, Ph.D., President
Scott Strobel, Ph.D., Provost
Steven Wilkinson, Ph.D., Dean of the Faculty of Arts and Sciences
Jeffery Brock, Ph.D., Dean of the School of Engineering & Applied Science

SCHEDULE OF ACADEMIC DATES AND DEADLINES

The following dates are subject to change as the university makes decisions regarding the 2025–2026 academic year. Changes will be posted online on the graduate school's website.

FALL TERM 2025

Aug. 18	M	New student orientation week begins (mandatory)
Aug. 25	M	Add/drop period opens, 8 a.m.
Aug. 27	W	Fall-term classes begin
Aug. 29	F	Monday classes meet on Friday Due date to notify department of intention to submit dissertation for award of the Ph.D. in December Final day to file petition for M.A., M.S., and M.Phil. degrees to be awarded in December
Sept. 1	M	Labor Day. Classes do not meet
Sept. 5	F	Add/drop period ends, 5 p.m.
Sept. 9	T	Final day for registration. A fee of $50 is assessed for course schedules accepted after this date Fall-term record will be removed for students who submit the dissertation on or before this date
Sept. 10	W	Final day to apply for a fall-term personal leave of absence The entire fall-term tuition charge or continuous registration fee (CRF) will be cancelled for students who withdraw from the graduate school on or before this date or who are granted a leave of absence effective on or before this date
Sept. 20	SA	One-half of the fall-term full tuition charge will be canceled for students who withdraw from the graduate school on or before this date, or who are granted a medical leave of absence effective on or before this date. The CRF is not prorated
Oct. 1	W	Due date for dissertations to be uploaded to DPRS in order to be considered by the Degree Committee for award of the Ph.D. in December Final date for the faculty to submit grades to replace grades of Temporary Incomplete (TI) awarded during the previous academic year
Oct. 14	T	October recess begins after last academic obligation
Oct. 20	M	Classes resume
Oct. 24	F	Midterm Final day to change enrollment in a fall-term course from Credit to Audit or from Audit to Credit Final day to withdraw from a fall-term course One-quarter of the fall-term full tuition charge will be canceled for students who withdraw from the graduate school on or before this date, or who are granted a medical leave of absence effective on or before this date. The CRF is not prorated
Oct. 31	F	Readers' Reports are due for dissertations to be considered by the Degree Committee for award of the Ph.D. in December

Nov. 5	W	Final day to withdraw a degree petition for degrees to be awarded in December
Nov. 7	F	Deadline for departments to return Degree Recommendation Forms for December degrees to registrar
Nov. 14	F	Registration for spring term 2026 opens, 8 a.m.
Nov. 21	F	November recess begins after last academic obligation
Dec. 1	M	Classes resume
Dec. 3	W	Final day to submit petitions for extended registration and Dissertation Completion Status for the spring term
Dec. 11	TH	Classes end Final examinations begin
Dec. 17	W	Examinations end Winter recess begins after last academic obligation
Dec. 18	TH	Registration for spring term 2026 closes, 5 p.m.
Dec. 22	M	Date of December degree award

SPRING TERM 2026

Jan. 5	M	Final grades for fall-term courses due Final day that faculty may submit a request for the assignment of a grade of Temporary Incomplete Add/drop period opens 8 a.m.
Jan. 12	M	Spring-term classes begin
Jan. 19	M	Martin Luther King, Jr. Day. Administrative offices are closed. Classes do not meet
Jan. 21	W	Add/drop period closes, 5 p.m. A fee of $50 is assessed for course schedules accepted after this date Spring-term record will be removed for students who submit the dissertation on or before this date
Jan. 23	F	Monday classes meet
Jan. 26	M	Final day to apply for a spring-term personal leave of absence The entire spring-term tuition charge or continuous registration fee (CRF) will be canceled for students who withdraw from the graduate school on or before this date, or who are granted a leave of absence effective on or before this date
Feb. 5	TH	One-half of the spring-term full tuition charge will be canceled for students who withdraw from the graduate school on or before this date, or who are granted a medical leave of absence effective on or before this date. The CRF is not prorated
Feb. 15	SU	Due date to notify department of intention to submit dissertation for award of the Ph.D. in May Final day to file petitions for M.A., M.S., and M.Phil. degrees to be awarded in May

Mar. 6	F	Midterm Spring recess begins after last academic obligation Final day to change enrollment in a spring-term course from Credit to Audit or from Audit to Credit Final day to withdraw from a spring-term course One-quarter of the spring-term full tuition charge will be canceled for students who withdraw from the graduate school on or before this date, or who are granted a medical leave of absence effective on or before this date. The CRF is not prorated
Mar. 15	SU	Due date for dissertations to be uploaded to DPRS for consideration by the Degree Committee for award of the Ph.D. in May
Mar. 23	M	Classes resume
Apr. 3	F	Good Friday. Administrative offices closed. Classes meet
Apr. 10	F	Registration for fall term 2026 opens, 8 a.m.
Apr. 15	W	Readers' Reports are due for dissertations to be considered by the Degree Committee for award of the Ph.D. in May
Apr. 17	F	Deadline for departments to return Degree Recommendation Forms for May degrees to registrar Final day to withdraw a degree petition for degrees to be awarded in May
Apr. 30	TH	Classes end Final examinations begin
May 6	W	Final examinations end
May 8	F	Final grades for spring-term courses are due for candidates for terminal M.A. and M.S. degrees to be awarded at Commencement
May 15	F	Registration for fall term 2026 closes, 5 p.m.
May 17	SU	Graduate School Convocation
May 18	M	University Commencement Date of May degree award
May 27	W	Final grades for spring-term and full-year courses due Final day that faculty may submit a request for the assignment of a grade of Temporary Incomplete
June 3	W	Final day to submit petitions for extended registration and Dissertation Completion Status for the fall term

A MESSAGE FROM THE DEAN

Welcome to the Graduate School of Arts and Sciences at Yale University, the first of its kind in North America. The graduate school stands at the very heart of Yale's mission as a university, and this publication, *Programs and Policies*, reveals the extraordinary breadth of opportunities for graduate study at Yale. As you peruse it, you likely will discover the intriguing ways in which graduate study differs from the undergraduate experience and the fulfillment brought by this intellectual progression. You have undertaken to explore a field in depth, master an area of inquiry, and learn to disseminate knowledge through classroom teaching. Graduate education culminates in a creative and original contribution in one's field of study representing the ability to participate in the advancement of human knowledge.

Yale's departments and programs constitute the center for most graduate student intellectual and social life at Yale. They comprise vital communities of faculty and students from around the world and with diverse backgrounds who share a common interest in advancing a particular discipline. Graduate students and faculty alike gain immeasurably from their intellectual and disciplinary collaborations. Yale's excellent laboratory facilities, unique museum collections, and tremendous library holdings all enrich the experience of a Yale University graduate education.

The Graduate School of Arts and Sciences has worked to extend and enrich the community life found within these disciplines. Interdisciplinary programs and institutes, as well as the events offered through the McDougal Graduate Student Center, the Office for Graduate Student Development and Diversity, the Office of Career Strategy, and the Poorvu Center for Teaching and Learning help graduate students prepare for their professional lives. The graduate school enables students to connect with skilled experts with a shared commitment to careers in teaching, research, and an array of potential leadership opportunities.

Use *Programs and Policies* as a guide throughout your graduate study at Yale. It includes practical information about registration, financial aid, teaching experiences, university resources available to you, and the full range of assistance provided by the graduate school. All of us in the graduate school wish you good fortune as you pursue your advanced degree, and we want you to contact us if we can help you along the way. Graduate study is exhilarating and life changing. For well over a century Yale has prepared students for truly extraordinary careers across many old, new, and evolving disciplines.

Lynn Cooley, Ph.D.
Dean, Graduate School of Arts and Sciences
Vice Provost for Postdoctoral Affairs
C.N.H. Long Professor of Genetics and Professor of Cell Biology and of Molecular, Cellular, and Developmental Biology

THE GRADUATE SCHOOL OF ARTS AND SCIENCES

The Yale Graduate School of Arts and Sciences is one of fifteen schools composing Yale University and the only one that awards the degrees of Doctor of Philosophy, Master of Philosophy, Master of Arts, and Master of Science. The work of the graduate school is carried on in the divisions of the Humanities, Social Sciences, Biological Sciences, and Physical Sciences and Engineering. Sixty departments and programs offer courses of study leading to the Ph.D. degree. Twenty-three departments and programs offer terminal master's degrees.

Yale began to offer graduate education in 1847, and in 1861 it conferred the first Ph.D. degrees in North America. In 1876 Yale became the first American university to award the Ph.D. to an African American. The Graduate School of Arts and Sciences was formally established in 1892, when the first dean was appointed. It was in that same year that women were first admitted as candidates for the doctorate.

The graduate-school community has grown vigorously since the early twentieth century; today it comprises more than 3,500 graduate students and a faculty of over 1,100 who are among the world's most distinguished teachers and scholars. Admission to the graduate school is highly competitive; currently each entering class is made up of about 700 students.

The graduate school's purpose is to educate students in research, scholarship, and teaching in the arts and sciences. Under the guidance of the faculty, graduate students engage in advanced study of a discipline and then proceed to generate new knowledge and ideas through research. They learn to disseminate this knowledge in scholarly publications and teaching. Yale's graduate students have built careers in colleges and universities, research laboratories, government, the nonprofit sector, and private industry. Their education equips them for leadership roles in each of these callings.

Yale's standing as a great international research university is based on the strength and reputation of its graduate programs. The pursuit of advanced learning and new knowledge takes place in the departments and programs of the graduate school. Thus, it is the graduate school that makes Yale a university. Furthermore, graduate students as scholars and teachers in training engage with undergraduates and the faculty. A shared sense of common purpose makes Yale a community of scholars and a center of vibrant, intellectual exchange.

Mission Statement

The Graduate School of Arts and Sciences educates graduate students to seek answers to life's most challenging questions by leading in the advancement, application, and preservation of knowledge. We carry out this mission by investing in and drawing upon the strengths of a collaborative, diverse, and inclusive community of scholars and researchers.

Yale and the World

The Yale Graduate School has always comprised an international community, but it recognizes as well that now, more than ever, advanced scholarship must occur on transnational grounds. It is increasingly important that we prepare our students to participate in a global economy of research and knowledge and that we create institutional channels through which such participation can flourish. In addition to formal student exchanges that enable graduate students to perform research and fieldwork abroad, individual faculty members, departments, and the school participate in collaborative efforts with international partners.

Over 40 percent of full-time graduate students at Yale come from outside the United States. In addition, many international students come to the graduate school as nondegree students in the Division of Special Registration (DSR). DSR students may undertake course work and/or research for periods of one term or one year. When appropriate the period may extend for a second year. These students are subject to the usual admissions procedure, are admitted to a department, and often work with a specific faculty member.

A GLOBAL UNIVERSITY

Global engagement is core to Yale's mission as one of the world's great universities. Yale aspires to:

- Be the university that best prepares students for global citizenship and leadership
- Be a worldwide research leader on matters of global import
- Be the university with the most effective global networks

Yale's engagement beyond the United States dates from its earliest years. The university remains committed to attracting the best and brightest from around the world by offering generous international financial aid packages, conducting programs that introduce and acclimate international students to Yale, and fostering a vibrant campus community.

Yale's globalization is guided by the vice provost for global strategy, who is responsible for ensuring that Yale's broader global initiatives serve its academic goals and priorities, and for enhancing Yale's international presence as a leader in liberal arts education and as a world-class research institution. The vice provost works closely with academic colleagues in all of the university's schools and provides support and strategic guidance to the many international programs and activities undertaken by Yale faculty, students, and staff.

Teaching and research at Yale benefit from the many collaborations underway with the university's international partners and the global networks forged by Yale across the globe. International activities across all Yale schools include curricular initiatives that enrich classroom experiences from in-depth study of a particular country to broader comparative studies; faculty research and practice on matters of international importance; the development of online courses and expansion of distance learning; and the many fellowships, internships, and opportunities for international collaborative research projects on campus and abroad. Together these efforts serve to enhance Yale's global educational impact and are encompassed in the university's global strategy.

The Office of International Affairs (https://world.yale.edu/oia) provides administrative support for the international activities of all schools, departments, centers, and organizations at Yale; promotes Yale and its faculty to international audiences; and works to increase the visibility of Yale's international activities around the globe. OIA also coordinates Yale's program for hosting scholars at risk.

The Office of International Students and Scholars (https://oiss.yale.edu) hosts orientation programs and social activities for the university's international community and is a resource for international students and scholars on immigration matters and other aspects of acclimating to life at Yale.

The Yale Alumni Association (https://alumni.yale.edu) provides a channel for communication between the alumni and the university and supports alumni organizations and programs around the world.

Additional information may be found on the "Yale and the World" website (https://world.yale.edu), including resources for those conducting international activities abroad and links to international initiatives across the university.

The Dean

Lynn Cooley; grad.dean@yale.edu

The dean of the graduate school is appointed by the president of the university and is responsible for the educational mission of the graduate school, the quality of its programs, and the welfare of graduate students.

Deputy Dean

Pamela Schirmeister, Deputy Dean, Graduate School; Deputy Dean and Dean of Undergraduate Education, Yale College; pamela.schirmeister@yale.edu

Associate and Assistant Deans for Academic Affairs

Michelle Nearon, Senior Associate Dean and Director, Office for Graduate Student Development and Diversity (OGSDD); michelle.nearon@yale.edu
John Alvaro, Associate Dean for the Biological and Biomedical Sciences; john.alvaro@yale.edu
Jasmina Besirevic Regan, Associate Dean for Graduate Education; jasmina.besirevic@yale.edu
Allegra di Bonaventura, Associate Dean for Graduate Academic Support; allegra.dibonaventura@yale.edu
Robert Harper-Mangels, Associate Dean for Admissions and Financial Support; robert.harper-mangels@yale.edu
Sarah Insley, Assistant Dean for Academic Support; sarah.insley@yale.edu
Ksenia Sidorenko, Assistant Dean for Diversity; ksenia.sidorenko@yale.edu
Suzanne Young, Assistant Dean for Graduate Student Professional Development; suzanne.young@yale.edu

The academic deans of the graduate school are responsible for the administration of graduate programs in consultation with the directors of graduate studies, and for the

academic progress and well-being of students. They participate in decisions regarding admissions, financial aid, academic performance, and the application of the policies of the graduate school.

Directors of Graduate Studies (DGS)

A senior faculty member, appointed by the dean, serves as director of graduate studies (DGS) for each department or program. The directors of graduate studies are responsible for the satisfactory administration of the programs and function as advisers and guides to all graduate students in their respective departments and programs. They help graduate students to plan an appropriate course of study and research, and they advise on course schedules. The DGS acts as the liaison between each student in the department or program and the Office of the Dean.

Graduate Student Development and Diversity

Michelle Nearon, Senior Associate Dean and Director, OGSDD; Warner House, 1 Hillhouse Ave.
Ksenia Sidorenko, Assistant Dean for Diversity; Dow Hall, 370 Temple St.
Suzanne Young, Assistant Dean for Graduate Student Professional Development; McDougal Center, 135 Prospect St.
Kristina Lynch, Associate Director of Student Support and Community Standards; Dow Hall, 370 Temple St.

The Office for Graduate Student Development and Diversity (OGSDD) is committed to expanding the diversity of the student body and enhancing the intellectual experience of the entire scholarly community. The OGSDD coordinates efforts to recruit and retain students at the graduate school. The senior associate dean works collaboratively with departments and programs to support the needs of all students as they pursue graduate study. The following programs and activities fall under the purview of the OGSDD: informal advising of prospective and current graduate students, the Summer Undergraduate Research Fellowship (SURF) Program, the Post-Baccalaureate Research Education Programs, Recruitment Days, Preview Days, GSAS First-Year Focus, and the Annual Yale Bouchet Conference on Graduate Education. The assistant dean of diversity, the assistant dean for graduate student professional development, and annually appointed graduate student fellows assist with the development and implementation of these programs, as well as virtual recruitment fairs and webinars, small-group-discussion seminars, mentoring programs, workshops and lectures, and social and professional development events.

McDougal Graduate Student Center

Founders Hall, 135 Prospect St., upper level, 203.432.BLUE (2583), mcdougal.center@yale.edu
http://gsas.yale.edu/life-yale/mcdougal-graduate-student-center

A generous gift from Alfred McDougal ’53 and his wife, Nancy Lauter, enabled Yale to create the McDougal Graduate Student Center in 1997. The McDougal Center provides space and programs for building intellectual, cultural, and social community, as well as facilitating professional development activities across the departments of the graduate

school. The McDougal Center endowment supports the facilities of the center and the appointment of more than sixty McDougal Fellows in five offices who create programs and services for the graduate community through five collaborating offices for Graduate Student Development and Diversity, Career Strategy, Graduate Student Life, and the Poorvu Center for Teaching and Learning's Graduate Writing Lab and Graduate Teaching Program.

GRADUATE STUDENT LIFE

Jennifer Mendelsohn, Director, McDougal Center; Founders Hall, 135 Prospect St., upper level, Rm. 186, jennifer.mendelsohn@yale.edu
http://gsas.yale.edu/life-yale/graduate-student-life-office
http://yaleconnect.yale.edu

The Office of Graduate Student Life is responsible for student life programs in the McDougal Center and student services in the graduate school. McDougal Graduate Student Life Fellows and staff produce a wide array of student life programs annually, including arts, literary, music, sports, and cultural events; health and wellness programs; outings; family activities and resources; international student events; public service opportunities; and dances and other social events. Graduate Student Life advises and supports more than seventy graduate student organizations, which sponsor events at the center, on and off campus. Activities are announced in the weekly email McDougal Graduate Student Life Notes, on social media, and on the Yale Connect site listed above. This office also oversees the facilities and general services of the McDougal Center, assists with departmental recruitment activities, and organizes new student orientation and graduate school dean's social events.

EMBEDDED MENTAL HEALTH SERVICES

Eva Wilson, Ph.D., Lead Embedded Mental Health Clinician
Julian Arias, M.S.W., L.C.S.W, Embedded Mental Health Clinician

Admissions

http://gsas.yale.edu/admission
graduate.admission@yale.edu
203.432.2771

Leah Phinney, Director
Nick Drake, Assistant Director of Non-Degree Programs
Lisa Furino, Assistant Director

The Office of Graduate Admissions supports the work of the faculty, programs, and deans of the graduate school by providing a centralized admissions process for attracting, admitting, and recruiting talented scholars and researchers from a broad range of backgrounds and perspectives to Yale. The office also assists applicants with the application and onboarding process.

Financial Aid

http://gsas.yale.edu/funding-aid/office-financial-aid
gradfinaid@yale.edu (gradfinaid@yale.edu)

Kerry Worsencroft, Director
Kellie Webb, Assistant Director
Lisbeth Chamba, Accounting Advisor and Financial Aid Advisor
Dawn Galbiscek, Senior Administrative Assistant

The Office of Financial Aid is a resource to graduate students, departments, and non-Yale organizations needing guidance or assistance regarding financial aid policies and the administration of fellowships and student loan programs. The office oversees and maintains financial and data management systems and disburses all graduate student financial aid.

Registrar's Office

https://registrar.yale.edu
registrar.gsas@yale.edu

Shonna Marshall, University Registrar
Renée Kamauf, Deputy University Registrar

The Registrar's Office maintains the academic records of all students in the graduate school. In addition, the office develops course and classroom schedules and oversees registration, tuition charges, academic holds, dissertation submission, final clearance at graduation, and release of diplomas for Commencement. Students should consult this office to report changes in name or social security number, to request transcripts, or to certify their enrollment in the graduate school. Students can change their address listing at https://registrar.yale.edu/students/yale-hub.

Teaching Fellow Program

http://gsas.yale.edu/academic-professional-development/teaching-fellow-program
teaching.fellows@yale.edu
Pamela Schirmeister, Deputy Dean, Graduate School; Deputy Dean and Dean of Undergraduate Education, Yale College; pamela.schirmeister@yale.edu Matthew Regan, Assistant Director; matthew.regan@yale.edu

The Teaching Fellow Program is the principal framework at Yale in which graduate students learn to become effective teachers. Learning to teach and to evaluate student work is fundamental to the education of graduate students. The Teaching Fellow Program provides opportunities for graduate students to develop teaching skills, under faculty guidance, through active participation in the teaching of Yale undergraduates. Teaching fellows who encounter problems or difficulties related to their teaching roles are encouraged to meet with the assistant director of the Teaching Fellow Program or the deputy dean.

Committees

Currently three standing committees are concerned with the policies and procedures of the graduate school; as with all standing committees, their deliberations are confidential. Student members of these committees are nominated by the Graduate Student Assembly.

The Executive Committee A committee of faculty members and graduate students, chaired by the dean, advises the dean on broad matters of policy, procedure, and curriculum and makes recommendations to the faculty of the graduate school.

The Degree Committee Composed of senior faculty and chaired by the dean, this committee meets twice a year and is responsible to the faculty of the graduate school for maintaining standards of graduate education in the school and for recommending candidates for degrees. The committee may review special academic problems of individual students and, when appropriate, the educational programs of the departments.

The Committee on Regulations and Discipline Composed of four graduate students, four faculty members, and two associate or assistant deans, this committee reviews alleged violations of the regulations governing academic and personal conduct.

Graduate Student Assembly (GSA)

gsa@yale.edu
http://gsa.yale.edu

Students in the graduate school are represented collectively by the Graduate Student Assembly (GSA), which provides a forum for students to address issues across the graduate school and university. The GSA consults with the dean and other administrators on proposed changes in graduate school policy, raises concerns expressed by the student body, nominates the student members of all graduate school standing committees, and administers a conference travel fund for graduate students. Representatives to the assembly are elected by students in individual departments and degree programs. Each department or program has at least one student representative, with additional representatives allotted proportionally by size of the student population.

Graduate and Professional Student Senate (GPSS)

gpss@yale.edu
https://gpsenate.yale.edu

The Graduate and Professional Student Senate (GPSS) is composed of student-elected representatives from each of the fourteen graduate and professional schools at Yale. Any student enrolled in these schools is eligible to run for a senate seat during fall elections. As a governing body, the GPSS advocates for student concerns and advancement within Yale, represents all graduate and professional students to the outside world, and facilitates interaction and collaboration among the schools through social gatherings,

academic or professional events, and community service. GPSS meetings occur on alternating Thursdays and are open to the entire graduate and professional school community, as well as representatives from the Yale administration. GPSS also oversees the management of the Gryphon, a graduate and professional student center, located at 204 York Street. The center provides office and event space for GPSS and other student organization activities, funds student groups, and houses Gryphon's Pub, open nightly.

DEGREE-GRANTING DEPARTMENTS AND PROGRAMS

This section provides information on all degree-granting departments and programs of the Graduate School of Arts and Sciences. Each listing provides a roster of faculty, special admissions and degree requirements, and course offerings for that department or program. The requirements appearing in the *Graduate School of Arts and Sciences Programs and Policies* take precedence over any statements published separately by individual departments and programs.

The degree requirements of the graduate school itself appear later in this publication, under Policies and Regulations. These apply to all students in the graduate school, although there are variations in the pattern of their fulfillment in individual departments and programs. The requirements of the graduate school may change from time to time. If a requirement changes within the period normally required for completion of a student's course of study, the student will normally be given the choice of completing either the new or the old requirement.

The requirements of individual departments also may change from time to time, with the approval of the graduate school. All changes in departmental degree requirements occurring after the publication closing date of the *Graduate School of Arts and Sciences Programs and Policies* bulletin are posted on the departments' websites. General changes to degree requirements will be posted on the graduate school's website (https://gsas.yale.edu).

The course listings and instructors reflect information received by the registrar as of the publication date and are subject to change without notice. Students are advised to consult https://courses.yale.edu for the most recent information.

Fall-term courses are indicated by the letter "a," spring-term courses by the letter "b"; summer courses are indicated by the letter "c." A course designated "a or b" is the same course given in both terms. Yearlong courses list both "a" and "b." Courses in brackets are not offered during the current academic year.

African Studies

Council on African Studies
The MacMillan Center
137 Rosenkranz Hall, 203.432.1425
http://african.macmillan.yale.edu
M.A.

Chair
Cajetan Iheaka (*English*)

Director of Graduate Studies
Jill Jarvis (*French*)

Director of Program in African Languages
Kiarie Wa'Njogu (203.432.0110, john.wanjogu@yale.edu)

Professors Serap Aksoy (*Epidemiology*), Lea Brilmayer (*Law*), Richard Bucala (*Internal Medicine*), Theodore Cohen (*Epidemiology*), John Darnell (*Near Eastern Languages and Civilizations*), Anna Dyson (*Architecture*), Owen Fiss (*Emeritus*; *Law*), Robert Harms (*History*), Cajetan Iheka (*English*), Ann Kurth (*Nursing*), Daniel Magaziner (*History*), Roderick McIntosh (*Anthropology*), Stephanie Newell (*English*), Elijah Paintsil (*Pediatrics*; *Epidemiology*; *Pharmacology*), Catherine Panter-Brick (*Anthropology*), Curtis Patton (*Emeritus*; *Epidemiology*), David Post (*Ecology and Evolutionary Biology*), Asghar Rastegar (*Emeritus*; *Internal Medicine*), Ian Shapiro (*Political Science*), Donna Spiegelman (*Biostatistics*), Michael Veal (*Music*), Sten Vermund (*Epidemiology*; *Pediatrics*), David Watts (*Anthropology*), Elisabeth Wood (*Political Science*)

Associate Professors Katharine Baldwin (*Political Science*), Marie Brault (*Public Health*), Cécile Fromont (*History of Art*), Jill Jarvis (*French*), Kaveh Khoshnood (*Epidemiology*), Louisa Lombard (*Anthropology*), Urania Magriples (*Obstetrics, Gynecology, and Reproductive Sciences*), Meleko Mokgosi (*School of Art*), LaRon Nelson (*Nursing*), Sunil Parikh (*Public Health*; *Internal Medicine*), Carla Staver (*Ecology and Evolutionary Biology*), Jonathan Wyrtzen (*Sociology*)

Assistant Professors Amy Bei (*Epidemiology*), Lauren Berquist (*Economics*), Nicholas R. Jones (*Spanish*), Benedito Machava (*History*), Hani Mowafi (*Emergency Medicine*), Kyama Mugambi (*Divinity*), Nontsikelelo Mutiti (*School of Art*), Oluwatosin Onibokun (*Obstetrics, Gynecology, and Reproductive Sciences*), Nana Osei Quarshie (*History*), Tracy Rabin (*Internal Medicine*), Jeremy Schwartz (*Internal Medicine*), Sheela Shenoi (*Internal Medicine*), Carla Staver (*Ecology and Evolutionary Biology*), Jessica Thompson (*Anthropology*)

Lecturers Adalgisa Caccone (*Ecology and Evolutionary Biology*), Lacina Coulibaly (*Theater and Performance Studies*), Leslie Gross-Wyrtzen (*African Studies*), W. Casey King (*Public Health*), Sarah Ryan (*Law*), David Simon (*Political Science*), Veronica Waweru (*African Languages*)

Senior Lectors Oluseye Adesola (*Yorùbá*), Jonas Elbousty (*Near Eastern Languages and Civilizations*), Matuku Ngame (*French*), Nandipa Sipengane (*isiZulu*), Kiarie Wa'Njogu (*Swahili*)

FIELDS OF STUDY

African Studies considers the arts, history, cultures, languages, literatures, politics, religions, and societies of Africa as well as issues concerning development, health, and the environment. Considerable flexibility and choice of areas of concentration are offered because students entering the program may have differing academic backgrounds and career plans. Enrollment in the M.A. program in African Studies provides students with the opportunity to register for the many African studies courses offered in the various departments of the Graduate School of Arts and Sciences and the professional schools.

The Program in African Studies also offers interdisciplinary seminars to create dialogue and to integrate approaches across disciplines. In addition to the M.A. degree program, the Council on African Studies offers students in the university's doctoral and other professional degree programs the chance to obtain a Graduate Certificate of Concentration in African Studies by fulfilling a supplementary curriculum. (See Council on African Studies, under Non-Degree Granting Programs, Councils, and Research Institutes.) Joint degrees are possible with the approval of the director of graduate studies (DGS) and the relevant officials in the Schools of the Environment and Public Health and the Law School.

The African collections of the Yale libraries together represent one of the largest holdings on Africa found in North America. The university now possesses more than 220,000 volumes including, but not limited to, government documents, art catalogs, photographs, manuscripts, correspondence, and theses, many published in Africa.

SPECIAL REQUIREMENTS FOR THE M.A. DEGREE

The Yale University Master of Arts degree program in African Studies was instituted in 1986. The two-year interdisciplinary, graduate-level curriculum is intended for students who will later continue in a Ph.D. program or a professional school, or for those who will enter business, government service, or another career in which a sound knowledge of Africa is essential or valuable. A student may choose one of the following areas of concentration: history; anthropology; political science; sociology; arts and literatures; languages and linguistics; religion; environmental and development studies; and public health.

The program requires sixteen courses: one compulsory interdisciplinary seminar, Gateway to Africa (AFST 5505); four courses of instruction in an African language; four courses in one of the foregoing areas of concentration; four other approved courses offered in the graduate school or professional schools; and three terms of directed reading and research (AFST 5580, AFST 5590, and AFST 9900) during which students will complete the required thesis, and one of which takes place as field research (with permission of the DGS, AFST 9951 may be substituted for AFST 5590). The choice of courses must be approved by the DGS, with whom students should consult as soon as possible in the first term.

THE MASTER'S THESIS

The master's thesis is based on research on a topic approved by the DGS and advised by a faculty member with expertise or specialized competence in the chosen topic.

Students must submit their thesis for joint evaluation by the adviser and a second reader, who is chosen by the student in consultation with the DGS.

PROGRAM IN AFRICAN LANGUAGES

The language program offers instruction in four major languages from sub-Saharan Africa: Kiswahili (eastern and central Africa), Wolof (through a consortium agreement with Columbia University), Yorùbá (West Africa), and isiZulu (southern Africa). Language-related courses and language courses for professionals are also offered. African language courses emphasize communicative competence, and instructors use multimedia materials that focus on the contemporary African context. Course sequences are designed to enable students to achieve advanced competence in all skill areas by the end of the third year, and the African Languages program encourages students to spend one summer or term in Africa during their language study.

Noncredited instruction in other African languages is available by application through the Directed Independent Language Study program at the Center for Language Study. Contact the director of the Program in African Languages.

More information is available on the program's website, http://african.macmillan.yale.edu.

COURSES

AFST 5505a, Gateway to Africa Veronica Waweru
This multidisciplinary seminar highlights the study of contemporary Africa through diverse academic disciplines. Each session features a Yale faculty scholar or guest speaker who shares their unique disciplinary perspective and methodological approach to studying Africa. Topics include themes drawn from the humanities, social sciences, and public health, with faculty representing expertise from across Yale's graduate and professional school departments. The course is intended to introduce graduate students and upper-level undergraduates to the breadth and depth of Yale scholarship on Africa, facilitating the identification of future topics and mentors for thesis or senior paper research. Each weekly seminar focuses on a specific topic or region, and students are exposed to various research methods and techniques in archival research, data collection, and analysis. A specific goal of the course is to impart students with knowledge of how research across diverse disciplines is carried out, as well as to demonstrate innovative methodology, fieldwork procedures, presentation of results, and ethical issues in human subjects research.

AFST 5568a, Tackling the Big Three: Malaria, TB, and HIV in Resource-Limited Settings Sunil Parikh
Malaria, tuberculosis, and HIV account for more than five million deaths worldwide each year. This course provides a deep foundation for understanding these pathogens and explores the public health issues that surround these infectious diseases in resource-limited settings. Emphasis is placed on issues in Africa, but contrasts for each disease are provided in the broader developing world. The course is divided into three sections, each focusing in depth on the individual infectious disease as well as discussions of interactions among the three diseases. The sections consist of three to four lectures each on the biology, individual consequences, and community/public health impact of each infectious disease. Discussion of ongoing, field-based research projects involving the diseases is led by relevant faculty (research into practice). The

course culminates with a critical discussion of major public health programmatic efforts to tackle these diseases, such as those of PEPFAR, the Bill & Melinda Gates Foundation, the Global Fund, and the Stop TB Partnership.

AFST 6351a / CPLT 6351a / FILM 6450, The Nigerian "Video Novel" and Nollywood Staff
The course introduces students to an emerging genre of the Nigerian novel in which writers adopt narrative repurposing strategies that invite transcription and adaptation to films. This evolving "Nigerian visual novel" or "video novel," is defined by its loosely structured, tabloid-themed and reader-friendly style, all reflecting the craft of Nollywood films, a thriving video film culture that emerged in the 1990s and has remained popular globally. Through the study of Nollywood films alongside new Nigerian fiction, the course examines the techniques adopted by writers to accommodate the aesthetics of popular culture, to revive a declining readership, and to make literature more sellable. As these novels win literature prizes and find their way onto syllabi, the implications they have for our understanding of the African literary canon is discussed. Students view selected Nollywood movies and read a number of novels in the new genre in order to appraise the extent to which the serious and the sensuous intersect in this remaking of literariness. Seminar discussions are accompanied by short lectures in which concepts such as "trans-mediality," "reverse-adaptation," "screen-to-page," "appropriation," and "quotation" are discussed to build an understanding of how the "new" approach reconfigures Nigerian novels.

AFST 7719a, Christianity and Coloniality in Contemporary Africa Kyama Mugambi
Missionary complicity with the colonial enterprise puts Christianity at the heart of the problematic relationship between the African continent and the West. At the same time, Christianity has continued to grow rapidly in post-independence Africa. In much of Africa south of the Sahara, decolonization efforts coincided with the period of the greatest Christian expansion in history. Africa is now the continent with the highest population of Christians. This course examines this conundrum through critical engagement with theory, literature, and data from the continent. Students examine historiographic, political, social, economic, and demographic dimensions of this discussion. They meet key theories posited with regard to African Christianity in the wake of a colonial history. The course surveys contemporary issues in the discourse within the urban, educational, social, and cultural spheres. Students also consider gender perspectives on coloniality as it pertains to religion and politics. The course assesses the role of indigenous agency in the development of Christianity within contemporary Africa. Through this course students will gain a more nuanced perspective as they examine and problematize critical arguments in the prevailing discourse on Christianity and coloniality in Africa today. Area III, Area V.

AFST 8833a / HIST 8321a, Agrarian History of Africa Robert Harms
The course examines changes in African rural life from precolonial times to the present. Issues to be examined include land use systems, rural modes of production, gender roles, markets and trade, the impact of colonialism, cash cropping, rural-urban migration, and development schemes.

AFST 9937a / AFAM 8250a / ENGL 6137a, African Urban Cultures: Mediations of the City Stephanie Newell
This course approaches the study of African cities and urbanization through the medium of diverse texts, including fiction, nonfiction, popular culture, film, and the

arts, as well as scholarly work on African cities. Through these cultural "texts," attention is given to everyday conceptualizations of the body and the environment, as well as to theoretical engagements with the African city. We study urban relationships as depicted in literature and popular media in relation to Africa's long history of intercultural encounters, including materials dating back to the 1880s and the 1930s. Previously ENGL 937.

AFST 9965b / CPLT 7290b / FREN 9650b, On Violence: Politics and Aesthetics across the Maghreb Jill Jarvis
This humanities laboratory investigates North African literary texts and other aesthetic works that document, theorize, and disrupt forms of state violence. How might these works—as well as our practices as humanities scholars, critics, curators, co-creators—run counter to state-sanctioned memory projects or compel rethinking practices of testimony, archiving, and justice in the face of enduring colonial occupation, institutionalized racism, and the state-sponsored violence that continues to take place on scales or in forms that are difficult to frame or fathom? Works by Fanon, Djebar, Kateb, Mechakra, Meddeb, Rahmani, Mouride, Hawad, Binebine, and many others. The seminar is an RITM Humanities Laboratory designed to cultivate new forms of collaborative and experimental humanities scholarship. See Canvas page for a more complete description. Conducted in English. Prerequisite: reading knowledge of French.

SWAH 6610a, Beginning Kiswahili I John Wa'Njogu
A beginning course with intensive training and practice in speaking, listening, reading, and writing. Initial emphasis is on the spoken language and conversation. Credit only on completion of SWAH 620.

SWAH 6630a, Intermediate Kiswahili I Veronica Waweru
Further development of speaking, listening, reading, and writing skills. Prepares students for further work in literary, language, and cultural studies as well as for a functional use of Kiswahili. Study of structure and vocabulary is based on a variety of texts from traditional and popular culture. Emphasis on command of idiomatic usage and stylistic nuance. Prerequisite: SWAH 620.

SWAH 6650a, Advanced Kiswahili I John Wa'Njogu
Development of fluency through readings and discussions on contemporary issues in Kiswahili. Introduction to literary criticism in Kiswahili. Materials include Kiswahili oral literature, prose, poetry, and plays, as well as texts drawn from popular and political culture. Prerequisite: SWAH 640.

SWAH 6670a, Topics in Kiswahili Literature John Wa'Njogu
Advanced readings and discussion with emphasis on literary and historical texts. Reading assignments include materials on Kiswahili prose, plays, poetry, Kiswahili dialects, and the history of the language.

YORU 6610a, Beginning Yorùbá I Oluseye Adesola
Training and practice in speaking, listening, reading, and writing. Initial emphasis is on the spoken aspect, with special attention to unfamiliar consonantal sounds, nasal vowels, and tone, using isolated phrases, set conversational pieces, and simple dialogues. Multimedia materials provide audio practice and cultural information. Credit only on completion of YORU 620.

YORU 6630a, Intermediate Yorùbá I Oluseye Adesola
Refinement of speaking, listening, reading, and writing skills. More natural texts are provided to prepare students for work in literary, language, and cultural studies as well as for a functional use of Yorùbá. Prerequisite: YORU 620.

YORU 6650a, Advanced Yorùbá I Oluseye Adesola
An advanced course intended to improve aural and reading comprehension as well as speaking and writing skills. Emphasis is on acquiring a command of idiomatic usage and stylistic nuance. Study materials include literary and nonliterary texts; social, political, and popular entertainment media such as video movies and recorded poems (*ewì*); and music. Prerequisite: YORU 640.

YORU 6680a, Advanced Topics in Yorùbá Literature and Culture Oluseye Adesola
A course for students with advanced proficiency in Yorùbá who are interested in discussion and research in Yorùbá at a level not covered by existing courses. A term paper or its equivalent is required.

ZULU 6610a, Beginning isiZulu I Nandipa Sipengane
A beginning course in conversational isiZulu, using web-based materials filmed in South Africa. Emphasis on the sounds of the language, including clicks and tonal variation, and on the words and structures needed for initial social interaction. Brief dialogues concern everyday activities; aspects of contemporary Zulu culture are introduced through readings and documentaries in English. Credit only on completion of ZULU 620.

ZULU 6630a, Intermediate isiZulu I Nandipa Sipengane
Development of basic fluency in speaking, listening, reading, and writing isiZulu, using web-based materials filmed in South Africa. Students describe and narrate spoken and written paragraphs. Review of morphology; concentration on tense and aspect. Materials are drawn from contemporary popular culture, folklore, and mass media. Prerequisite: ZULU 620.

ZULU 6650a, Advanced isiZulu I Nandipa Sipengane
Development of fluency in using idioms, speaking about abstract concepts, and voicing preferences and opinions. Excerpts are drawn from oral genres, short stories, and dramas made for television. Introduction to other South African languages and to issues of standardization, dialect, and language attitude. Prerequisite: ZULU 640.

American Studies

Humanities Quadrangle, 203.432.1186
http://americanstudies.yale.edu
M.A., M.Phil., Ph.D.

Chair
Laura Barraclough (HQ 314, 203.432.1186)

Director of Graduate Studies
Joanne Meyerowitz, [F] (HQ 324, 203.432.1186)
Daniel HoSang, [Sp] (HQ 304, 203.432.1186)

Professors Laura Barraclough, Daphne Brooks, Michael Denning, Kathryn Dudley, Roderick Ferguson, Scott Herring, Daniel HoSang, Matthew Jacobson, Kathryn Lofton, Lisa Lowe, Mary Lui, Joanne Meyerowitz, Charles Musser, Tavia Nyong'o, Stephen Pitti, Sally Promey, Ana Ramos-Zayas, Marc Robinson, Paul Sabin, Caleb Smith, Dara Strolovitch, Kalindi Vora, Tisa Wenger, Laura Wexler

Associate Professors Crystal Feimster, Zareena Grewal, Greta LaFleur, Albert Laguna, Elihu Rubin

Assistant Professors Julian Posada, Madiha Tahir

Senior Lecturer James Berger

Affiliated Faculty Rene Almeling, Tarren Andrews, David Blight, Edward Cooke, Joanne Freeman, Beverly Gage, Jacqueline Goldsby, Hi'ilei Hobart, Elleza Kelley, Regina Kunzel, Jennifer Raab, Joanna Radin, Edward Rugemer, Alicia Schmidt Camacho, Kevin Lloyd Sy, Deb Vargas, Michael Veal, John Warner, Michael Warner, Sunny Xiang, Talya Zemach-Bersin

FIELDS OF STUDY

Fields include American literature, history, the arts and material culture, philosophy, cultural theory, and the social sciences.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

During the first two years of study students are required to take twelve term courses; at least half of these courses must be in American Studies. Two courses, both graded Satisfactory/Unsatisfactory, are required: AMST 6600, American Scholars, taken in the first year, and AMST 6602, Field Studies, taken in the second year. The student's program will be decided in consultation with the adviser and the director of graduate studies (DGS). In each of the two years, the student should take at least one seminar devoted to research or requiring a substantial original paper, and must achieve two grades of Honors, with an average overall of High Pass.

Students are required to show proficiency in a language other than English; they may fulfill this requirement by (1) conducting substantial research in the chosen language as part of the course requirements for one of the twelve required seminars, (2) passing a translation test, offered each term by various language departments, or (3) receiving a grade of B or higher in a Yale College intermediate- or advanced-level language course

or in a Yale language-for-reading course, such as French for Reading or German for Reading.

Upon completion of coursework, students in their third year of study are required to participate in at least one term of a monthly prospectus workshop, AMST 9002. Intended to complement the work of the prospectus committee, the workshop is designed as a professionalization experience that culminates in students' presentation of the dissertation prospectus at their prospectus colloquium.

Students should schedule the oral qualifying examinations in four fields, in the fifth term of study. Preparation, submission, and approval of the dissertation prospectus should be completed by the end of the sixth term, with a final deadline at the end of the seventh term with permission from the DGS. Students are admitted to candidacy for the Ph.D. upon completion of all predissertation requirements, including the prospectus. The faculty in American Studies considers training in teaching to be an important part of the program. Students in American Studies normally teach in years three and four.

COMBINED PH.D. PROGRAMS

American Studies and Black Studies

The American Studies Program also offers, in conjunction with the Department of Black Studies, a combined Ph.D. in American Studies and Black Studies. This combined degree is most appropriate for students who intend to concentrate in and write a dissertation on any aspect of Black history, literature, or culture in the United States and other parts of the Americas. Applicants to the combined program must indicate on their application that they are applying both to American Studies and to Black Studies. All documentation within the application should include this information. For further details, see Black Studies.

American Studies and Film and Media Studies

The American Studies Program also offers, in conjunction with the Program in Film and Media Studies, a combined Ph.D. in American Studies and Film and Media Studies. Applicants to the combined program must indicate on their application that they are applying both to American Studies and to Film and Media Studies. All documentation within the application should include this information. For further details, see Film and Media Studies.

American Studies and Women's, Gender, and Sexuality Studies

The American Studies Program also offers, in conjunction with the Program in Women's, Gender, and Sexuality Studies, a combined Ph.D. in American Studies and Women's, Gender, and Sexuality Studies. This combined degree is most appropriate for students who intend to concentrate in and write a dissertation on any aspect of gender and sexuality; transnational politics and security regimes; citizenship and statelessness; public law and sexual violence; public policy and political representation; kinship, reproduction, and reproductive technologies; policing, surveillance, and incarceration; social movements and protest; indigeneity, racialization, and racism; literature, language, and translation; Islam and neoliberalism; colonialism and postcolonialism. Applicants to the combined program must indicate on their application that they are

applying both to American Studies and to Women's, Gender, and Sexuality Studies. All documentation within the application should include this information. For further details, see Women's, Gender, and Sexuality Studies.

PUBLIC HUMANITIES CERTIFICATE

The Certificate in Public Humanities is granted upon the completion of all requirements. For more details on these requirements, as well as information on courses, projects, and teaching opportunities, see Public Humanities under Non-Degree Granting Programs, Councils, and Research Institutes.

MASTER'S DEGREES

M.Phil. See Degree Requirements under Policies and Regulations.

M.A. Students may apply for a terminal master's degree in American Studies. For the M.A. degree, students must successfully complete seven term courses, including a special writing project, and the language requirement. The project involves the submission of substantial written work either in conjunction with one course or as a tutorial that substitutes for one course. Students must earn a grade of Honors in two of their courses and an average grade of High Pass in the others. Candidates in combined programs will be awarded the M.A. only when the master's degree requirements for both programs have been met. Doctoral students who withdraw from the Ph.D. program may be eligible to receive the M.A. degree if they have met the above requirements and have not already received the M.Phil. degree.

More information is available on the department's website, http://americanstudies.yale.edu.

COURSES

AMST 6600a, American Scholars Lisa Lowe
This required seminar for incoming first-year graduate students in the American Studies doctoral program focuses on varieties of scholarship and research methods employed in the field. The course aims to be both a history of the interdisciplinary American Studies field and an exploration of newer debates, approaches, and frameworks that engage and revise earlier objects, areas, historical timelines, methods, and periods. Beyond the narratives of United States exceptionalism, we engage American Studies scholarship that considers U.S. culture, history, and politics in relation to the histories of slavery, settler colonialism, capitalism, race, gender, sexuality, subcultures, war and empire. To explore the various kinds of approaches and projects, the seminar features visits from Yale scholars. Students will read 100 pages of visiting scholars' work and collaborate on topical and thematic questions for discussion. Assignments include brief weekly writing assignments. This course is mandatory for first-year American Studies graduate students.

AMST 6602b, Field Studies Laura Barraclough
Students work with faculty to identify relevant field-specific literature (e.g., in preparation for oral examinations), formulate compelling research questions, explore appropriate interdisciplinary methods, and/or describe intended contributions to the field. On completion of the course, students are prepared to write competitive

fellowship applications and to engage in full-time dissertation research (after their transition to candidacy).

AMST 6605a or b, Pedagogy Staff
Faculty members instruct their Teaching Fellows on the pedagogical methods for teaching specific subject matter.

AMST 6612a / AFAM 5610a / ENGL 5761a / FREN 7610a, Caribbean Literary and Cultural Studies Marlene Daut
This course examines eighteenth- and nineteenth-century writing (in translation, where applicable) by writers from the Anglophone, Francophone, and Hispanophone islands that make up the Caribbean. Haitian independence in 1804 ushered in a vibrant and diverse print culture that included poetry, plays, newspapers, and historical writing. From the pages of *La Gazette Royale d'Hayti* (1811–1820), to the poems of Jean-Baptiste Romane (1807–1858), to the historical writings of Louis-Félix Boisrond-Tonnerre (1776–1806), to the operas of Juste Chanlatte (1766–1828), there arose a distinct nineteenth-century literary culture in Haiti. Beginning with national literary developments in Haiti, this course expands to consider writing from Barbados, Cuba, Trinidad, Jamaica, Antigua, and Bermuda. These writings, both fictional and non-fictional, help us to think about whether and/or how a coherent early Caribbean literary tradition developed across geographical, linguistic, national, and imperial lines.

AMST 6619a / ER&M 6520 / HSHM 7920a / WGSS 6620a, Enduring Conditions: Chronic Illness, Disability, Care, and Access Kalindi Vora
This interdisciplinary course brings together scholarship on access and care that bridges concerns in the fields of disability studies and humanistic approaches to chronic illness. Scholarly texts are drawn from the fields of critical race and ethnic studies, gender and sexuality studies, anthropology and sociology of medicine, history, and feminist science and technology studies (fSTS). Seminar participants also engage with the arts and media as critical sites for understanding culture work bringing together knowledge in disability and chronic illness spaces. To embrace community-based research and knowledge sharing, the course features regular guest lectures from grassroots disability justice organizers and culture workers. The course is offered in a hybrid format. To consider what disability studies and work on chronic illness can build together, we explore the work of Moya Bailey, Aimi Hamraie, Jina B. Kim, Sami Schalk, Akemi Nishida, Ryan Cartwright, and Arthur Kleinman, among others. Permission of instructor is required. Undergraduates may also enroll with permission of instructor.

AMST 6622a and AMST 6623b / CPLT 6220a, Working Group on Globalization and Culture Staff
A continuing yearlong collective research project, a cultural studies "laboratory." The group, drawing on several disciplines, meets regularly to discuss common readings, develop collective and individual research projects, and present that research publicly. The general theme for the working group is globalization and culture, with three principal aspects: (1) the globalization of cultural industries and goods, and its consequences for patterns of everyday life as well as for forms of fiction, film, broadcasting, and music; (2) the trajectories of social movements and their relation to patterns of migration, the rise of global cities, the transformation of labor processes, and forms of ethnic, class, and gender conflict; (3) the emergence of and debates within transnational social and cultural theory. The specific focus, projects, and directions of the working group are determined by the interests, expertise, and ambitions of the

members of the group, and change as its members change. The working group is open to doctoral students in their second year and beyond. Graduate students interested in participating should contact michael.denning@yale.edu.

AMST 6627b / ENGL 5820b / FILM 6020b / RLST 6600b, Media and Religion John Peters and Kathryn Lofton

Media and religion are devices of information and agencies of order. This course proceeds from the possible synonymy of its organizing terms, using as a form of weekly debate the relationship between media and religion. Readings think about how religion and media generate meanings about human doings and their relations with ecological and economic systems while also being constitutive parts of those systems. Students develop projects that allow them to explore a relationship between concept and subject in humanistic study.

AMST 6630b / HSAR 6529b / RLST 8190b, Museums and Religion: The Politics of Preservation and Display Sally Promey

This interdisciplinary seminar focuses on the tangled relations of religion and museums, historically and in the present. What does it mean to "exhibit religion" in the institutional context of the museum? What practices of display might one encounter for this subject? What kinds of museums most frequently invite religious display? How is religion suited (or not) for museum exhibition and museum education? Enrollment is by permission of the instructor; qualified undergraduates are not only welcome but also encouraged to join us. There are no set prerequisites, but, assuming available seats, permission is granted on the basis of response to three questions: Why do you wish to take this course? What relevant educational or professional background/experience do you bring to the course? How does the course help you to meet your own intellectual, artistic, or career aspirations?

AMST 6636a / HSAR 6526a, Art and Extraction Jennifer Raab

This graduate seminar examines the relationship of art with extraction: as visual representation and material condition, as shaping political consensus or giving form to dissent, as imagining land and geological time, and as naturalizing—or revealing—the violences of settler-colonialism and racial capitalism. We think about gold, silver, oil, and water, about mines, mills, rocks, and rivers, about empire and enslavement, about golden myth and toxic dust. Classes often revolve around works of art and visual culture held in Yale collections and museums. Instructor permission required.

AMST 6655b, Labor and Technology Studies Julian Posada

This seminar is structured as a laboratory for the study of labor and technology, focusing on recent transformations driven by the digital economy. We draw from several disciplines to analyze readings, conduct scholarly reviews, develop research projects, and discuss various aspects of the academic profession. The topics and discussions are informed by the background and interests of each cohort of students, complementing the instructor's ongoing research in three areas: the gig economy and the use of labor platforms both locally and internationally, the impacts of artificial intelligence on work and broader policy and governance, and the effects of digital infrastructures on workers and their communities. Permission of the instructor is required to enroll in this seminar. Undergraduates may enroll with the instructor's permission.

AMST 7705a / HIST 7304a / RLST 7050a, Readings in Religion and American Society Tisa Wenger and Jamil Drake

This seminar explores intersections of religion and society in North American history from the colonial period to the present as well as methodological problems important to their study. The course is designed to give graduate students a working knowledge of the field by examining key historiographical trends and influential approaches in recent years. It is not a specialized research seminar, but it does require a basic understanding of historiography. We think together about the sources, conversation partners, methods, and key interventions of each text we read.

AMST 7720b / RLST 6980b, Variety and Standardization Sally Promey and Jamil Drake

Variety and standardization number among Western modernity's favorite binaries, fully entangled with another sibling set of "dualities": religion and secularization. In the United States, the process of "nationing" citizens (to use Tony Bennett's term) has taken the shape and motto of a linear movement from variety to standardization: *e pluribus unum*, out of many one. Perhaps not surprisingly, given the US Constitution's stated commitment to free exercise and nonestablishment, religion invites us to explore the relationship and tension between variety and standardization in American sociopolitical life. On the one hand, religion is a site that not only accommodates but also generates a variety of diverse identities, communities, ideals, epistemes, and practices. On the other hand, religion is a site that enforces standardization and encourages adherence and conformity to authorized ideals, knowledges, behaviors, and institutions. Under pressure of these "opposing" rubrics, variety and standardization are co-constitutive in configuring and managing racial, class, gender/sexual, and national as well as religious differences. This graduate seminar explores religion within the interstices of variety and standardization and at their intersections. Guest experts in the field(s) have been invited to present their work. Given the professors' geography of expertise, the in-class course content most closely examines variety and standardization in the context of the United States. Other geographical/chronological interest and expertise is welcome and encouraged in student projects, course readings, and class discussion.

AMST 7725a / ER&M 6525, Writing the Academic Journal Article Albert Laguna

Graduate students are often told that publishing a journal article is a crucial part of their professional development. This course helps students get it done. Students come to class with a piece of writing—seminar paper, dissertation chapter—that we workshop as a group throughout the course of the term. In addition to personalized feedback, we also have broader discussions about the nuts and bolts of this genre of academic writing: organizing your argument, revision, clarity, framing interventions, etc. We complement this structured approach to writing with discussions aimed at demystifying the process by which an article gets published—the art of selecting the right journal, how to read and respond to reader reports, and general timelines. The goal is for all students to submit their article to the journal of their choice by the end of the term. Students are required to have a piece of writing ready to workshop into an article at the very beginning of the class. Students interested in the course should contact the instructor at albert.laguna@yale.edu.

AMST 7740a / FILM 6810a / WGSS 741a, The Photographic Memory Workshop Laura Wexler
This seminar considers landmark examples of photography's cultural work in producing, cementing and erasing individual and collective memory. Topics to be considered include but are not confined to "memory, post-memory and counter-memory"; "the biopolitics of images"; "the visuality of violence"; "photography's place and space"; and the "potential history of photography." Students are invited to develop and present their own case studies on topics of interest. Readings encompass: *The Unseen Truth* by Sarah Lewis; *Camera Geologica* by Siobhan Angus; *The Unintended* by Monica Huerta; *Race Stories* by Maurice Berger; *Through a Native Lens* by Nicole Dawn Strathman; *When a Photograph is Home* by Leigh Raiford; *From These Roots* by Tamara Lanier; and *Collaboration: A Potential History of Photography* by Ariella Azoulay, Wendy Ewald, Susan Meiselas, Leigh Raiford, and Laura Wexler. Guest lectures and travel to exhibitions are anticipated.

AMST 7741a / HIST 7400a, Indians and Empires Ned Blackhawk
This course explores recent scholarship on Indian-imperial relations throughout North American colonial spheres from roughly 1500 to 1900. It examines indigenous responses to Spanish, Dutch, French, English, and lastly American and Canadian colonialism and interrogates commonplace periodization and geographic and conceptual approaches to American historiography. It concludes with an examination of American Indian political history, contextualizing it within larger assessments of Indian-imperial and Indian-state relations.

AMST 7746b / ANTH 6803b, Ethnographic Writing Kathryn Dudley
This course explores the practice of ethnographic analysis, writing, and representation. Through our reading of contemporary ethnographies and theoretical work on ethnographic fieldwork in anthropological and interdisciplinary research, we explore key approaches to intersubjective encounters, including phenomenological anthropology, relational psychoanalysis, affect studies, and the new materialisms. Our inquiries coalesce around the poetics and politics of what it means to sense and sensationalize co-present subjectivities, temporalities, and ontologies in multispecies worlds and global economies. This is a core anthropology graduate program course; others admitted only by permission of the instructor.

AMST 7752a / PLSC 8120a, American Progressivism and Its Critics Stephen Skowronek
The progressive reform tradition in American politics. The tradition's conceptual underpinnings, social supports, practical manifestations in policy and in new governmental arrangements, and conservative critics. Emphasis on the origins of progressivism in the early decades of the twentieth century, with attention to latter-day manifestations and to changes in the progressive impulse over time.

AMST 7768b / ER&M 6680b / HIST 7500b, Asian American History and Historiography Mary Lui
This reading and discussion seminar examines Asian American history through a selection of recently published texts and established works that have significantly shaped the field. Major topics include the racial formation of Asian Americans in U.S. culture, politics, and law; U.S. imperialism; U.S. capitalist development and Asian labor migration; and transnational and local ethnic community formations. The class

considers both the political and academic roots of the field as well as its evolving relationship to "mainstream" American history.

AMST 7771a / AFAM 7771a, Affect Theory Tav Nyong'o
This graduate seminar traces the emergence of affect, sense, feeling, and mood as critical keywords in American studies. Particular attention is paid to the manner in which queer theorists such as Eve Kosofsky Sedgwick, Lauren Berlant, Ann Cvetkovich, Heather Love, Jennifer Doyle, Jonathan Flatley, and José Esteban Muñoz developed the concept in what has been called "the affective turn" in queer and feminist aesthetics. The philosophical basis of affect theory in the writings of Spinoza, Heidegger, and Deleuze forms the core of the seminar. We also look to an alternate genealogy for affect politics in the writings of Bergson and Deleuze on fabulation. We consider the psychoanalytic take on affect, in particular, the object relations school of Klein and Winnicott, and we read critics who contrast affect theory with trauma theory. Marxist contributions to affect theory include readings from Virno (on humor), Hardt and Negri (on affective labor), and Ranciere (on the distribution of the sensible). The writings of Jasbir Puar and Brian Massumi on the affective politics of contemporary war, empire, and societies of control are also considered, as are writings by Fred Moten, Saidiya Hartman, and Frank Wilderson on optimism and pessimism as moods/modalities of black studies.

AMST 7783a / FILM 7830a, The Historical Documentary Charles Musser
This course looks at the historical documentary as a method for carrying out historical work in the public humanities. It investigates the evolving discourse sand resonances within such topics as the Vietnam War, the Holocaust, and African American history. It is concerned with the relationship of documentary to traditional scholarly written histories as well as the history of the genre and what is often called the "archival turn."

AMST 7789a, Social Theory of the City Laura Barraclough
This graduate readings course considers how scholars from a variety of social science disciplines have conceptualized the city, focusing on the relationships between processes of urbanization, the material forms of urban space, and power relations. Students examine the historiography of urban theory, including both classical and contemporary approaches. Readings draw from theoretical formations including but not limited to urban ecology, political economy, political ecology, neoliberal urbanism, critical race studies, critical Indigenous studies and settler colonial studies, feminism, queer theory, and more. A primary aim is to trouble the spatial, temporal, and conceptual bounds of what qualifies as the "urban," and to consider how distinct ways of imagining the city can and do support a range of political agendas and social movements.

AMST 7796b / AFAM 7196b / HIST 8130b, Slave Systems in World History Edward Rugemer
Slavery has been a protean institution in world history, with pre-historic origins and nearly countless manifestations across time and place. This readings course explores the history of slavery over the *longue duree*, moving through time from the ancient world through the nineteenth century with readings on some of the major slave systems in world history. One goal of the course is to situate the well-known slave systems of the Americas within a broader historical context. Student writing includes a historiographical essay on one of the major slave systems discussed in the course.

AMST 8805a / HSAR 6720a / RLST 6990a / WGSS 7779a, Sensational Materialities: Sensory Cultures in History, Theory, and Method Sally Promey
This interdisciplinary seminar explores the sensory and material histories of (often religious) images, objects, buildings, and performances as well as the potential for the senses to spark contention in material practice. While course content focuses on United States things and religions (given the professor's areas of expertise and academic appointments), the course also considers broader geographical and categorical parameters so as to invite intellectual engagement with the most challenging and decisive developments in relevant fields, including recent literatures on material agencies. The goal is to investigate possibilities for scholarly examination of a robust human sensorium of sound, taste, touch, scent, and sight—and even "sixth senses"—the points where the senses meet material things (and vice versa) in life and practice. Topics include the cultural construction of the senses and sensory hierarchies; investigation of the sensory capacities of things; and specific episodes of sensory contention in and among various religious traditions. In addition, the course invites thinking beyond the "Western" five senses to other locations and historical possibilities for identifying the dynamics of sensing human bodies in religious practices, experience, and ideas. Course is by permission of instructor; qualified undergraduates are welcome. In order to request permission, please email the professor (sally.promey@yale.edu) with responses to the following questions: (1) Why are you interested in taking this seminar?; (2) what educational, intellectual, artistic, or other experiences do you bring to the seminar's subjects?; (3) how does the content of this course relate to your own career and/or personal aspirations?

AMST 8808a / FILM 6310a / WGSS 6310a, Media, Embodiment, and the Senses Neta Alexander
This graduate seminar examines the intersections of critical disability studies and media theory to challenge conventional understandings of communication, technology, and culture. Through critical engagement with contemporary film, media, art, and design, this course explores how all technology functions as "assistive" technology and interrogates the pervasive idealization of able-bodiedness. Readings, screenings, discussions, and practice-based assignments encourage students to rethink normative assumptions about the body, ability, and accessibility, moving beyond audio-visual approaches to media.

AMST 8832a / FILM 7350a, Documentary Film Workshop Charles Musser
This workshop in audiovisual scholarship explores ways to present research through the moving image. Students work within a Public Humanities framework to make a documentary that draws on their disciplinary fields of study. Designed to fulfill requirements for the M.A. with a concentration in Public Humanities.

AMST 8835a / HIST 7200a, Research in Recent U.S. History Regina Kunzel and Joanne Meyerowitz
Students conduct research in primary sources and write original essays on post-1945 U.S. history. Readings include scholarly articles that might serve as models for students' research projects.

AMST 8867b / AFAM 7152b / HIST 8902b / HSHM 7610b, Researching and Writing Medicine, Health, and Empire Carolyn Roberts
This small graduate seminar is for students currently engaged in research and writing projects that touch on issues related to health, medicine, science, or the body in

the context of slavery, colonialism, or neocolonialism. Students will explore their relationship to the craft of writing, their identity as "authors," the politics of the archive, the methodological and evidentiary challenges in their work, and tools that will level up their research organization and management skills. The course provides graduate students with a balance of support and independence as they further their research and writing projects. Graduate students in any discipline are warmly invited to participate in a compassion-based research community that prioritizes values of deep listening, presence, and care

AMST 9000a or b, Independent Research Staff
For those students who are interested in pursuing an independent study or directed reading.

AMST 9001a or b, Directed Reading Staff
Arrangement with faculty for those students who are interested in pursuing directed reading course.

AMST 9002b, Prospectus Workshop Daniel HoSang
Upon completion of course work, students are required to participate in at least one term of the prospectus workshop, ideally the term before the prospectus colloquium is held. Open to all students in the program and joint departments, the workshop serves as a forum for discussing the selection of a dissertation topic, refining a project's scope, organizing research materials, identifying appropriate methods and theoretical frameworks, and evaluating work in progress. Additional topics include finding intellectual communities, preparing for academic conferences, and balancing the demands of teaching and research. The workshop meets six times during the semester.

AMST 9003b / HIST 7260b / PHUM 9003b, Introduction to Public Humanities Karin Roffman
What is the relationship between knowledge produced in the university and the circulation of ideas among a broader public, between academic expertise on the one hand and nonprofessionalized ways of knowing and thinking on the other? What is possible? This seminar provides an introduction to various institutional relations and to the modes of inquiry, interpretation, and presentation by which practitioners in the humanities seek to invigorate the flow of information and ideas among a public more broadly conceived than the academy, its classrooms, and its exclusive readership of specialists. Topics include public history, museum studies, oral and community history, public art, documentary film and photography, public writing and educational outreach, the socially conscious performing arts, and fundraising. In addition to core readings and discussions, the seminar includes presentations by several practitioners who are currently engaged in different aspects of the Public Humanities. With the help of Yale faculty and affiliated institutions, participants collaborate in developing and executing a Public Humanities project of their own definition and design. Possibilities might include, but are not limited to, an exhibit or installation, a documentary, a set of walking tours, a website, a documents collection for use in public schools.

AMST 9004a or b / PHUM 9004a or b, Practicum Karin Roffman
Public Humanities students are required to complete a one-term internship with one of our partnered affiliates (to be approved by the Public Humanities DGS or assistant DGS) for practical experience in the field. Potential internships include in-house opportunities at the Beinecke Library, Sterling Memorial Library, or one of Yale's

museums, or work at a regional or national institution such as a media outlet, museum, or historical society. In lieu of the internship, students may choose to complete a "micro-credential." Micro-credentials are structured as workshop series (3–5 daylong meetings over the course of a year) rather than as term courses, and include revolving offerings in topics such as oral history, collections and curation, writing for exhibits, podcast production, website design, scriptwriting from the archive, or grant writing for public intellectual work.

AMST 9005a or b / PHUM 9005a or b, Public Humanities Capstone Project Karin Roffman

The coursework and practicum/micro-credential lead to a significant project to be approved by the DGS or assistant DGS (an exhibition, documentary, research paper, etc.) and to be presented in a public forum on its completion.

AMST 9010a or b, American Studies Professionalization Workshop Staff

This seminar is designed for advanced Ph.D. candidates who are going on the job market. Students draft and revise three full rounds of the five standard genres of job market materials: job letter, CV, dissertation abstract, teaching portfolio, and diversity statement. Students also participate in mock interviewing skills, developing a job talk, and preparing applications for postdoctoral fellowships. Graded Satisfactory/Unsatisfactory.

Anthropology

10 Sachem Street, 203.432.3670
http://anthropology.yale.edu
M.A., M.Phil., Ph.D.

Chair
Douglas Rogers

Director of Graduate Studies
Lisa Messeri

Professors Richard Bribiescas, Richard Burger, Michael Dove (*School of the Environment*), Kathryn Dudley (*Anthropology*; *American Studies*), Eduardo Fernandez-Duque, Erik Harms, William Honeychurch, Marcia Inhorn, Paul Kockelman, Catherine Panter-Brick, Douglas Rogers, Eric Sargis, Helen Siu, Kalyanakrishnan Sivaramakrishnan, Anne Underhill, Claudia Valeggia, David Watts

Associate Professors Oswaldo Chinchilla, Yukiko Koga, Louisa Lombard, Lisa Messeri, Christen Smith (*Anthropology*; *African American Studies*)

Assistant Professors Jessica Thompson, Serena Tucci

Lecturers Carol Carpenter, Jane Lynch

FIELDS OF STUDY

The department covers three subfields: archaeology; sociocultural and linguistic anthropology; and biological anthropology.

Archaeology focuses on ritual complexes and writing, ceramic analysis, warfare, ancient civilizations, origins of agriculture, the emergence of complex societies, and museum studies.

Sociocultural anthropology provides a range of courses: ethnography and social theory, science and technology, performance, racial formations, Black feminisms, religion, myth and ritual, kinship and descent, historical anthropology, culture and political economy, agrarian studies, ecology, environment and social change, medical anthropology, public health, sexual meanings and gender, postcolonial development, ethnicity, identity politics and diaspora, urban anthropology, and global culture.

Linguistic anthropology includes language, nationalism and ideology, and structuralism and semiotics.

Biological anthropology focuses on paleoanthropology, evolutionary theory, human functional anatomy, race and human biological diversity, reproductive ecology, human heath, molecular anthropology, and primate ecology. There is strong geographical coverage in Africa, the Caribbean, Latin America and South America, East Asia, Southeast Asia, South Asia, the Middle East, Europe, and the United States.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

To earn a Ph.D. in anthropology, students must be admitted to candidacy and submit a dissertation which is deemed to be of sufficient academic integrity to be

approved by the faculty. Students are expected to complete these requirements in six years. Admission to Ph.D. candidacy requires:

- completion of two years of coursework (twelve term courses),
- independent study and research,
- satisfactory performance on qualifying examinations, and
- a dissertation research prospectus submitted and approved before the end of the third year.

The form of the exams and prospectus is specific to each subfield and is described in detail in the anthropology graduate student handbook (https://anthropology.yale.edu/graduates/resources-for-current-graduate-students), which is updated annually before the start of each academic term and posted to the graduate student resources page on the anthropology program's website. For coursework, sociocultural students must take three required courses plus enroll in four semesters of the 0.5 credit Ethnography and Social Theory seminar, with the remainder of courses being electives among anthropology courses and other departments' courses. There are three required courses for archaeology students. There are no required courses for biological anthropology students. However, students in this subfield are expected to confer closely with their advisory committee to develop the most enriching and cogent program of courses.

Because of the diversity of our students' training program, the department does not have a general foreign language requirement, either for admission or for admission to Ph.D. candidacy. Rather, each student's advisory committee determines the necessary level and nature of foreign language proficiency (including scholarly languages and languages to be used in field research) to be met by the student, as well as any required competencies in statistics and other quantitative or qualitative methods.

The faculty consider teaching to be an important part of the professional preparation of graduate students. Department policies and expectations around teaching can be found in the graduate student handbook.

COMBINED PH.D. PROGRAMS

The Anthropology department also offers a combined Ph.D. in Anthropology and Environment in conjunction with the School of the Environment; a combined Ph.D. in Anthropology and Black Studies in conjunction with the Department of Black Studies; and a combined Ph.D. in Anthropology and Women's, Gender, and Sexuality Studies with the Program in Women's, Gender, and Sexuality Studies. These combined programs are ideal for students who intend to concentrate in, and to write dissertations on, thematic and theoretical issues centrally concerned with anthropology and one of these other areas of study. Students in the combined-degree programs will receive supervision from faculty members in the Anthropology department and in the respective department or school.

Admission into combined-degree programs is based on mutual agreement between the two admitting units. Requirements for each combined program is detailed in the graduate student handbook and consists of required courses in both units as well as agreed-upon procedures for exams and the prospectus.

For more information on the combined-degree program in Anthropology and Environment, see Environment.

For more information on the combined-degree program in Anthropology and Black Studies, see Black Studies.

For more information on the combined-degree program in Anthropology and Women's, Gender, and Sexuality Studies, see Women's, Gender, and Sexuality Studies.

MASTER'S DEGREES

M.Phil. See Degree Requirements under Policies and Regulations.

M.A. Applications for a terminal master's degree are not accepted. The M.A. degree is awarded only to students not continuing in the Ph.D. program. The student must complete eight graduate-level term courses approved for credit in the Anthropology department and maintain an average grade of High Pass. Students who are eligible for or who have already received the M.Phil. will not be awarded the M.A.

Contact information: Director of Graduate Studies, Department of Anthropology, Yale University, PO Box 208277, New Haven CT 06520-8277; 203.432.3670; anthropology@yale.edu.

COURSES

ANTH 5328b / ARCG 5328b / NELC 7290b, Magic and Ritual in Ancient Egypt and the Near East John Darnell
Introduction to ancient Egyptian and Near East magic and rituals with an overview on the use of magic and discussion of the different rituals and festivals.

ANTH 5710a, Ethnography and Social Theory Paul Kockelman
This seminar for first- and second-year Ph.D. students in Anthropology runs in tandem with the department's reinvigorated EST Colloquium. The colloquium consists of public presentations by cutting-edge speakers—four or five each term—selected and invited by students enrolled in the seminar. In the seminar, students and the instructor discuss selected works (generally no longer than article-length) related to the topics presented by the colloquium speakers and engage in planning activities associated with organizing the EST Colloquium, including but not limited to developing readings lists, creating a viable calendar, curating the list of speakers, securing co-sponsorships, writing invitations, and introducing and hosting the speakers. Open to first- and second-year Ph.D. students in Anthropology only. ½ Course cr

ANTH 5730a, Engaging Anthropology: Histories, Theories, and Practices Lisa Messeri
This is the first course of a yearlong sequence for doctoral students in Anthropology and combined programs. Students are introduced to the discipline through theoretical, historical, and experimental approaches. In addition to gaining an expansive view of the field, students have the opportunity to hone foundational scholarly skills.

ANTH 5740b, Anthropological Imaginations Louisa Lombard
This is the second course of a yearlong sequence for doctoral students in Anthropology and combined programs. The seminar explores anthropological imaginations as modes of experience, perception, and writing. Anthropology as a discipline has transformed from the frontline of colonial projects to critical reflections on power dynamics that

produce and reproduce systems of oppression, injustice, and violence. Yet knowing and representing are never external to these power dynamics, and there is simply a vast unknowability of human and non-human experiences. How do we as anthropologists give meanings to the world out there that is so intertwined and complex beneath what we see and hear? How do we see what seems invisible and how to listen to silence? How do we account for our own implication in the encounters through which we experience and learn, and reflect upon? How do we weave stories through writing? While there are no right or wrong answers to these questions, in this seminar we explore how different imaginaries open up new possibilities as we embark on our ethnographic research.

ANTH 5750a, Research in Sociocultural Anthropology: Design and Methods
Douglas Rogers
The course offers critical evaluation of the nature of ethnographic research. Research design includes the rethinking of site, voice, and ethnographic authority.

ANTH 5824a, Politics of Memory Yukiko Koga
This course explores the role of memory as a social, cultural, and political force in contemporary society. How societies remember difficult pasts has become a contested site for negotiating the present. Through the lens of memory, we examine complex roles that our relationships to difficult pasts play in navigating issues we face today. The course explores the politics of memory that takes place in the realm of popular culture and public space. It asks such questions as: How do you represent difficult and contested pasts? What does it mean to enable long-silenced victims' voices to be heard? What are the consequences of re-narrating the past by highlighting past injuries and trauma? Does memory work heal or open wounds of a society and a nation? Through examples drawn from the Holocaust, the atomic bombing in Hiroshima, the Vietnam War, genocide in Indonesia, and massacres in Lebanon, to debates on confederacy statues, slavery, and lynching in the United States, the course approaches these questions through an anthropological exploration of concepts such as memory, trauma, mourning, silence, voice, testimony, and victimhood.

ANTH 5848a, Medical Anthropology at the Intersections: Theory and Ethnography
Marcia Inhorn
Examination of narratives of gender in India. Folkloristic and anthropological approaches to gendered performance in story, song, and theater. Recent feminist examinations of television, film, advertising, and literature. Topics include classical epic (Ramayana, Shilapathigaram).

ANTH 5856a, Masculinity and Men's Health Marcia Inhorn
This interdisciplinary seminar—designed for students in Anthropology; Women's, Gender, and Sexuality Studies; and Global Health—explores in an in-depth fashion ethnographic approaches to masculinity and men's health around the globe. The course begins with two theoretical texts on masculinity, followed by eleven anthropological ethnographies on various dimensions of men's health and well-being. Students gain broad exposure to a number of exigent global men's health issues, issues of ethnographic research design and methodology, and the interdisciplinary theorizing of masculinity scholars in anthropology, sociology, and cultural studies. In particular, the course demonstrates how anthropologists studying men's health issues in a variety of Western and non-Western sites, including the Middle East, Africa, Latin America,

and Asia, have contributed to both social theory and ethnographic scholarship of importance to health policy.

ANTH 6136b / ARCG 6136b, Geoarchaeology: Earth and Environmental Sciences in Archaeological Investigations Ellery Frahm
A survey of the numerous ways in which theories, approaches, techniques, and data from the earth and environmental sciences are used to address archaeological research questions. A range of interfaces between archaeology and the geological sciences are considered. Topics include stratigraphy, geomorphology, site formation processes, climate reconstruction, site location, and dating techniques.

ANTH 6375a / ARCG 6375a, The Green Hell and the Mother Serpent: Amazonian Archaeology, Ethnography, and Politics Richard Burger
Survey and seminar discussing the archaeology and ethnography of greater Amazonia, along with the political stakes of this heritage for modern Indigenous communities in the region. Introduces students to the varied geography and ecology of greater Amazonia, before delving into topics such as: the archaeological record of domestication and landscape investment by past Indigenous societies; the ethnographic and historical records of their descendants; the contested spheres of knowledge production in anthropology that underpins both of these records; and the modern political struggles that Indigenous communities face today amid deforestation and the pursuit of economic development.

ANTH 6443a, Primate Behavior and Ecology David Watts
Socioecology of primates compared with that of other mammals, emphasizing both general principles and unique primate characteristics. Topics include life-history strategies, feeding ecology, mating systems, and ecological influences on social organization.

ANTH 6665b / ARCG 6665b, Evolution of Human Diet Jessica Thompson
This course examines human nutrition and subsistence behavior from an evolutionary perspective. It begins with human nutritional literature and discussions of our biological requirements, then moves into comparison of modern human dietary ecology with those of other primates, especially our closest living relatives, the great apes. We then turn to literature that demonstrates the methods and theoretical approaches that are currently used to reconstruct past diets. As we begin to follow the evidence for changes in subsistence in the hominin lineage, case studies using these methods are integrated into discussions of how we know what we do about past nutrition. The course spends time on key issues and debates such as changes from closed-habitat to open-habitat foraging, the origins of meat-eating, the role of extractive foraging in human social systems, variation in hunter-forager subsistence systems, the origins of domestication, and the phenomenon of fad diets in industrialized nations. The course is delivered in a seminar-style format, with key readings each week that follow topical themes, with assessment based on in-class participation, critical essays, and a final research project.

ANTH 6803b / AMST 7746b, Ethnographic Writing Kathryn Dudley
This course explores the practice of ethnographic analysis, writing, and representation. Through our reading of contemporary ethnographies and theoretical work on ethnographic fieldwork in anthropological and interdisciplinary research, we explore key approaches to intersubjective encounters, including phenomenological

anthropology, relational psychoanalysis, affect studies, and the new materialisms. Our inquiries coalesce around the poetics and politics of what it means to sense and sensationalize co-present subjectivities, temporalities, and ontologies in multispecies worlds and global economies. This is a core anthropology graduate program course; others admitted only by permission of the instructor.

ANTH 6841a / ENV 836a / HIST 8160a / PLSC 7790 / SOCY 7170a, Agrarian Societies: Culture, Society, History, and Development Louisa Lombard and Marcela Echeverri Munoz

An interdisciplinary examination of agrarian societies, contemporary and historical, Western and non-Western. Major analytical perspectives from anthropology, economics, history, political science, and environmental studies are used to develop a meaning-centered and historically grounded account of the transformations of rural society. Team-taught.

ANTH 6842a, Histories and Ethnographies of the Corporation Douglas Rogers

A survey of recent approaches to the study of corporations, with a focus on historical and anthropological perspectives. Topics include early modern corporations and colonialisms; states and corporations; labor; transformations of corporations in the neoliberal era; corporate "culture"; corporate philanthropy; and methodological considerations for conducting research on/in corporations. Case studies drawn from around the world and focused on the twentieth and twenty-first centuries. Prerequisites: graduate student status and permission of the instructor.

ANTH 7075b / ARCG 7075b, Anthropology of Mobile Societies William Honeychurch

The social and cultural significance of the ways that hunter-gatherers, pastoral nomads, maritime traders, and members of our own society traverse space. The impact of mobility and transport technologies on subsistence, trade, interaction, and warfare from the first horse riders of five thousand years ago to jet-propulsion tourists of today.

ANTH 7116La / ARCG 7116La, Introduction to Archaeological Laboratory Sciences Ellery Frahm

Introduction to techniques of archaeological laboratory analysis, with quantitative data styles and statistics appropriate to each. Topics include dating of artifacts, sourcing of ancient materials, remote sensing, and microscopic and biochemical analysis. Specific techniques covered vary from year to year.

ANTH 7150a / ARCG 7150a, Analysis of Lithic Technology Oswaldo Chinchilla Mazariegos

This course provides an introduction to the analysis of the chipped and ground stone tools found on archaeological sites. As a laboratory course, it includes hands-on instruction: we learn how to manufacture chipped stone tools out of obsidian. We begin by reviewing the development of chipped and ground stone tool technology from the earliest simple pebble tools to historical period tools. We discuss the relevance of lithics research to issues of subsistence, craft specialization, and trade. We also discuss how these artifacts are recorded, analyzed, and drawn, and we review related studies such as sourcing and use-wear analysis.

ANTH 7185b / ARCG 7185b, Archaeological Ceramics I Anne Underhill

Ceramics are a rich source of information about a range of topics including ancient technology, cooking practices, craft specialization, regional trade, and religious beliefs.

This course provides a foundation for investigating such topics and gaining practical experience in archaeological analysis of ceramics. Students have opportunities to focus on ceramics of particular interest to them, whether these are low-fired earthen wares, or porcelains. We discuss ancient pottery production and use made in diverse contexts ranging from households in villages to workshops in cities. In addition we refer to the abundant ethnoarchaeological data about traditional pottery production.

ANTH 7259b / ARCG 7259b, Social Complexity in Ancient China Anne Underhill
This seminar explores the variety of archaeological methods and theoretical approaches that have been employed to investigate the development and nature of social complexity in ancient China. The session meetings focus on the later prehistoric and early historic periods, and several geographic regions are included. They also consider how developments in ancient China compare to other areas of the world. Most of the readings emphasize archaeological remains, although relevant information from early historical texts is considered.

ANTH 7272b / ARCG 7272b, Cities in Antiquity: The Archaeology of Urbanism Piphal Heng
Archaeological studies of ancient cities and urbanism. Topics include the origin and growth of cities; the economic, social, and political implications of urban life; and archaeological methods and theories for the study of ancient urbanism. Case studies include ancient cities around the world.

ANTH 7280a / ARCG 7280a, Archaeology of Religion Richard Burger and Piphal Heng
The course explores archaeological approaches to the study of religion. While the term "religion" is hard to define, it is generally agreed that religious phenomena occur in almost all cultures and that this realm played a significant part in most prehistoric cultures. In order to provide a broad vision of this theme, the course begins by considering influential schools of thought on the definition, origins, and social significance of religious behavior. The course then reviews a variety of methods that scholars may use to reconstruct ancient beliefs and rituals. The course assesses the applicability and success of these methodologies across the broad spectrum of ancient cultures representing differing degrees of sociopolitical complexity. Finally, we explore case studies from a diverse range of ancient societies and consider the impact of religious behaviors within their broader cultural contexts.

ANTH 7297a / ARCG 7297a, Archaeology of East Asia Staff
East and Southeast Asia have increasingly emerged as hotspots for global political, economic, and cultural interactions. What were the roots and social processes that gave rise to such systems? In this seminar, we explore archaeological evidence for the development of social and political organization and religious practices, using selected examples from East and Southeast Asia spanning approximately 5000 BCE to 1500 CE. We examine four key themes: (1) the origins and timing of plant and animal domestication, (2) the emergence and impact of early metallurgy, (3) patterns of interregional interaction, and (4) the rise of sociopolitical complexity. Using a comparative archaeological perspective—focusing on settlement patterns, urbanism, craft production, monumentality, and diverse material culture—we examine how both local factors and long-distance connections shaped these trajectories. We conclude the course with a reflection on the role of archaeology in contemporary society, particularly in countries where the past is actively curated, celebrated, and contested.

No background in archaeology or East/Southeast Asian studies is required. Through short lectures, weekly discussions, student presentations, and a final research paper on selected case studies, students learn how archaeological research is conducted and interpreted. By the end of the term, students are able to outline the broad historical sequence of the region from the earliest food production through the mid-second millennium CE; identify major archaeological sites and their contributions to our understanding of domestication, metallurgy, and early urbanism; and compare the historical trajectories of East and Southeast Asian societies. The course also emphasizes critical thinking and analytical reasoning, encouraging students to evaluate evidence, interrogate interpretive frameworks, and formulate informed perspectives on the region's past.

ANTH 7818b / ER&M 6606b / SPAN 9718b / WGSS 7718b, Multi-Sited Ethnography: Trans-Atlantic Port Cities in Colombia and Spain Eda Pepi and Ana Ramos-Zayas

Critical to colonial, imperial, and capitalist expansion, the Atlantic offers a dynamic setting for adapting ethnographic practices to address questions around interconnected oppressions, revolts, and revolutions that are foundational to global modernity. Anchored in a Spanish and a Colombian port city, this course engages trans-Atlantic "worlding" through a multi-sited and historically grounded ethnographic lens. Las Palmas, the earliest mid-Atlantic port and Europe's first settler colony in Africa, and Cartagena, once the principal gateway connecting Spain and its American empire, illuminate urgent contemporary issues such as climate, displacement, inter-regional subjectivities, and commerce. During a spring recess field experience (March 8–16, 2026), students will immerse themselves for four nights each in Las Palmas and Cartagena, developing critical "tracking" skills that bridge ethnographic practice with cultural theory. Preparation for fieldwork includes an on-campus curriculum, organized around Cartagena and Las Palmas, and sessions with Yale Ethnography Hub faculty, covering different methodologies. As part of this broader programming, the curriculum delves as well into trans-Atlantic migrations from the Middle East, South Asia, and Africa that have transformed port cities, labor and aesthetic practices, class-making racial formations, and global geopolitics. After recess, the course shifts toward independent work, as students synthesize field-collected data and insights into a collaborative multimodal group project and individual ethnographic papers. Instructor Permission: Interested students must apply by November first via the course website. This course does not have a shopping period, but students may withdraw by the university deadlines in April. Prerequisite: Conversational and reading proficiency in Spanish. Readings are in English and Spanish, with assignments accepted in either language.

ANTH 7853a / WGSS 7757a, Feminist Anthropology Eda Pepi

This seminar explores the impact of feminist theory on anthropology and interdisciplinary ethnography, charting its influence from the decline of structural functionalism to the embrace of poststructuralist and post-colonial perspectives. It engages feminist contributions on pivotal debates over the universality of women's subordination, the denaturalization of kinship, and the reframing of gender and sexuality as performative, highlighting the intersection of the "sex/gender system" with other analytical categories on a global scale. Through the feminist reevaluation of kinship studies, once the bedrock of anthropology, the course takes up how traditional

analyses of biological, social, and societal reproduction that treat politics, economy, kinship, and religion as distinct cultural domains naturalize power and inequality. This paradigm shift inspired empirically informed interdisciplinary analyses across the social sciences and humanities—including in women's studies, Black and Latina studies, queer studies, masculinity studies, affect theory, and science and technology studies. As such, the seminar is also an invitation to participate in both hopeful and skeptical new visions of anthropology—to dream of an "otherwise" future for our and other fields.

ANTH 8512b, Current Topics in Anthropological Genetics Serena Tucci
This course is a series of seminars on cutting-edge topics in the field of anthropological genetics. Topics include the use of modern and ancient DNA as powerful tools for studying human evolution, population history, and adaptation. The course also explores ethical and social implications of human genetic research and direct-to-consumer genetic testing. Students actively work through these topics, using readings, presentations, and class discussions. Students learn how genetic data can help us unlock our evolutionary past, how to interpret and communicate human genetic variation, and how to assess issues and challenges of conducting anthropological genetic research.

ANTH 8513a or b / ARCG 8513a or b, Human Osteology Eric Sargis
A lecture and laboratory course focusing on the characteristics of the human skeleton and its use in studies of functional morphology, paleodemography, and paleopathology. Laboratories familiarize students with skeletal parts; lectures focus on the nature of bone tissue, its biomechanical modification, sexing, aging, and interpretation of lesions.

ANTH 8532a or b, Topics and Issues Primate Evolution Staff
Examination of the evolutionary history of living and extinct primates. Focus is on major controversies in primate systematics and evolution. Topics include primate supraordinal relationships, euprimate origins, and anthropoid origins. Both morphological and molecular studies are considered.

ANTH 8897a and ANTH 8898b / HIST 5804a and HIST 5805b / HSAR 6841a and HSAR 6842b / HSHM 7691a and HSHM 7692b, Topics in the Environmental Humanities Paul Sabin
This is the required workshop for the Graduate Certificate in Environmental Humanities. The workshop meets six times per term to explore concepts, methods, and pedagogy in the environmental humanities, and to share student and faculty research. Each student pursuing the Graduate Certificate in Environmental Humanities must complete both a fall term and a spring term of the workshop, but the two terms of student participation need not be consecutive. The fall term each year emphasizes key concepts and major intellectual currents. The spring term each year emphasizes pedagogy, methods, and public practice. Specific topics vary each year. Students who have previously enrolled in the course may audit the course in a subsequent year. This course does not count toward the coursework requirement in history. Open only to students pursuing the Graduate Certificate in Environmental Humanities. ½ Course cr per term

ANTH 9655a, Directed Research in Evolutionary Biology Staff
By arrangement with faculty.

ANTH 9850a, Directed Research: Preparation for Qualifying Exam Lisa Messeri
By arrangement with faculty.

ANTH 9953a, Directed Research in Archaeology and Prehistory Staff
By arrangement with faculty.

Applied and Computational Mathematics

Leet Oliver Memorial Hall
http://applied.math.yale.edu
M.S., M.Phil., Ph.D.

Director of Graduate Studies
Ronald Coifman

Professors Ronald Coifman (*Mathematics*; *Computer Science*),* Yuval Kluger (*Pathology*),* Rajit Manohar (*Electrical and Computer Engineering*),* Vidvuds Ozolins (*Applied Physics*; *Material Science*),* Vladimir Rokhlin (*Computer Science*; *Mathematics*),* Charles Smart (*Mathematics*),* Steven Zucker (*Computer Science*; *Biomedical Engineering*)*

* A secondary appointment with primary affiliation in another department or school.

FIELDS OF STUDY

The graduate program in Applied Mathematics comprises the study and application of mathematics to problems motivated by a wide range of application domains. Areas of concentration include the analysis of data in very high-dimensional spaces, the geometry of information, computational biology, mathematical physics (optical and condensed matter physics), and randomized algorithms. Topics covered by the program include classical and modern applied harmonic analysis, linear and nonlinear partial differential equations, inverse problems, quantum optics, imaging, numerical analysis, scientific computing and applications, discrete algorithms, combinatorics and combinatorial optimization, graph algorithms, geometric algorithms, discrete mathematics and applications, cryptography, statistical theory and applications, probability theory and applications, information theory, econometrics, financial mathematics, statistical computing, and applications of mathematical and computational techniques to fluid mechanics, combustion, and other scientific and engineering problems.

INTEGRATED GRADUATE PROGRAM IN PHYSICAL AND ENGINEERING BIOLOGY (PEB)

Students applying to the Ph.D. program in Applied Mathematics may also apply to be part of the PEB program. See the description under Non-Degree-Granting Programs, Councils, and Research Institutes for course requirements, and http://peb.yale.edu for more information about the benefits of this program and application instructions.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

All students are required to complete at least eight graduate-level courses, at least two with Honors grades. Four courses must meet core requirements. Courses counted toward the eight-course minimum must be full-credit graduate courses with clear focus that are related to applied and computational mathematics in the judgment of the director of graduate studies (DGS) and/or research adviser. Courses such as Special Investigation, Dissertation Research, Master's Thesis, or Seminar do not count towards the eight-course requirement. Core classes will be selected from four broad areas and students are required to take a minimum of one class from each area: analysis (real, complex, and functional), probability theory and statistics, computing (either

numerical analysis or algorithms and complexity theory), and application area (discrete mathematics, science/engineering, data science, ODEs/PDE).

Additionally, first year students will be required to complete one course on the responsible conduct of research (i.e. MATH 9910) and the Seminar in Applied Mathematics (AMTH 5250). These courses do not count toward the eight-course minimum requirement.

Students typically complete most of their core course requirements in the first year, and sufficient progress toward meeting the course requirements is necessary to remain in good standing in the program. By the end of the first year, students must find a research adviser.

Students must pass a qualifying exam by the end of their second year. The qualifying exam will consist of either an oral presentation to the qualifying committee followed by questions from the committee or a series of written examinations on topics chosen by the adviser. The content of the exam will be tailored to the research interests of the student, emphasizing broad foundational knowledge in mathematics, applied and computational mathematics, and their area of interest, as well as specific topics and current developments, in the chosen area.

In their third year, students must submit a written research prospectus and pass an oral area examination. The thesis prospectus should summarize the first significant research project undertaken with the adviser and demonstrate familiarity with relevant literature. Further, it should outline plans for the thesis research, contextualize the work, and provide a timeline for completion.

Upon completing all coursework, finding an adviser, and passing both the qualifying and area examinations, the student is admitted to candidacy. At the latest, the student must be admitted to candidacy by the end of the third year.

A final oral presentation of the dissertation research is required.

Teaching is considered an integral part of training at Yale University, so all students are expected to complete two terms of teaching. Students who require additional support from the graduate school will be required to teach additional terms, if needed, after they have fulfilled the academic teaching requirement.

Students are expected to be in residence for at least three years.

HONORS REQUIREMENT

Students must meet the graduate school's honors requirement by the end of the fourth term of full-time study.

M.D.-PH.D. STUDENTS

With permission of the DGS, M.D.-Ph.D. students may request a reduction in the program's academic teaching requirement to one term of teaching. Only students who teach are eligible to receive a university stipend contingent on teaching.

MASTER'S DEGREES

M.Phil. The minimum requirements for this degree are that a student shall have completed all requirements for the Applied Mathematics Ph.D. program as described

above except the required teaching, the prospectus, and the dissertation. Students will not generally have satisfied the requirements for the M.Phil. until after two years of study, except where graduate work done before admission to Yale has reduced the student's graduate course work at Yale. In no case will the degree be awarded after less than one year of residence in the Yale Graduate School of Arts and Sciences. See also Degree Requirements under Policies and Regulations.

M.S. Only students who withdraw from the Ph.D. program may be eligible to receive the M.S. degree if they have met the requirements and have not already received the M.Phil. degree. For the M.S., students must successfully complete seven graduate-level term courses, maintain a High Pass average, and meet the graduate school's honors requirement.

More information is available on the program's website, http://applied.math.yale.edu.

COURSES

AMTH 640b / CPSC 6400b / MATH 6400b, Topics in Numerical Computation Vladimir Rokhlin

This course discusses several areas of numerical computing that often cause difficulties to non-numericists, from the ever-present issue of condition numbers and ill-posedness to the algorithms of numerical linear algebra to the reliability of numerical software. The course also provides a brief introduction to "fast" algorithms and their interactions with modern hardware environments. The course is addressed to Computer Science graduate students who do not necessarily specialize in numerical computation; it assumes the understanding of calculus and linear algebra and familiarity with (or willingness to learn) either C or FORTRAN. Its purpose is to prepare students for using elementary numerical techniques when and if the need arises.

AMTH 765b / CB&B 5620b / ENAS 5620b / INP 562b / INP 7562b / MB&B 5620b / PHYS 5620b, Modeling Biological Systems II Thierry Emonet, Jing Yan, and Damon Clark

This course covers advanced topics in computational biology. How do cells compute, how do they count and tell time, how do they oscillate and generate spatial patterns? Topics include time-dependent dynamics in regulatory, signal-transduction, and neuronal networks; fluctuations, growth, and form; mechanics of cell shape and motion; spatially heterogeneous processes; diffusion. This year, the course spends roughly half its time on mechanical systems at the cellular and tissue level, and half on models of neurons and neural systems in computational neuroscience. Prerequisite: a 200-level biology course or permission of the instructor.

AMTH 999a, Directed Reading Anna Gilbert

In-depth study of elliptic partial differential equations.

AMTH 2220a or b / MATH 2220a or b, Linear Algebra with Applications Staff

Matrix representation of linear equations. Gauss elimination. Vector spaces. Linear independence, basis, and dimension. Orthogonality, projection, least squares approximation; orthogonalization and orthogonal bases. Extension to function spaces. Determinants. Eigenvalues and eigenvectors. Diagonalization. Difference equations and matrix differential equations. Symmetric and Hermitian matrices. Orthogonal and unitary transformations; similarity transformations. Students who plan to continue with upper level math courses should instead consider MATH 2250 or 2260. After

MATH 1150 or equivalent. May not be taken after MATH 2250 or 2260. May not be counted toward the Math, CPSC + Math, or Econ + Math major. QR

AMTH 2320b / MATH 2320b, Advanced Linear Algebra with Applications Ian Adelstein

This course is a natural continuation of MATH 2220. The core content includes eigenvectors and the Spectral Theorem for real symmetric matrices; singular value decomposition (SVD) and principle component analysis (PCA); quadratic forms, Rayleigh quotients and generalized eigenvalues. We also consider a number of applications: optimization and stochastic gradient descent (SGD); eigen-decomposition and dimensionality reduction; graph Laplacians and data diffusion; neural networks and machine learning. A main theme of the course is using linear algebra to learn from data. Students complete (computational) projects on topics of their choosing. Prerequisites: MATH 1200 and MATH 2220, 2250, or 2260. This is not a proof-based course. May not be taken after MATH 3400. QR

AMTH 2440a or b / MATH 2440a or b, Discrete Mathematics Staff

Basic concepts and results in discrete mathematics: graphs, trees, connectivity, Ramsey theorem, enumeration, binomial coefficients, Stirling numbers. Properties of finite set systems. Prerequisite: MATH 1150 or equivalent. Some prior exposure to proofs is recommended (ex. MATH 2250). QR

AMTH 2470b / MATH 2470b, Intro to Partial Differential Equations Ruoyu Wang

Introduction to partial differential equations, wave equation, Laplace's equation, heat equation, method of characteristics, calculus of variations, series and transform methods, and numerical methods. Prerequisites: MATH 2220 or 2250 or 2260, MATH 2460 or ENAS 1940. QR

AMTH 3220a / MATH 3220a, Geometric and Topological Methods in Machine Learning Smita Krishnaswamy

This course provides an introduction to geometric and topological methods in data science. Our starting point is the manifold hypothesis: that high dimensional data live on or near a much lower dimensional smooth manifold. We introduce tools to study the geometric and topological properties of this manifold in order to reveal relevant features and organization of the data. Topics include: metric space structures, curvature, geodesics, diffusion maps, eigenmaps, geometric model spaces, gradient descent, data embeddings and projections, and topological data analysis (TDA) in the form of persistence homology and their associated "barcodes." We see applications of these methods in a variety of data types. Prerequisites: MATH 225 or 226; MATH 255 or 256; MATH 302; and CPSC 112 or equivalent programming experience. Students who completed MATH 231 or 250 may substitute another analysis course level 300 or above in place of MATH 302. QR, SC

*** AMTH 3420a / ECE 4320a, Linear Systems** A Stephen Morse

Introduction to finite-dimensional, continuous, and discrete-time linear dynamical systems. Exploration of the basic properties and mathematical structure of the linear systems used for modeling dynamical processes in robotics, signal and image processing, economics, statistics, environmental and biomedical engineering, and control theory. Prerequisite: MATH 222 or permission of instructor. QR

AMTH 3610b / S&DS 3610b, Data Analysis Brian Macdonald
Selected topics in statistics explored through analysis of data sets using the R statistical computing language. Topics include linear and nonlinear models, maximum likelihood, resampling methods, curve estimation, model selection, classification, and clustering. Extensive use of the R programming language. Experience with R programming (from e.g. S&DS 106, S&DS 220, S&DS 230, S&DS 242), probability and statistics (e.g. S&DS 106, S&DS 220, S&DS 238, S&DS 241, or concurrently with S&DS 242), linear algebra (e.g. MATH 222, MATH 225, MATH 118), and calculus is required. This course is a prerequisite for S&DS 425 and may not be taken after S&DS 425. QR

AMTH 3640b / EENG 454 / S&DS 3640b, Information Theory Yihong Wu
Foundations of information theory in communications, statistical inference, statistical mechanics, probability, and algorithmic complexity. Quantities of information and their properties: entropy, conditional entropy, divergence, redundancy, mutual information, channel capacity. Basic theorems of data compression, data summarization, and channel coding. Applications in statistics and finance. After STAT 241. QR

* **AMTH 3660b / CPSC 3660b / ECON 3366b, Intensive Algorithms** Anna Gilbert
Mathematically sophisticated treatment of the design and analysis of algorithms and the theory of NP completeness. Algorithmic paradigms including greedy algorithms, divide and conquer, dynamic programming, network flow, approximation algorithms, and randomized algorithms. Problems drawn from the social sciences, Data Science, Computer Science, and engineering. For students with a flair for proofs and problem solving. Only one of CPSC 365, CPSC 366, or CPSC 368 may be taken for credit. Prerequisites: MATH 244 and CPSC 223. QR

AMTH 4200a / MATH 4210a, The Mathematics of Data Science Gilles Mordant
This course aims to be an introduction to the mathematical background that underlies modern data science. The emphasis is on the mathematics but occasional applications are discussed (in particular, no programming skills are required). Covered material may include (but is not limited to) a rigorous treatment of tail bounds in probability, concentration inequalities, the Johnson-Lindenstrauss Lemma as well as fundamentals of random matrices, and spectral graph theory. Prerequisite: MATH 3050. QR, SC

* **AMTH 4820a, Research Project** John Wettlaufer
Individual research. Requires a faculty supervisor and the permission of the director of undergraduate studies. The student must submit a written report about the results of the project. May be taken more than once for credit.

* **AMTH 4910a, Senior Project** John Wettlaufer
Individual research that fulfills the senior requirement. Requires a faculty supervisor and the permission of the director of undergraduate studies. The student must submit a written report about the results of the project.

AMTH 5520b / CB&B 6663b / CPSC 5520b / GENE 6630b, Deep Learning Theory and Applications Smita Krishnaswamy
Deep neural networks have gained immense popularity within the past decade due to their success in many important machine-learning tasks such as image recognition, speech recognition, and natural language processing. This course provides a principled and hands-on approach to deep learning with neural networks. Students master the principles and practices underlying neural networks, including modern methods of deep learning, and apply deep learning methods to real-world problems including

image recognition, natural language processing, and biomedical applications. Course work includes homework, a final exam, and a final project—either group or individual, depending on enrollment—with both a written and oral (i.e., presentation) component. The course assumes basic prior knowledge in linear algebra and probability. Prerequisites: CPSC 202 and knowledge of Python programming.

AMTH 6750a / MATH 6750a, Numerical Methods for Partial Differential Equations Vladimir Rokhlin

(1) Review of the classical qualitative theory of ODEs; (2) Cauchy problem. Elementary numerical methods: Euler, Runge-Kutta, predictor-corrector. Stiff systems of ODEs: definition and associated difficulties, implicit Euler, Crank-Nicolson, barrier theorems. Richardson extrapolation and deferred corrections; (3) Boundary value problems. Elementary theory: finite differences, finite elements, abstract formulation and related spaces, integral formulations and associated numerical tools, nonlinear problems; (4) Partial differential equations (PDEs). Introduction: counterexamples, Cauchy–Kowalevski theorem, classification of second-order PDEs, separation of variables; (5) Numerical methods for elliptic PDEs. Finite differences, finite elements, Richardson and deferred corrections, Lippmann–Schwinger equation and associated numerical tools, classical potential theory, "fast" algorithms; (6) Numerical methods for parabolic PDEs. Finite differences, finite elements, Richardson and deferred corrections, integral formulations and related numerical tools; (7) Numerical methods for hyperbolic PDEs. Finite differences, finite elements, Richardson and deferred corrections, time-invariant problems and Fourier transform.

AMTH 8650a / MATH 8650a, Inverse Problems John Schotland

This is a course on inverse problems and their applications in imaging. The prototypical problem we consider is to recover the coefficients of a partial differential equation from boundary measurements of its solutions. The fundamental theoretical questions concern the uniqueness, stability, and reconstruction of the coefficients. This is a vast subject, and we are only able to discuss a few of its important aspects. These include: the Radon transform and other ray transforms, the Calderón problem and related problems for elliptic equations, inverse transport problems and optical tomography, and the Gelfand problem and related problems for hyperbolic equations. The necessary tools from partial differential equations, differential geometry, and microlocal analysis are developed as needed. Prerequisite: Real and functional analysis. Some exposure to partial differential equations would be useful but is not essential.

Applied Physics

Becton Center, 203.432.2210
http://appliedphysics.yale.edu
M.S., M.Phil., Ph.D.

Chair
Sohrab Ismail-Beigi

Director of Graduate Studies
Daniel Prober (BCT 417; 203.432.4280; daniel.prober@yale.edu)

Professors Charles Ahn, Sean Barrett (*Physics*), Hui Cao, Michel Devoret, Paul Fleury (*Emeritus*), Steven Girvin (*Physics*), Leonid Glazman (*Physics*), Jack Harris (*Physics*), Victor Henrich (*Emeritus*), Sohrab Ismail-Beigi, Simon Mochrie, Corey O'Hern (*Mechanical Engineering and Materials Science*), Vidvuds Ozolins, Daniel Prober, Peter Rakich, Nicholas Read, Robert Schoelkopf, John Schotland, Ramamurti Shankar (*Physics*), A. Douglas Stone, Hong Tang (*Electrical Engineering*), Robert Wheeler (*Emeritus*), Werner Wolf (*Emeritus*)

Associate Professors Michael Hatridge, Owen Miller

Assistant Professors Meng Cheng, Eduardo da Silva Neto, Yongshan Ding, Yu He, Mengxia Liu, Shruti Puri, Diana Qiu, Christina Rodriguez, John Sous, Cong Su, Logan Wright

FIELDS OF STUDY

Fields include areas of theoretical and experimental condensed-matter and materials physics, optical and laser physics, quantum science, quantum information, and nanoscale science. Specific programs include surface and interface science, first principles electronic structure methods, photonic materials and devices, complex oxides, magnetic and superconducting artificially engineered systems, quantum computing and superconducting device research, quantum transport, quantum optics, and random lasers.

INTEGRATED GRADUATE PROGRAM IN PHYSICAL AND ENGINEERING BIOLOGY (PEB)

Students applying to the Ph.D. program in Applied Physics may also apply to be part of the PEB program. See the description under Non-Degree-Granting Programs, Councils, and Research Institutes for course requirements, and http://peb.yale.edu for more information about the benefits of this program and application instructions.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

The requirements for a Ph.D. in applied physics include passing at least nine course units. Courses such as Dissertation Research, Master's Thesis, or seminars do not count towards the nine-course requirement, but two terms of Special Investigation courses are acceptable. Other than the Special Investigation courses, the courses counting toward the nine-course requirement must be full-credit graduate courses. Courses outside of those identified as acceptable in the departmental degree guidelines must

have a clear technical, scientific, or mathematical focus that is related to applied physics in the judgement of the student's adviser and the DGS.

Within the nine-course requirement, students must pass the three core courses, unless they are substituted or waived with approval by the DGS. The three core courses are Electromagnetic Theory I (PHYS 5020) or Theory of Electromagnetic Waves, Radiation, and Scattering (APHY 5220), Quantum Mechanics I (PHYS 5080), and Statistical Physics I (PHYS 5120).

Students must also take the Research in Applied Physics Seminar (APHY 5760) and the Responsible Conduct in Research for Physical Scientists Seminar (APHY 5900).

Students typically complete most of their course requirements in the first year, and sufficient progress toward meeting the course requirements is necessary to remain in good standing in the program. Note that the required courses are just the minimum, and students are strongly encouraged to consult with their adviser about taking additional courses that are needed to facilitate their dissertation research.

By the end of the first year, students must find a research adviser who is willing to supervise a project that is consonant with the research program of that faculty. Research advisers must have an appointment in the graduate school and be engaged in research that falls broadly within the subject of applied physics, although they do not need to be members of the department's faculty.

After completing coursework, the next step toward a degree is admission to candidacy, indicating that the student is prepared to do original and independent research. To be admitted to candidacy, students must submit a written research prospectus and pass an area examination early in their third year. If a student has faced unusual circumstances, this deadline can be extended, with the support of the research adviser and approval of the DGS.

There is no foreign language requirement.

Teaching experience is regarded as an integral part of the graduate training program at Yale University, and all applied physics graduate students are required to serve as teaching fellows for two terms, typically during years two and three. Teaching duties normally involve assisting in laboratories or discussion sections and grading papers. Teaching duties are not expected to require more than ten hours per week. Students are not permitted to teach during the first year of study. Students who require additional support from the graduate school must teach for up to an additional two terms, if needed.

If a student was admitted to the program having earned a score of less than 26 on the Speaking section of the Internet-based TOEFL, the student will be required to take an English as a Second Language (ESL) course each term at Yale until the graduate school's Oral English Proficiency standard has been met. This must be achieved by the end of the third year in order for the student to remain in good standing.

HONORS REQUIREMENT

In order to remain in good standing in the program, students are expected make steady progress in meeting their course requirements and to obtain Honors grades in at least two full-term courses by the end of their fourth term of full-time study. Courses such

as Master's Thesis, seminars, or Special Investigations cannot be used to fulfill the requirement for two Honors grades. An extension may be granted on a case-by-case basis at the discretion of the DGS, in consultation with the student's adviser. Students are also expected to maintain an average grade of High Pass during their time at Yale, following the averaging methodology determined by the graduate school.

MASTER'S DEGREES

M.Phil. See Degree Requirements under Policies and Regulations.

M.S. Students may apply for a terminal master's degree in applied physics. For the M.S. degree, the requirements are that the student pass eight full-credit graduate courses (not seminars), typically courses similar to those that would meet the course requirements for the Ph.D. No more than two of the courses may be Special Investigations. Students may substitute other graduate courses with a clear technical, scientific, or mathematical focus that is related to applied physics in the judgement of the student's adviser and the DGS. An average grade of at least High Pass is required, with at least one grade of Honors. This terminal degree program is normally completed in one year. Doctoral students who withdraw from the Ph.D. program may be eligible to receive the M.S. if they have met the above requirements and have not already received the M.Phil.

Program materials are available upon e-mail request to applied.physics@yale.edu, or at http://appliedphysics.yale.edu.

COURSES

APHY 5060a, Basic Quantum Mechanics John Sous
Basic concepts and techniques of quantum mechanics essential for solid state physics and quantum electronics. Topics include the Schrödinger treatment of the harmonic oscillator, atoms and molecules and tunneling, matrix methods, and perturbation theory.

APHY 5220b, Theory of Electromagnetic Waves, Radiation, and Scattering A Douglas Stone
This is a graduate-level course on electromagnetic theory, focusing on electromagnetic wave phenomena in a variety of contexts. Electrostatics and magnetostatics are reviewed briefly and then the full time-dependent Maxwell equations are studied to derive the fundamentals of wave propagation, the wave equation, plane waves, polarization, energy and momentum flow in EM waves, conservation laws, gauge transformation, and Green functions for the wave equations. Dielectric media and Fresnel reflection and refraction, total internal reflection, group velocity, wave packets and dispersion. Beam propagation and gaussian optics, optical birefringence. Waves in confined structures, waveguides, optical fibers, resonant cavities. Radiating sources, electric and magnetic dipolar radiation, multipolar radiation, near and far-field solutions, radiating antennas. Scattering theory, scalar and vector diffraction, Rayleigh scattering, scattering matrix and temporal coupled mode theory, scattering resonances, multiple scattering, systems with gain and lasing. Time permitting: relativistic kinematics, covariance of Maxwell's equations, Lorentz transformation of electric and magnetic fields, relativistic mechanics of charged particles. Prerequisites: an undergraduate course on electricity and magnetism and graduate-level vector calculus and differential equations.

APHY 5260a, Explorations in Physics and Computation Logan Wright
Computation has taken on an important, often central, role in both the practice and conception of physical science and engineering physics. This relationship is intricate and multifaceted, including computation for physics, computation with physics, and computation as a lens through which to understand physical processes. This course takes a more or less random walk within this space, surveying ideas and technologies that either apply computation to physics, that understand physical phenomena through the lens of computation, or that use physics to perform computation. Given the extent to which machine learning methods are currently revolutionizing this space of ideas, we focus somewhat more on topics related to modern machine learning, as opposed to other sorts of algorithms and computation. Since it is covered more deeply in other courses, we do not extensively cover error-corrected/fault tolerant quantum information processing, but we do frequently consider quantum physics. The course does not provide a systematic overview of any one topic, but rather a sampling of ideas and concepts relevant to modern research challenges. It is therefore intended for graduate students in early years of their program or research-inclined senior undergraduate students contemplating a research career. As a result, in addition to the scientific topics at hand, key learning goals include the basics of literature review, presentation, collegial criticism (peer review), and synthesizing new research ideas. Evaluation is primarily through two projects, one a lecture reviewing a topic area of interest and one a tutorial notebook providing worked numerical examples/code meant to develop or introduce a concept. Prior experience with Python is ideal, but can be learned as part of the coursework. Students should ideally be familiar with quantum mechanics, including density matrices and some phase-space methods, but this applies to only small fraction of the course. The course is primarily a survey-level overview of many topics, not a deep dive into any one topic. As a result, students who have extensive background on many of the topics described in the syllabus are welcome to participate but should speak with the instructor beforehand so we can determine if their learning goals can be met.

APHY 5480a / PHYS 5480a, Solid State Physics I Yu He
A two-term sequence (with APHY 549) covering the principles underlying the electrical, thermal, magnetic, and optical properties of solids, including crystal structures, phonons, energy bands, semiconductors, Fermi surfaces, magnetic resonance, phase transitions, and superconductivity.

APHY 5490b / ENAS 851 / PHYS 5490b, Solid State Physics II Vidvuds Ozolins
A two-term sequence (with APHY 548) covering the principles underlying the electrical, thermal, magnetic, and optical properties of solids, including crystal structures, phonons, energy bands, semiconductors, Fermi surfaces, magnetic resonance, phase transitions, and superconductivity.

APHY 5750b, Physics of AI John Sous
A introduction to current research in AI from a physics perspective, i.e. one that emphasizes the mechanisms through which various AI architectures learn. Topics include, linear regression, neural nets, transformers, diffusion, etc. Prerequisites: linear algebra, calculus.

APHY 5760a, Topics in Applied Physics Research Peter Rakich
The course introduces the fundamentals of applied physics research to graduate students in the Department of Applied Physics in order to introduce them to resources

and opportunities for research activities. The content of the class includes overview presentations from faculty and other senior members of the department and related departments about their research and their career trajectories. The class also includes presentations from campus experts who offer important services that support Applied Physics graduate students in their successful degree completion.

APHY 5900b / PHYS 5900b, Responsible Conduct in Research for Physical Scientists
Staff
A review and discussion of best practices of conduct in research including scientific integrity and misconduct; mentorship; data management; and diversity, equity, and inclusion in science.

APHY 6070b, Modern Topics in Optics and Quantum Electronics Peter Rakich
This course provides a survey of modern topics involving integrated photonics, optomechanics, nonlinear optics, and laser physics for students interested in contemporary experimental optics research. Subjects include nonlinear wave phenomena, optomechanical interactions, phonon physics, light scattering, light emission and detection, cavities, systems of cavities, traveling-wave devices and interactions, perturbation theory, reciprocal and nonreciprocal systems, parametric interactions, laser oscillators and related technologies. Students are encouraged to explore these and related research topics through independent study and classroom presentations.

APHY 6100a / PHYS 6100a, Quantum Many-Body Theory Yoram Alhassid
Identical particles and second quantization. Electron tunneling and spectral function. General linear response theory. Approximate methods of quantum many-body theory. Dielectric response, screening of long-range interactions, electric conductance, collective modes, and photon absorption spectra. Fermi liquid; Cooper and Stoner instabilities; notions of superconductivity and magnetism. BCS theory, Josephson effect, and Majorana fermions in condensed matter; superconducting qubits. Bose-Einstein condensation; Bogoliubov quasiparticles and solitons.

APHY 6280a / PHYS 6120a, Statistical Physics II Nicholas Read
An advanced course in statistical mechanics. Topics may include mean field theory of and fluctuations at continuous phase transitions; critical phenomena, scaling, and introduction to the renormalization group ideas; topological phase transitions; dynamic correlation functions and linear response theory; quantum phase transitions; superfluid and superconducting phase transitions; cooperative phenomena in low-dimensional systems.

APHY 6330b / PHYS 6330b, Introduction to Superconductivity Yu He
The fundamentals of superconductivity, including both theoretical understandings of basic mechanism and description of major applications. Topics include historical overview, Ginzburg-Landau (mean field) theory, critical currents and fields of type II superconductors, BCS theory, Josephson junctions and microelectronic and quantum-bit devices, and high-Tc oxide superconductors.

APHY 6600a / PHYS 6010a, Quantum Information and Computation Shruti Puri
This course focuses on the theory of quantum information and computation. We cover the following tentative list of topics: overview of postulates of quantum mechanics and measurements, quantum circuits, physical implementation of quantum operations, introduction to computational complexity, quantum algorithms (DJ, Shor's, Grover's,

and others as time permits), decoherence and noisy quantum channels, quantum error-correction and fault-tolerance, stabilizer formalism, error-correcting codes (Shor, Steane, surface-code, and others as time permits), quantum key distribution, quantum Shannon theory, entropy, and data compression.

APHY 6610b, Fault Tolerance and Quantum Error Correction Aleksander Kubica
This course focuses on the theory of fault tolerance and quantum error correction. We cover the following tentative list of topics: criteria for quantum error correction, classical linear codes and quantum CSS codes, stabilizer codes, existence of good codes, concatenated codes, threshold theorems, topological codes, decoding algorithms, statistical-mechanical mappings, logical gates and fault-tolerant quantum computing, resource overheads, limitations and no-go theorems, quantum LDPC codes, approximate quantum error correction, experimental realizations of quantum error correction, and open research problems. Prerequisite: APHY 660 or CPSC 547 (or equivalent).

APHY 6700a, Statistical Methods with Applications in Science and Finance Sohrab Ismail-Beigi
Introduction to key methods in statistical physics with examples drawn principally from the sciences (physics, chemistry, astronomy, statistics, biology) as well as added examples from finance. Students learn the fundamentals of Monte Carlo, stochastic random walks, and analysis of covariance analytically as well as via numerical exercises. Prerequisites: ENAS 1940, MATH 2220, ENAS 1300 or equivalents.

APHY 6750a / PHYS 6750a, Principles of Optics with Applications Hui Cao
Introduction to the principles of optics and electromagnetic wave phenomena with applications to microscopy, optical fibers, laser spectroscopy, nanophotonics, plasmonics, and metamaterials. Topics include propagation of light, reflection and refraction, guiding light, polarization, interference, diffraction, scattering, Fourier optics, and optical coherence.

APHY 6760a / PHYS 6760a, Introduction to Light-Matter Interactions Peter Rakich
Optical properties of materials and a variety of coherent light-matter interactions are explored through the classical and quantum treatments. The role of electronic, phononic, and plasmonic interactions in shaping the optical properties of materials is examined using generalized quantum and classical coupled-mode theories. The dynamic response of media to strain, magnetic, and electric fields is also treated. Modern topics are explored, including optical forces, photonic crystals, and metamaterials; multi-photon absorption; and parametric processes resulting from electronic, optomechanical, and Raman interactions.

APHY 6790b / PHYS 6790b, Nonlinear Optics and Lasers Logan Wright
Properties and origins of the nonlinear susceptibility; Sum-freq, diff-freq and 2nd-harmonic generation; Intensity-dependent refractive index; Optical phase conjugation; Self-focusing, self-phase modulation, solitons; Stimulated light scattering; Fixed points, bifurcations; Amplification; Rate equations; Relaxation oscillations, frequency pulling; Hole burning; Q-switching; Semiconductor and DFB lasers; Mode-locking; Injection-locking; Intense-field NLO and QM laser theory (time permitting)

APHY 7260a, Advanced Thin Film Synthesis and Characterization Charles Ahn
This course covers principles of thin film growth and characterization for advanced electronic and quantum materials applications. Topics include physical vapor deposition

and related techniques for achieving state-of-the-art thin films and heterostructures, along with atomic-scale and spectroscopic characterization of thin film structures, including scanning probe microscopies, electron microscopies, diffraction techniques, and photon-based spectroscopies.

APHY 7270b, Circuit Quantum Electrodynamics Michael Hatridge and Robert Schoelkopf

Circuit quantum electrodynamics, or circuit QED, is the field of quantum optics with microwave photons, and is the basis of most solid-state quantum computing technologies. In the microwave domain, we can engineer the properties of "artificial atoms" constructed from circuits containing Josephson junctions and couple them strongly to stationary photons trapped in a cavity or resonant circuit and to traveling photons in a waveguide or transmission line. With this approach, one can access regions of strong coupling between "light" and "matter" that are not accessible in atomic physics. This course is an introduction to the concepts and techniques of circuit QED, aimed for the beginning graduate student or advanced undergraduate with a solid background in classical electricity and magnetism and also basic quantum mechanics. The course is intended to provide an important base of knowledge that can prepare the student for research in quantum information processing with superconducting circuits. Topics to be covered include the basics of superconducting qubits, the Jaynes-Cummings model and the strong dispersive regime, and the use of light-matter interactions for measurement, control, and quantum computing with quantum circuits. Extra work for graduate students: The last homework set is optional for undergrads and required for grads. Prerequisites: one semester QM and one semester E&M at advanced undergrad or higher.

Archaeological Studies

10 Sachem Street, 203.432.3670
http://archaeology.yale.edu
M.A.

Chair and Director of Graduate Studies
Richard Burger

Professors Richard Burger (*Anthropology*), Edward Cooke, Jr. (*History of Art*; *American Studies*), John Darnell (*Near Eastern Languages and Civilizations*), Stephen Davis (*Religious Studies*; *History*), Eckart Frahm (*Near Eastern Languages and Civilizations*), Milette Gaifman (*History of Art*; *Classics*), William Honeychurch (*Anthropology*), J.G. Manning (*Classics*; *History*), Roderick McIntosh (*Emeritus*), Nadine Moeller (*Near Eastern Languages and Civilizations*), Eric Sargis (*Anthropology*; *Ecology and Evolutionary Biology*), Anne Underhill (*Anthropology*), David Watts (*Anthropology*), Harvey Weiss (*Near Eastern Languages and Civilizations*; *School of the Environment*)

Associate Professors Oswaldo Chinchilla (*Anthropology*), Andrew Johnston (*Classics*; *History*)

Assistant Professors Allison Caplan (*History of Art*), Alexander Ekserdjian (*History of Art*; *Classics*), Piphal Heng, Jessica Thompson (*Anthropology*)

Lecturers, Research Associates, and Research Scientists Ellery Frahm (*Anthropology*), Gregory Marouard (*Near Eastern Languages and Civilizations*), Catherine Skinner (*Earth and Planetary Sciences*)

The aim of the program is to give students the academic background needed for careers in museums, cultural resource management, and teaching in community colleges and secondary schools. It also provides the opportunity for teachers, curators, and administrators to refresh themselves on recent developments in archaeology. In addition, the program enables some of our students to strengthen their background in archaeology before applying to Ph.D. programs. The program is administered by Yale's Council on Archaeological Studies, with faculty from the Departments of Anthropology, Classics, Earth and Planetary Sciences, History, History of Art, Near Eastern Languages and Civilizations, and Religious Studies.

SPECIAL REQUIREMENTS FOR THE M.A. DEGREE

Courses are drawn from the graduate programs of the participating departments and from those undergraduate courses that are also open to graduate students. Eight courses are required. Unless previously taken for credit, these will include:

- the archaeological laboratory overview
- at least one additional laboratory course
- a course related to archaeology in two of the following three groups:

  (1) anthropology

  (2) classics, history, history of art, Near Eastern languages and civilizations, or religious studies

(3) earth and planetary sciences, ecology and evolutionary biology, or environment

- four electives.

All students are required to participate in an approved summer field project. In addition, each student will write a master's thesis. Degree candidates are required to pay a minimum of one year of full tuition. Full-time students can complete the course requirements in one academic year, and all students are expected to complete the program within a maximum period of three academic years.

For further information, visit the Archaeological Studies website, http://archaeology.yale.edu. Inquiries may be directed to Director of Graduate Studies, c/o Registrar, Archaeological Studies, Department of Anthropology, Yale University, PO Box 208277, New Haven CT 06520-8277, or via email to anthropology.registrar@yale.edu.

COURSES

ARCG 5328b / ANTH 5328b / NELC 7290b, Magic and Ritual in Ancient Egypt and the Near East John Darnell

Introduction to ancient Egyptian and Near East magic and rituals with an overview on the use of magic and discussion of the different rituals and festivals.

ARCG 6136b / ANTH 6136b, Geoarchaeology: Earth and Environmental Sciences in Archaeological Investigations Ellery Frahm

A survey of the numerous ways in which theories, approaches, techniques, and data from the earth and environmental sciences are used to address archaeological research questions. A range of interfaces between archaeology and the geological sciences are considered. Topics include stratigraphy, geomorphology, site formation processes, climate reconstruction, site location, and dating techniques.

ARCG 6242b / NELC 7440b, Ancient Egyptian Materials and Techniques: Their Histories and Socioeconomic Implications Gregory Marouard

This seminar investigates in detail ancient Egyptian materials, techniques, and industries through the scope of archaeology, history, and socioeconomical, textual, and iconographic data. When possible, ethnoarchaeological and experimental approaches of the antique *chaîne-opératoire* are discussed in order to illustrate skills and professions that have now completely disappeared. This class is organized according to various themes within a diachronical approach, from the fourth millennium BCE to the Roman period. Copper and precious metals, construction stones, hard stones and gems, glass and faience production, imported wood or ivory—we explore multiple categories of materials; where and how they were collected or exchanged; the way these products were transported, transformed, refined, or assembled; and the complex organization of the work involved and administration that was required in order to satisfy the tastes of Egyptian elites or their desires to worship their gods. Some other vernacular savoir-faire linked to everyday life and death is explored, through food production and mummification practices. The aim is not only to give an overview of the history of techniques for this early civilization but also, beyond how things were made, to acquire a more critical view of ancient Egyptian culture through material culture and the strong economic and sociological implications linked to objects and constructions#rather than the usual focus on Egyptian temples and tombs.

ARCG 6345a / ARCG 645 / NELC 7430a, Archaeology of Ancient Egypt - The Age of the Pyramids Gregory Marouard
This lecture course introduces the archaeology of ancient Egypt, beginning with an overview of the environment, climate, and history of the discipline, as well as the new archaeological methods used in contemporary fieldwork in Egypt. The course then explores ancient Egypt's origins, starting with the Predynastic and Early Dynastic Periods (5300-2800 BCE) and continuing chronologically to the great pyramids of the Old Kingdom (2800-2055 BCE) and the Middle Kingdom (2055-1700 BCE). It covers the historical framework, the evolution of ancient Egyptian art and architecture, and material culture, and includes specific case studies of important archaeological sites and discoveries. This course is the first of two introductory lecture courses. However, it is not necessary to take both parts, and the order in which you take them does not matter. Discussion sections are included.

ARCG 6375a / ANTH 6375a, The Green Hell and the Mother Serpent: Amazonian Archaeology, Ethnography, and Politics Richard Burger
Survey and seminar discussing the archaeology and ethnography of greater Amazonia, along with the political stakes of this heritage for modern Indigenous communities in the region. Introduces students to the varied geography and ecology of greater Amazonia, before delving into topics such as: the archaeological record of domestication and landscape investment by past Indigenous societies; the ethnographic and historical records of their descendants; the contested spheres of knowledge production in anthropology that underpins both of these records; and the modern political struggles that Indigenous communities face today amid deforestation and the pursuit of economic development.

ARCG 6665b / ANTH 6665b, Evolution of Human Diet Jessica Thompson
This course examines human nutrition and subsistence behavior from an evolutionary perspective. It begins with human nutritional literature and discussions of our biological requirements, then moves into comparison of modern human dietary ecology with those of other primates, especially our closest living relatives, the great apes. We then turn to literature that demonstrates the methods and theoretical approaches that are currently used to reconstruct past diets. As we begin to follow the evidence for changes in subsistence in the hominin lineage, case studies using these methods are integrated into discussions of how we know what we do about past nutrition. The course spends time on key issues and debates such as changes from closed-habitat to open-habitat foraging, the origins of meat-eating, the role of extractive foraging in human social systems, variation in hunter-forager subsistence systems, the origins of domestication, and the phenomenon of fad diets in industrialized nations. The course is delivered in a seminar-style format, with key readings each week that follow topical themes, with assessment based on in-class participation, critical essays, and a final research project.

ARCG 7075b / ANTH 7075b, Anthropology of Mobile Societies William Honeychurch
The social and cultural significance of the ways that hunter-gatherers, pastoral nomads, maritime traders, and members of our own society traverse space. The impact of mobility and transport technologies on subsistence, trade, interaction, and warfare from the first horse riders of five thousand years ago to jet-propulsion tourists of today.

ARCG 7116La / ANTH 7116La, Introduction to Archaeological Laboratory Sciences Ellery Frahm
Introduction to techniques of archaeological laboratory analysis, with quantitative data styles and statistics appropriate to each. Topics include dating of artifacts, sourcing of ancient materials, remote sensing, and microscopic and biochemical analysis. Specific techniques covered vary from year to year.

ARCG 7150a / ANTH 7150a, Analysis of Lithic Technology Oswaldo Chinchilla Mazariegos
This course provides an introduction to the analysis of the chipped and ground stone tools found on archaeological sites. As a laboratory course, it includes hands-on instruction: we learn how to manufacture chipped stone tools out of obsidian. We begin by reviewing the development of chipped and ground stone tool technology from the earliest simple pebble tools to historical period tools. We discuss the relevance of lithics research to issues of subsistence, craft specialization, and trade. We also discuss how these artifacts are recorded, analyzed, and drawn, and we review related studies such as sourcing and use-wear analysis.

ARCG 7185b / ANTH 7185b, Archaeological Ceramics I Anne Underhill
Ceramics are a rich source of information about a range of topics including ancient technology, cooking practices, craft specialization, regional trade, and religious beliefs. This course provides a foundation for investigating such topics and gaining practical experience in archaeological analysis of ceramics. Students have opportunities to focus on ceramics of particular interest to them, whether these are low-fired earthen wares, or porcelains. We discuss ancient pottery production and use made in diverse contexts ranging from households in villages to workshops in cities. In addition we refer to the abundant ethnoarchaeological data about traditional pottery production.

ARCG 7259b / ANTH 7259b, Social Complexity in Ancient China Anne Underhill
This seminar explores the variety of archaeological methods and theoretical approaches that have been employed to investigate the development and nature of social complexity in ancient China. The session meetings focus on the later prehistoric and early historic periods, and several geographic regions are included. They also consider how developments in ancient China compare to other areas of the world. Most of the readings emphasize archaeological remains, although relevant information from early historical texts is considered.

ARCG 7272b / ANTH 7272b, Cities in Antiquity: The Archaeology of Urbanism Piphal Heng
Archaeological studies of ancient cities and urbanism. Topics include the origin and growth of cities; the economic, social, and political implications of urban life; and archaeological methods and theories for the study of ancient urbanism. Case studies include ancient cities around the world.

ARCG 7280a / ANTH 7280a, Archaeology of Religion Richard Burger and Piphal Heng
The course explores archaeological approaches to the study of religion. While the term "religion" is hard to define, it is generally agreed that religious phenomena occur in almost all cultures and that this realm played a significant part in most prehistoric cultures. In order to provide a broad vision of this theme, the course begins by considering influential schools of thought on the definition, origins, and

social significance of religious behavior. The course then reviews a variety of methods that scholars may use to reconstruct ancient beliefs and rituals. The course assesses the applicability and success of these methodologies across the broad spectrum of ancient cultures representing differing degrees of sociopolitical complexity. Finally, we explore case studies from a diverse range of ancient societies and consider the impact of religious behaviors within their broader cultural contexts.

ARCG 7297a / ANTH 7297a, Archaeology of East Asia Staff
East and Southeast Asia have increasingly emerged as hotspots for global political, economic, and cultural interactions. What were the roots and social processes that gave rise to such systems? In this seminar, we explore archaeological evidence for the development of social and political organization and religious practices, using selected examples from East and Southeast Asia spanning approximately 5000 BCE to 1500 CE. We examine four key themes: (1) the origins and timing of plant and animal domestication, (2) the emergence and impact of early metallurgy, (3) patterns of interregional interaction, and (4) the rise of sociopolitical complexity. Using a comparative archaeological perspective—focusing on settlement patterns, urbanism, craft production, monumentality, and diverse material culture—we examine how both local factors and long-distance connections shaped these trajectories. We conclude the course with a reflection on the role of archaeology in contemporary society, particularly in countries where the past is actively curated, celebrated, and contested. No background in archaeology or East/Southeast Asian studies is required. Through short lectures, weekly discussions, student presentations, and a final research paper on selected case studies, students learn how archaeological research is conducted and interpreted. By the end of the term, students are able to outline the broad historical sequence of the region from the earliest food production through the mid-second millennium CE; identify major archaeological sites and their contributions to our understanding of domestication, metallurgy, and early urbanism; and compare the historical trajectories of East and Southeast Asian societies. The course also emphasizes critical thinking and analytical reasoning, encouraging students to evaluate evidence, interrogate interpretive frameworks, and formulate informed perspectives on the region's past.

ARCG 8513a or b / ANTH 8513a or b, Human Osteology Eric Sargis
A lecture and laboratory course focusing on the characteristics of the human skeleton and its use in studies of functional morphology, paleodemography, and paleopathology. Laboratories familiarize students with skeletal parts; lectures focus on the nature of bone tissue, its biomechanical modification, sexing, aging, and interpretation of lesions.

ARCG 9053a or b, Directed Research in Archaeology and Prehistory Staff
By arrangement with faculty.

ARCG 9900a or b, Dir Reading Staff
Direct Reading course for ARCG

ARCG 9901a or b, Master's Thesis Staff
Master's thesis course

ARCG 9950a or b, Master's Essay Staff
Master's Essay for ARCG

Architecture

Rudolph Hall, 203.432.2288
https://www.architecture.yale.edu/academics/programs/4-p-h-d
M.Phil., Ph.D.

Dean
Deborah Berke

Director of Doctoral Studies
David Gissen (517 Rudolph, 203.432.6874, david.gissen@yale.edu)

Professors Sunil Bald, Phillip G. Bernstein, Francesco Casetti, Anna Dyson, Keller Easterling, David Gissen, Francesca Hughes, Joan Ockman, Michael Osman, Eeva-Liisa Pelkonen, Alan Plattus, Kishwar Rivzi

Associate Professors Craig Buckley, Mark Foster Gage, Elihu Rubin

Assistant Professors Anthony Acciavatti, Mae-Ling Lokko, David Sadighian, Ife Vanable

Lecturers and Critics Mohamed Aly-Etman, Kyle Dugdale, Christopher Hawthorne, Yoko Kawai, Justin Garrett Moore, M. Surry Schlabs

Visiting Faculty Luis Carranza, Vyjayanthi Rao

FIELDS OF STUDY

The doctoral program in Architecture offers two tracks of study: History and Theory of Architecture and Ecosystems in Architectural Sciences. Both tracks offer rigorous grounding in their respective fields of specialization while giving future scholars and educators a broad awareness of issues currently facing architecture in its relations with society and the world at large.

The History and Theory track provides training in the historiography and culture of architecture and the built environment. It prepares candidates for careers in university teaching, cultural advocacy and administration, museum curatorship, and publishing, among others. Students focus on a diverse range of topics, often drawing on related disciplines ranging from art history to the history of science and technology and beyond. The program aims to foster both a deep knowledge of the past and a strong spirit of critical inquiry.

The Ecosystems in Architectural Sciences track provides preparation in interdisciplinary scientific inquiry in support of both academic and professional research careers, qualifying students to collaborate across disciplines and to incorporate environmental research methods within new design frameworks. Doctoral thesis work involves the investigation, development, and testing of novel material and information systems. Students in this track engage in research related to the behaviors of living ecosystems, emphasizing their interconnection with built environment processes.

HISTORY AND THEORY TRACK

Admission Requirements

Applicants must have a master's degree or equivalent in architecture, urban planning, environmental design, or, exceptionally, a related field. Two years of professional work in an architecture office are recommended. The Graduate Record Examination (GRE) General Test taken no more than five years prior to application is required. All applicants whose native language is not English are also required to take the Internet-based Test of English as a Foreign Language (TOEFL iBT), which includes a section on spoken English. The TOEFL requirement may be waived only for applicants who, prior to matriculation at Yale, will have received a baccalaureate degree or its international equivalent from a college or university where English is the primary language of instruction. Applicants must have studied in residence at the baccalaureate institution for at least three years to receive the waiver. A waiver will not be granted on the basis of an advanced degree (such as M.A., M.S., or Ph.D.) from another institution.

In addition to meeting the qualifying criteria, candidates are required as part of the application to submit a portfolio of their own architectural work, a writing sample in the form of a substantial research paper or publication, and an explanation of their motivation for engaging in their chosen course of study. Qualified applicants may be invited to interview with a member of the doctoral faculty.

The portfolio should be a well-edited representation of the applicant's creative work. Portfolios may not contain videos. Anything submitted that is not entirely the applicant's own work must be clearly identified as such. The portfolio is submitted digitally as a single PDF document optimized not to exceed 20Mb and will need to be uploaded as part of the online application. Pages of the pdf portfolio should be uploaded as spreads. The digital portfolio will be viewed on computer screens, so resolution above 150 dpi is not necessary.

Admission to the Ph.D. program in Architecture is administered by the Yale Graduate School of Arts and Sciences. For general questions regarding admissions, please contact graduate.admissions@yale.edu.

The Application Process

The online application can be accessed at http://gsas.yale.edu/admission when it is available. Applications for the program beginning in the 2025–2026 academic year must be submitted no later than January 2, 2025. Applicants will not be allowed to submit applications after the deadline has passed.

Requirements for the History and Theory Ph.D. Track

Students are required to be full-time and in residence in the New Haven area during their first three academic years. Students may be asked to attend summer orientation courses before their first term. (See Degree Requirements under Policies and Regulations in the Bulletin of the Graduate School of Arts and Sciences.)

During the first two years, students engage in a concerted course of study that leads directly to work on the dissertation. In all, they are required to take twelve graduate-level seminars for credit. These include a Ph.D. seminar taught in each of the first

two terms by a standing or visiting faculty member of the School of Architecture. The Ph.D. seminars, ARCH 9901, ARCH 9902, ARCH 9903, and ARCH 9904 constitute the program's methodological foundation and introduce students to an array of historiographic approaches and areas of study. The content of the two seminars varies from year to year.

For purposes of fulfilling their remaining course requirements, students are encouraged to take one or more courses outside the School of Architecture that are related to their specific area of interest. For example, a student working on architecture in Brazil would likely take courses in Latin American history and culture. Students may also opt to do independent readings with individual faculty in their area.

Not later than the end of the second year, students are expected to demonstrate competence in at least one foreign language relevant to their field of study. Language competence is more than a formality and requires some acquaintance with literature in the chosen language; competency may be demonstrated by a grade of B or better in a full-year intermediate-level language course or through examination. By the end of the second year, all course and language requirements are normally completed, and the student's field of interest is defined. At this point the director of doctoral studies (DDS) works with the student to identify a thesis adviser, who may or may not be from the School of Architecture.

In the fall term of the third year, students are required to take an oral examination on three topics relevant to their field of doctoral research. The exam, combining questions on each of the three fields in one two-hour session, is administered by the thesis adviser and two additional examiners selected by the student. Following their successful completion, the DDS, in consultation with the student's principal adviser, appoints the student's dissertation committee, which consists of the student's principal adviser plus two additional faculty members. It is typical for one of the dissertation committee members to come from outside the School of Architecture, with selection based on the student's area of interest.

At the end of the third year or, at latest, the beginning of the fourth, students are expected to defend their dissertation prospectus, a preliminary proposal of their dissertation topic. The prospectus comprises a description of the topic, an outline of a detailed program of research, and an annotated bibliography. Upon passing all pre-dissertation requirements including the field exams and prospectus defense, students are admitted to candidacy for the Ph.D. and are "ABD" (all but dissertation). At this point, they embark on their dissertation research and writing, submitting drafts of the dissertation chapters as they are completed. The dissertation committee guides and monitors the student's progress through the course of writing and evaluates the dissertation upon completion.

The Ph.D. program is designed to be completed in five years. However, if the dissertation has not been completed by the end of the fifth year and if, at that time, the program certifies that the candidate will complete the dissertation by August of the following academic year, the candidate may be eligible to take a teaching position in the School of Architecture or elsewhere in the university and extend funding for up to an additional nine months.

Graduate Research Assistant and Teaching Fellow Experience

Teaching is an important part of the doctoral program in History and Theory of Architecture. Students in the program are expected to teach or serve as research assistants (Ecosystems in Architectural Sciences Track only) for four terms, normally in their third and fourth years. During these four terms, it is anticipated that a student in the History and Theory track will teach in two survey courses in the student's area of study at the School of Architecture or elsewhere in the university and teach in two design studios at the School of Architecture. All teaching assignments are carried out under the direct supervision of senior faculty.

ECOSYSTEMS IN ARCHITECTURAL SCIENCES TRACK

The Ecosystems in Architectural Sciences track supports students to innovate the means and methods of architectural systems. This track provides preparation in interdisciplinary scientific inquiry, qualifying students to incorporate rigorous scientific methods in the research, development, and deployment of novel material and informational ecosystems for the built environment. Students in this track engage in research related to the behaviors of living ecosystems, emphasizing the interconnections between the built environment process and health, equity, and justice across both human and non-human living systems.

Admission Requirements

Applicants must have a master's degree or equivalent in architecture, engineering, environmental design, or, exceptionally, in a related field. Two years of professional work in an architecture office are recommended. The Graduate Record Examination (GRE) General Test taken no more than five years prior to application is required. All applicants whose native language is not English are also required to take the Internet-based Test of English as a Foreign Language (TOEFL iBT), which includes a section on spoken English.

In addition to meeting the qualifying criteria, candidates are required as part of the application to submit a portfolio of their own architectural work, a writing sample in the form of a substantial research paper or publication, and an explanation of their motivation for engaging in their chosen course of study. Qualified applicants may be invited to interview with a member of the doctoral faculty.

The portfolio should be a well-edited representation of the applicant's creative work. Anything submitted that is not entirely the applicant's own work must be clearly identified as such. The portfolio is submitted digitally as a single PDF document optimized not to exceed 20Mb and will need to be uploaded as part of the online application. Pages of the pdf portfolio should be uploaded as spreads. The digital portfolio will be viewed on computer screens, so resolution above 150 dpi is not necessary.

Admission to the Ph.D. program in Architecture is administered by the Yale Graduate School of Arts and Sciences. For general questions regarding admissions, please contact graduate.admissions@yale.edu.

The Application Process

The online application can be accessed at http://gsas.yale.edu/admission when it is available. Applications for the program beginning in the 2025–2026 academic year must be submitted no later than January 2, 2025. Applicants will not be allowed to submit applications after the deadline has passed.

Requirements for the Ecosystems in Architectural Sciences Ph.D. Track

The Ecosystems in Architectural Sciences is housed within the Yale Center for Ecosystems in Architecture (Yale CEA) at the Yale School of Architecture. As a lab-based program, this track requires students to be full-time and in residence in the New Haven lab during the duration of their program, with the exception of a maximum of four semesters that might be undertaken in field research related to their area of inquiry. Students may be asked to attend summer orientation courses before their first term. (See Degree Requirements in the chapter Policies and Regulations)

This Ph.D. track supports two areas of specialization: (1) Built Environment (BE) Systems Modeling and (2) Environmental Control Systems (ECS) Design and Development. The two proposed areas of specialization are complementary and have considerable overlap in terms of curriculum. However, they differ in terms of the dissertation deliverables. The modeling specialization requires the development of novel contributions to computational methods for quantifying and qualifying the behavior and performance of built environment systems, and the experimental specialization requires the design, physical prototyping, and experimental observation of a novel environmental systems concept within the context of architectural design research.

All students are encouraged to take courses related to their specific areas of interest outside the School of Architecture. For example, a student working on biodiversity in urban contexts might take courses in the School of the Environment. Typically, at least two of the eight elective seminars would be in related fields. Students can also opt to do independent readings with individual faculty members related to their specific areas of interest.

For the Ecosystems in Architectural Sciences track, not later than the end of their second year, students are also expected to demonstrate competence in the pertinent bioclimatic and architectural modeling languages. Computational design competence is more than a formality and requires some acquaintance with the software languages that are current in the chosen area of inquiry. Competency may be demonstrated by a grade of High Pass in at least two of the related required courses and/or seminars.

The student's field of interest within the Ecosystems in Architectural Sciences track is defined by the end of the second year, by which point all course requirements are normally completed, although further options courses that deepen interdisciplinary expertise may be pursued beyond second year. At this time, the program director assigns the student a thesis adviser, who may or may not be from the School of Architecture, and typically many students may be co-advised by an additional member of their committee depending on the area of inquiry. During the fall term of the third year, students undergo an examination on topics relevant to their doctoral research in

the presence of the thesis adviser. Following successful completion of the examination, the program director, in consultation with the student's adviser, appoints a dissertation committee for the student. The dissertation committee consists of the student's adviser plus a minimum of two additional faculty members. One of the dissertation committee members typically comes from outside the School of Architecture, with selection based on the student's area of interest. Upon appointment of the committee, the student will undertake a qualifications exam, which includes an oral component with the committee and a written component. Upon successful completion of the Qualification Exam, a student is ready to prepare for the Candidacy Exam and final dissertation.

FIELD, QUALIFYING, AND CANDIDACY EXAMINATIONS

Each Ph.D. student in the Ecosystems in Architectural Sciences track is required to undergo three stages of evaluations that determine whether they are prepared to proceed to the next stage in the Ph.D. course of study. The proposed timelines are typical but may be adjusted in exceptional cases in consultation with the Graduate School of Arts and Sciences. During the first three terms of coursework, the student will undertake three oral field examinations in the presence of their adviser, typically taking the standard format of architectural design review juries. Between the second and third year of doctoral studies, the student undergoes a qualification examination with their appointed committee that contains both written and oral components. Finally, between the third and fourth year, the student takes the candidacy examination with their committee.

Field Examinations

Purpose The field examinations are designed to test the basic knowledge in the chosen field of inquiry, as accumulated within the student's first terms of coursework, including topics in building physics, energy modeling, passive and active building systems, history and theory of ecology and environmental design, and material systems and production. Students undertake an oral exam with external reviewers sometime after the first year of course work, and successful completion is required in order to continue on to further doctoral studies within the Ecosystems in Architectural Sciences track.

Descriptions and Procedures The field exam is given as an oral exam by a minimum of three master's-sequence course instructors in which the candidate presents their work and is asked a series of questions by the reviewers. Usually, this process takes place during the period of mid-term and end-of-term reviews. The review takes sixty to ninety minutes with articulated responses to questions in which a variety of topics as listed above may be covered.

Evaluation Following the reviews, instructors meet to discuss the student's performance on the exam and determine whether the student warrants a pass or fail grade. Pass: student proceeds without conditions; Fail: student may not be considered for continuing acceptance into the Ph.D. program.

Qualifying Examination

Purpose The qualifying examination is the prerequisite for preparing the candidacy proposal and writing a dissertation. It is designed to examine the knowledge acquired by the student in their proposed field of inquiry. In this context, knowledge of the field not only entails a mastery of the subjects related to the field but also requires

the ability to formulate and elaborate on both theoretical and practical problems related to the chosen field of inquiry. Both aspects are tested with the oral and written formats of the qualifying examination. The qualifying examination in the Ecosystems in Architectural Sciences track is typically taken after the conclusion of coursework and must be completed before admission to Ph.D. candidacy. Preparation for the qualifying examination comprises a combination of coursework and supplementary individual readings as discussed with advisers throughout the course of doctoral studies. Typically, students are recommended to take the examination at the end of their second year of doctoral studies, depending on the required coursework and preparation as agreed upon by the student and their primary adviser. The scope and focus of each examination is a matter for discussion and negotiation with individual examiners. In preparation, the student should strive for a level of knowledge and expertise such as would be required to construct and teach a course on the subject and to be able to conduct independent scholarship in the field.

Descriptions and Procedures The qualifying examination is divided into two parts: an oral examination and a written examination. The examination format is intended to strike a balance between comprehensive knowledge of the related field(s) that are pertinent to the proposed dissertation and the requisite tools for critical scholarship in the chosen area within Ecosystems in Architectural Sciences. The specific format of each examination is tailored to individual student needs, interests, and background.

For the preparation of both parts of the examination, the student prepares and submits a comprehensive bibliography in support of their dissertation proposal and related to the preparatory literature review that they have accumulated during course work and independent readings in support of their proposed dissertation topic. This comprehensive bibliography should be submitted alongside their proposal (two to five pages) to their adviser and eventual examiners two months prior to taking the qualifying examinations. Responsibility for formulating exam questions rests with faculty members specializing in the related fields of inquiry, and others who are appropriate in specific cases as deemed by the examination committee members. The committee is made up of at least two examiners who are not the principal adviser to the student and at least one examiner who is from a department outside of the School of Architecture.

The oral examination, which does not exceed two hours, concentrates intensively on a precise cluster of problems specifically related to the body of literature as presented by the student's qualification proposal summary and bibliography.

The written examination is also formulated by the committee in response to the student's proposal summary and bibliography and is designed to examine the student's facility in carrying out research in the chosen field. The examiners present the student with three relevant questions to be answered in essay format. Two of the questions can be answered with access to books, notes, and any other available resources and are to be completed within five days, comprising no more than thirty typewritten, double-spaced pages. The third question is prepared during a six-hour session at the end of the five-day period within the Ecosystems in Architectural Science lab space, without the aid of supporting materials.

Evaluation There are four possible categories of evaluation on the qualifying exam.

1. *Pass*: The student will proceed to prepare the candidacy exam and the doctoral committee will be confirmed.
2. *Pass with conditions*: The exam was generally acceptable and the student will begin preparations for candidacy but minor specific recommendations on further evaluation are needed, and a doctoral committee will be confirmed to set a date for further evaluation of additional requirements.
3. *Re-examination required*: The scheduling of another examination date to be determined.
4. *Fail*: The committee doesn't think that the candidate will be able to accomplish the proposed dissertation project.

The student receives an M.Phil. degree upon graduation of this phase, provided that the units of academic credit on all coursework have been successfully completed.

Candidacy Examination

By the end of the third year, students are required to present and defend their preliminary proposal of a dissertation topic. This prospectus should consist of a topic statement, an outline of a detailed program of research, and an annotated bibliography. Students are admitted to candidacy for the Ph.D. upon completion of all pre-dissertation requirements, including the prospectus, oral examinations, and qualifying exam with the committee. At this point, they begin dissertation research and writing, submitting drafts of the dissertation chapters as they are completed. The dissertation committee guides and monitors the student's progress in writing the dissertation and evaluates the dissertation upon completion.

Procedures Following the successful completion of the qualifying examination and acceptance of the summary dissertation proposal, the committee is confirmed for the development of the dissertation proposal itself. The dissertation proposal, accompanied by a working bibliography, is prepared and submitted to the committee three months prior to the candidacy exam. It is worked out in consultation with the advising faculty and submitted to the committee, who then meet with the student for a two-hour colloquium to assess the scope, significance, and feasibility of the topic and the student's preparation to accomplish it within the standard doctoral time frame. After approval by the committee, a two-page, single-spaced summary of the proposal is submitted to director of doctoral studies for approval to proceed. Once accepted, this proposal becomes the basis for the eventual assessment of the completed dissertation. After acceptance of the proposal, the student is admitted to candidacy for the Ph.D. Students must be admitted to candidacy by the beginning of the fourth year of study, unless exceptional circumstances are approved by the director of graduate studies and the Graduate School of Arts and Sciences.

Graduate Research Assistant and Teaching Fellow Experience

The program in Architecture considers teaching to be an important part of graduate training. Students in the Ph.D. program in Architecture are expected to teach or serve as research assistants for four terms, normally in their third and fourth years. Students in the Ecosystems in Architectural Sciences track are expected to serve as both teaching fellows in the School of Architecture and research assistants in the school's Center for

Ecosystems in Architecture. All assignments are carried out under the direct supervision of senior faculty.

EN ROUTE MASTER'S DEGREE

M.Phil. The Master of Philosophy degree is awarded en route to the Ph.D. The minimum requirement for this degree is completion of all requirements for the Ph.D., with the exception of the teaching or research assignments and the dissertation.

COURSES

For a current listing of Architecture courses, consult the School of Architecture bulletin, available online at https://bulletin.yale.edu, and Yale Course Search at https://courses.yale.edu.

Required Courses in the History and Theory of Architecture Track

ARCH 9901	Ph.D. Seminar: History/Theory I: Adv. Topics in the History & Theory of Arch. since World War II
ARCH 9902	Ph.D. Seminar: History/Theory II
ARCH 9903	Ph.D. Seminar: History/Theory III
ARCH 9904	Ph.D. Seminar: History/Theory IV

Required Courses in the Ecosystems in Architectural Sciences Track

ARCH 9906	Ph.D. Seminar: Ecosystems in Architecture I
ARCH 9907	Ph.D. Seminar: Ecosystems in Architecture II
ARCH 9908	Ph.D. Seminar: Ecosystems in Architecture III
ARCH 9909	Ph.D. Seminar: Ecosystems in Architecture IV

Astronomy

219 Prospect St., 203.432.3000
http://astronomy.yale.edu
M.S., M.Phil., Ph.D.

Chair
Priyamvada Natarajan

Director of Graduate Studies
Pieter van Dokkum (203.432.3000, pieter.vandokkum@yale.edu)

Professors Héctor Arce, Charles Bailyn, Charles Baltay (*Physics*), Sarbani Basu, Paolo Coppi, Pierre Demarque (*Emeritus*), Debra Fischer (*Emeritus*), Marla Geha, Larry Gladney (*Physics*), Jeffrey Kenney, Richard Larson (*Emeritus*), Priyamvada Natarajan, C. Megan Urry (*Physics*), William van Altena (*Emeritus*), Frank van den Bosch, Pieter van Dokkum, Robert Zinn

Associate Professors Reina Maruyama (*Physics*), Daisuke Nagai (*Physics*), Nikhil Padmanabhan (*Physics*)

Assistant Professor Earl Bellinger, Laura Newburgh (*Physics*), Chiara Mingarelli (*Physics*), Malena Rice

FIELDS OF STUDY

Fields include observational and theoretical astronomy, solar and stellar astrophysics, exoplanets, the interstellar medium and star formation, galactic astronomy, extragalactic astronomy, radio astronomy, high-energy astrophysics, and cosmology.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

A typical program of study includes twelve courses taken during the first four terms, and must include the core courses listed below.

Core Courses

ASTR 5000	The Physics of Astrophysics	1
ASTR 5100	Stellar Populations	1
or ASTR 5500	Stellar Astrophysics	
ASTR 5200	Computational Methods in Astrophysics and Geophysics [1]	1
ASTR 5300	Galaxies	1
or ASTR 5650	The Evolving Universe	
ASTR 5550	Observational Astronomy	1
ASTR 5600	Interstellar Matter and Star Formation	1

[1] ASTR 6200 or PHYS 6780 may be substituted for ASTR 5200 with the permission of the DGS.

Students require the permission of the instructor and the DGS to skip a core class if they think that they have sufficient knowledge of the field. Students will be required to demonstrate their knowledge of the field before they are allowed to skip any core class.

Two of the twelve courses must be research credits, each earned by working in close collaboration with a faculty member. Of the two research credits, one must be earned doing a theoretical research project and one doing an experimental research project. The students need to present the results of the project as a written report and will be given an evaluation of their performance.

The choice of the four remaining courses depends on the candidate's interest and background and must be decided in consultation with the DGS and/or the prospective thesis adviser. Advisers may require students to take particular classes and obtain a specified minimum grade in order for a student to work with them for their thesis. Students must take any additional course that their supervisors require even after their fourth term. In addition, all students, regardless of their term of study, have to attend Professional Seminar (ASTR 7100 and ASTR 7110) every term, unless registered in absentia. Students must also take Responsible Conduct in Research for Physical Scientists (PHYS 5900), which discusses ethics and responsible conduct in scientific research and fulfills the requirement stipulated by the National Science Foundation for all students and for all postdoctoral researchers funded by the NSF. Note that ASTR 7100, ASTR 7110, and PHYS 5900 may not be used to fulfill the twelve-course requirement.

Students are encouraged to take graduate courses in physics or related subjects. On an irregular basis, special topic courses and seminars are offered, which provide the opportunity to study some fields in greater depth than is possible in standard courses. To achieve both breadth and depth in their education, students are encouraged to take a few courses beyond their second year of study.

There is no foreign language requirement. An oral qualifying exam, normally taken at the end of the fourth term of graduate work, tests the student's familiarity with the field in which the student plans to do research, and on the material covered in three thesis work-relevant taught courses taken by the student during the first two year.

Teaching experience is an integral part of graduate education in astronomy. All students are required to serve as teaching fellows for four terms. Both the level of teaching assignments and the scheduling of teaching are variable and partly determined by the needs of the department. Most students will teach in each of their first three terms and complete their fourth teaching assignment sometime after the qualifying exam. Students who require additional support from the graduate school must teach additional terms, if needed, after they have fulfilled the academic teaching requirement.

HONORS REQUIREMENT

Students must earn a grade of Honors in at least three classes by the end of the fourth term of full-time study and have a grade average of High Pass or better.

MASTER'S DEGREES

M.Phil. Upon application, the department will recommend for the award of the M.Phil. degree any student who has completed all the requirements of the Ph.D. degree except the Ph.D. dissertation. These requirements include taking and passing the qualifying exam and submission of the research projects' final written reports (one for each of the two ASTR 5800 projects).

M.S. Students who withdraw from the Ph.D. program may be eligible to receive the M.S. degree if they have met the requirements and have not already received the M.Phil. degree. For the M.S., students must successfully complete at least nine courses (not including ASTR 7100 and ASTR 7110) and at least one research project (ASTR 5800). The student should have a grade average of High Pass in the courses and a grade of High Pass or above in the research project.

Program materials are available upon request to the Director of Graduate Studies, Department of Astronomy, Yale University, PO Box 208101, New Haven CT 06520-8101.

COURSES

ASTR 5000b, The Physics of Astrophysics Sarbani Basu
Primarily for incoming students in the Ph.D. program in Astronomy. The basic physics and related mathematics needed to take the advanced graduate courses. Topics in mechanics, thermodynamics and statistical mechanics, fluid mechanics, special relativity, and electrodynamics with applications to astrophysical systems are covered. Open to undergraduates with permission of the instructor.

ASTR 5010a, Dynamics of Astrophysical Many-Body Systems Frank van den Bosch
This course presents an in-depth treatment of the dynamics of astrophysical systems, including gases, plasmas, and stellar systems. The course starts with a detailed formulation of the theoretical foundations, using kinetic theory and statistical physics to describe the dynamics of many-body systems. Special emphasis is given to collisional processes in various astrophysical systems. Next, after deriving the relevant moment equations, we focus on specific topics related to (1) stellar dynamics, (2) hydrodynamics, and (3) plasma physics. Related to stellar dynamics we cover potential theory, orbit theory, Jeans modeling, gravitational encounters, and secular evolution (bars and spiral structure). In the field of (non-radiative) hydrodynamics we study, among others, the Navier-Stokes equation, vorticity, transport coefficients, accretion flow, turbulence, fluid instabilities, and shocks. We end with a cursory overview of plasma physics, including the Vlasov equation and the two-fluid model, Langmuir waves, Alfvén waves, Landau damping, ideal vs. resistive magnetohydrodynamics (MHD), and dynamos. Throughout the course, we focus on specific astrophysical applications. Prerequisites: undergraduate degree in physics or astronomy and basic knowledge of classical, Hamiltonian dynamics.

ASTR 5100b, Stellar Populations Robert Zinn
The stellar population of our galaxy and the galaxies of the local group. The properties of stars and star clusters, stellar evolution, and the structure and evolution of our galaxy.

ASTR 5200a / EPS 5380a, Computational Methods in Astrophysics and Geophysics Paolo Coppi
The analytic and numerical/computational tools necessary for effective research in astronomy, geophysics, and related disciplines. Topics include numerical solutions to differential equations, spectral methods, and Monte Carlo simulations. Applications are made to common astrophysical and geophysical problems including fluids and N-body simulations.

ASTR 5550a, Observational Astronomy Pieter van Dokkum
The design and use of optical telescopes, cameras, spectrographs, and detectors to make astronomical observations. The reduction and analysis of photometric and spectroscopic observations.

ASTR 5560a, Astrostatistics and Data Mining Earl Bellinger
Introduction to the statistical tools used to analyze and interpret astrophysical data, including common data mining techniques for finding patterns in large data sets and data-based prediction methods. Use of publicly available high-quality astronomical data from large surveys such as SDSS and 2MASS, and from space-based observatories such as Spitzer, Herschel, and WISE. Coding with the Python programming language.

ASTR 5650b, The Evolving Universe Pieter van Dokkum
Overview of cosmic history from the formation of the first star to the present day, focusing on direct observations of the high-redshift universe.

ASTR 5700b / PHYS 570 / PHYS 5700b, High-Energy Astrophysics Paolo Coppi
A survey of current topics in high-energy astrophysics, including accreting black hole and neutron star systems in our galaxy, pulsars, active galactic nuclei and relativistic jets, gamma-ray bursts, and ultra-high-energy cosmic rays. The basic physical processes underlying the observed high-energy phenomena are also covered.

ASTR 6000b / PHYS 6000b, Cosmology Nikhil Padmanabhan
A comprehensive introduction to cosmology at the graduate level. The standard paradigm for the formation, growth, and evolution of structure in the universe is covered in detail. Topics include the inflationary origin of density fluctuations; the thermodynamics of the early universe; assembly of structure at late times and current status of observations. The basics of general relativity required to understand essential topics in cosmology are covered. Advanced undergraduates may register for the course with permission of the instructor.

ASTR 7100a and ASTR 7110b, Professional Seminar Staff
A weekly seminar covering science and professional issues in astronomy.

ASTR 7460a / MATH 7460a / PHYS 7460a, Global Properties of Nonlinear Relativistic Fields Vincent Moncrief
Many relativistic field equations of interest in mathematical physics, astrophysics and cosmology are intrinsically nonlinear. Notable examples are various nonlinear wave equations, the Maxwell-Klein-Gordon equations, the Yang-Mills-Higgs equations and the Einstein field equations of general relativity. Techniques for analyzing their global solutions on various manifolds include (higher order) energy estimates and so-called light-cone estimates. An interesting question for the Einstein equations is whether the so-called "cosmological principle," according to which only the very special manifolds admitting (spatially) homogeneous and isotropic metrics need be considered for cosmology, is firmly established or whether this principle can be relaxed to allow for much more general manifolds and still be consistent with observations. Another issue is how the Thurston geometrization theorem, established by Hamilton and Perlman via Ricci flow, relates to the "cosmic censorship conjecture" of Roger Penrose, often regarded as the main open mathematical problem of general relativity.

Biomedical Engineering

17 Hillhouse Avenue, 203.432.4220
M.S., M.Phil., Ph.D.

Chair
James Duncan

Director of Graduate Studies
Kathryn Miller-Jensen (kathryn.miller-jensen@yale.edu)

Professors Helene Benveniste,* Joerg Bewersdorf,* Stuart Campbell, Richard Carson,† Nicholas Christakis,* Todd Constable,* Robin de Graaf,* James Duncan,† Rong Fan, Anjelica Gonzalez, Michelle Hampson,* Michael Higley,* Henry Hsia,* Jay Humphrey, Fahmeed Hyder,† Farren Isaacs,* Themis Kyriakides,† Francis Lee,* Andre Levchenko, Chi Liu, Graeme Mason,* Kathryn Miller-Jensen, Evan Morris,* Xenophon Papademetris,* Dana Peters,* Douglas Rothman,† W. Mark Saltzman, Martin Schwartz,* Fred Sigworth,* Albert Sinusas,* Brian Smith,* Lawrence Staib,† Hemant Tagare,* John Tsang,* Paul Van Tassel,* Jiangbing Zhou,* Steven Zucker†

Associate Professors Fadi Akar,* Julius Chapiro, Tarek Fahmy, Gigi Galiana,* Chenxiang Lin,* Michael Murrell, Yibing Qyang*

Assistant Professors Sanjay Aneja,* Daniel Coman,* Purushottam Dixit,* Nicha Dvornek,* Paul Han,* Aaron Kuan,* Evelyn Lake, Xiaofeng Liu,* Chao Ma,* John Onofrey, Cristina Rodriguez, Shreya Saxena, Dustin Scheinost*

* A secondary appointment with primary affiliation in another department or school.

† A joint appointment with another department.

FIELDS OF STUDY

Biological and medical devices, biological signals and sensors, biomaterials, biophotonics, cellular biomechanics, computational biomechanics, computational medicine, computer vision, digital image analysis and processing, drug delivery, energy metabolism, experimental biomechanics, gene delivery, gene therapy, image analysis, Magnetic Resonance Imaging (MRI), Magnetic Resonance Spectroscopy (MRS), modeling in mechanobiology, molecular biomechanics, nanomedicine, network analysis, neuroreceptors, physics of image formation (MRI, optics, ultrasound, nuclear medicine, and X-ray), physiology and human factors engineering, Positron Emission Tomography (PET), regenerative medicine, signaling pathways, Single Photon Emission Computed Tomography (SPECT), systems biology, systems medicine, tissue engineering, tracer kinetic modeling, and vascular biology.

For degree requirements—including the joint M.D.-Ph.D. in Biomedical Engineering—and courses, see Engineering & Applied Science.

Black Studies

81 Wall Street, 203.432.1170
http://afamstudies.yale.edu
M.A., M.Phil., Ph.D.

Chair
Phillip Atiba Goff

Interim Director of Graduate Studies
Jonathan Howard

Professors Nana Adusei-Poku, Elijah Anderson, David Blight, Daphne Brooks, Marlene Daut, Erica Edwards, Roderick Ferguson, Kaiama Glover, Jacqueline Goldsby, Allison Harris, Elizabeth Hinton, Matthew Jacobson, Gerald Jaynes, Tavia Nyong'o, Edward Rugemer, Christen Smith, Phillip Atiba Solomon, Michael Veal, Shane Vogel

Associate Professors Crystal Feimster, David Knight

Assistant Professors Na Na Adusei-Poku, Allison Harris, Jonathan Howard, Elleza Kelley, Ernest Mitchell, Carolyn Roberts

Lecturers Thomas Allen Harris, Tasha Hawthorne, Ferentz Lafargue, Sarah Mahurin

FIELDS OF STUDY

The Department of Black Studies offers a combined Ph.D. in conjunction with several other departments and programs: currently, American Studies; Anthropology; English; Film and Media Studies; French; History; History of Art; Music; Political Science; Psychology; Religious Studies; Sociology; Spanish and Portuguese; and Women's, Gender, and Sexuality Studies. Within the field of study, the student will select an area of concentration in consultation with the directors of graduate studies (DGS) of Black Studies and the joint department or program. An area of concentration in Black studies may take the form of a single area study or a comparative area study. Students may focus on the history or artistic productions of any region within the African diaspora. Students are encouraged to draw from multiple disciplines in their intellectual pursuits, both in preparation for their qualifying examinations and in their dissertation research and writing. An area of concentration may also follow the fields of study already established within a single discipline, for example, race/minority/ethnic studies in a combined degree with sociology; the study of Black political thought, or voting patterns, in a combined degree with political science; a study of racial bias in a combined degree with psychology; or an ethnography in a combined degree with either anthropology, or sociology. An area of concentration must either be a field of study offered by the joint department or fall within the rubric of such a field. Please refer to the description of fields of study of the prospective joint department or program.

This is a combined degree program. To be considered for admission to this program, applicants must indicate both Black Studies and one of the participating departments/programs listed above.

REQUIREMENTS FOR TRANSFER INTO THE BLACK STUDIES COMBINED PH.D. PROGRAM

1. Students applying for transfer into the combined Ph.D. program must already have taken AFAM 5005 or be taking it in the term of application; must provide a plan outlining the AFAM courses already taken and those they will take; and must submit a research statement that explains how the combined Ph.D. will advance their research interests.
2. Students must provide two letters of recommendation: one from their adviser in the joint department or program, unless that adviser is jointly appointed with Black Studies, in which case a letter from the student's DGS in the joint department or program is required; *and* a second letter from a faculty member in Black Studies who commits to being the student's adviser throughout the completion of the dissertation.
3. Students cannot apply sooner than the second term of the first year and must apply by January 3, which is the deadline for Black Studies' annual admissions cycle. Preference will be given to students in the second year of their Ph.D. program. Applications will receive a faculty vote early in the spring term to approve or reject, and results will be communicated to the student no later than spring break.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Students will be subject to the combined Ph.D. supervision of the Black Studies department and the relevant participating department or program. The student's academic program will be decided in consultation with an adviser, the DGS of Black Studies, and the DGS of the participating department or program and must be approved by all three. Students are required to take five courses in Black studies, generally at least one course each term. Any variance in scheduling requires DGS approval. Core courses are (1) Theorizing Racial Formations (AFAM 5005), which is a required course for all first-year graduate students in the combined program and (2) Dissertation Prospectus Workshop (AFAM 8095 and AFAM 8096), a two-term course, which graduate students in their third year of study must satisfactorily complete. This workshop is intended to support preparation of the dissertation proposal; each student will be required to present the dissertation prospectus orally to the faculty and to turn in a written prospectus draft by the end of spring term. Three other graduate-level Black studies courses are required: (1) a history course, (2) a social science course, and (3) a course in literature or culture.

Qualifying examinations and the dissertation proposal will be administered jointly by the Black Studies department and the participating department or program and must be passed within the time required by the participating department or program. A current tenured or ladder faculty member in Black Studies must serve on the qualifying examination committee, and on the dissertation committee. Both the qualifying exams and the dissertation must have an Black studies component. The total number of courses required will adhere to the requirements of the participating department or program. Each student must complete the minimum number of courses required by the participating department or program; Black studies courses (excepting the Dissertation Prospectus Workshop) count toward the participating department's or program's total. The number of courses that will count depends on the joint department or program. For details of these requirements, see the special requirements of the combined Ph.D.

for the particular department or program in this bulletin. Students will be required to meet the foreign language requirements of the participating department or program. (See Degree Requirements under Policies and Regulations.) Students will not be admitted to candidacy until all requirements, including the dissertation prospectus, have been met and approved by the Graduate Studies Executive Committee of the Black Studies department and the participating department or program. A student who intends to apply for this combined Ph.D. in Black Studies and another department or program should consult the other department's or program's Ph.D. requirements and courses.

The faculty in Black Studies consider teaching to be an essential component of graduate education, and students therefore will teach, under the supervision of departmental professors, in their third and fourth years.

MASTER'S DEGREES

M.Phil. See Degree Requirements under Policies and Regulations.

M.A. (en route to the combined Ph.D.) Students will be awarded a combined M.A. degree in Black studies and the relevant participating department or program upon successful completion of all course work except the Dissertation Prospectus Workshop, which is taken in the student's third year of study. See also Degree Requirements under Policies and Regulations.

More information is available on the department's website, http://afamstudies.yale.edu.

COURSES

AFAM 5005a, Theorizing Racial Formations Erica Edwards
A required course for all first-year students in the combined Ph.D. program in African American Studies; also open to students in American Studies. This interdisciplinary reading seminar focuses on new work that is challenging the temporal, theoretical, and spatial boundaries of the field.

AFAM 5610a / AMST 6612a / ENGL 5761a / FREN 7610a, Caribbean Literary and Cultural Studies Marlene Daut
This course examines eighteenth- and nineteenth-century writing (in translation, where applicable) by writers from the Anglophone, Francophone, and Hispanophone islands that make up the Caribbean. Haitian independence in 1804 ushered in a vibrant and diverse print culture that included poetry, plays, newspapers, and historical writing. From the pages of *La Gazette Royale d'Hayti* (1811–1820), to the poems of Jean-Baptiste Romane (1807–1858), to the historical writings of Louis-Félix Boisrond-Tonnerre (1776–1806), to the operas of Juste Chanlatte (1766–1828), there arose a distinct nineteenth-century literary culture in Haiti. Beginning with national literary developments in Haiti, this course expands to consider writing from Barbados, Cuba, Trinidad, Jamaica, Antigua, and Bermuda. These writings, both fictional and non-fictional, help us to think about whether and/or how a coherent early Caribbean literary tradition developed across geographical, linguistic, national, and imperial lines.

AFAM 6227a / ENGL 6847a, Black Environmental Thought Jonathan Howard
What if the greatest threat to life on Earth is not humanity in general, but the specific practice of human being indexed by whiteness? Since the advent of the "modern world," race has been a defining, though often obscured, fault line along which the

human enterprise has unfolded. So what would a racial accounting of humanity's environmental harm entail? Who else are we as a species beyond the norms and aspirations enshrined by whiteness? And who must we become before Nature phases us out? If there is a future for humanity on Earth, it will not come apart from a serious reckoning with these questions. Guided by these questions, this course interrogates how the West has mutually imagined the category of the human as an aspiring independence from and dominion over Nature, on the one hand, and white, on the other. But beyond uncovering the unspoken whiteness of "the human" and its environmental harm, this course further takes up the alternative visions of human being and nature expressed within black nature writing. By undertaking a broad survey of this literary tradition, we consider the unique environmental perspectives of those, who, once considered no more than livestock, *were* the nature over which their masters ruled and consequently could not so easily imagine their humanity apart from it. Perhaps for this very reason, we may ultimately come to locate in black nature writing the resources for imagining a sustainable human life in nature, rather than apart from it.

AFAM 7119b / HIST 8900b / HSHM 7710b, Researching and Writing Histories of Health, Medicine, and Science Carolyn Roberts

This small graduate seminar is for students currently researching and writing histories of health, science, and medicine. Students learn about slow scholarship, the politics of the archive, and research organization and management and explore the craft of writing. Preference is given to graduate students in history, the history of science and medicine, and African American studies.

AFAM 7152b / AMST 8867b / HIST 8902b / HSHM 7610b, Researching and Writing Medicine, Health, and Empire Carolyn Roberts

This small graduate seminar is for students currently engaged in research and writing projects that touch on issues related to health, medicine, science, or the body in the context of slavery, colonialism, or neocolonialism. Students will explore their relationship to the craft of writing, their identity as "authors," the politics of the archive, the methodological and evidentiary challenges in their work, and tools that will level up their research organization and management skills. The course provides graduate students with a balance of support and independence as they further their research and writing projects. Graduate students in any discipline are warmly invited to participate in a compassion-based research community that prioritizes values of deep listening, presence, and care

AFAM 7196b / AMST 7796b / HIST 8130b, Slave Systems in World History Edward Rugemer

Slavery has been a protean institution in world history, with pre-historic origins and nearly countless manifestations across time and place. This readings course explores the history of slavery over the *longue duree*, moving through time from the ancient world through the nineteenth century with readings on some of the major slave systems in world history. One goal of the course is to situate the well-known slave systems of the Americas within a broader historical context. Student writing includes a historiographical essay on one of the major slave systems discussed in the course.

AFAM 7771a / AMST 7771a, Affect Theory Tav Nyong'o

This graduate seminar traces the emergence of affect, sense, feeling, and mood as critical keywords in American studies. Particular attention is paid to the manner in which queer theorists such as Eve Kosofsky Sedgwick, Lauren Berlant, Ann Cvetkovich,

Heather Love, Jennifer Doyle, Jonathan Flatley, and José Esteban Muñoz developed the concept in what has been called "the affective turn" in queer and feminist aesthetics. The philosophical basis of affect theory in the writings of Spinoza, Heidegger, and Deleuze forms the core of the seminar. We also look to an alternate genealogy for affect politics in the writings of Bergson and Deleuze on fabulation. We consider the psychoanalytic take on affect, in particular, the object relations school of Klein and Winnicott, and we read critics who contrast affect theory with trauma theory. Marxist contributions to affect theory include readings from Virno (on humor), Hardt and Negri (on affective labor), and Ranciere (on the distribution of the sensible). The writings of Jasbir Puar and Brian Massumi on the affective politics of contemporary war, empire, and societies of control are also considered, as are writings by Fred Moten, Saidiya Hartman, and Frank Wilderson on optimism and pessimism as moods/modalities of black studies.

AFAM 7973a / SOCY 6300a, Workshop in Urban Ethnography Elijah Anderson
The ethnographic interpretation of urban life and culture. Conceptual and methodological issues are discussed. Ongoing projects of participants are presented in a workshop format, thus providing participants with critical feedback as well as the opportunity to learn from and contribute to ethnographic work in progress. Selected ethnographic works are read and assessed.

AFAM 7978a / PSYC 7280a, Research Topics in Racial Justice in Public Safety Phillip Atiba Solomon
In this seminar, graduate students and postdoctoral fellows have a chance to present their research, and undergraduate research assistants learn about how to conduct interdisciplinary quantitative social science research on racial justice in public safety. The course consists of weekly presentations by members and occasional discussions of readings that are handed out in advance. The course is designed to be entirely *synchronous*. Presenters may request a video recording if they can benefit from seeing themselves present (e.g., for a practice talk). This course is intended for graduate students, postdocs, and undergraduates interested in conducting original quantitative social science research about race and public safety. Permission of the instructor is required.

AFAM 8095a, Dissertation Prospectus Workshop Shane Vogel
A noncredit, two-term course, which graduate students in their third year of study must satisfactorily complete. This workshop is intended to support preparation of the dissertation proposal. o Course cr

AFAM 8128b / HIST 7430b, Politics and Belonging in Post-Emancipation Americas Anne Eller
This course examines literature about emancipation contests throughout the Americas, with a preponderance of texts about the Caribbean and the US South. The hemispheric approach seeks working peoples' negotiations within, outside, and across national frames. The course builds on decades of literature that dismantle old binaries between enslavement and "freedom," considering contests from 1804 through World War I. The course ponders freedom's many meanings, from the intimate to the electoral. Land, gendered power and violence, state services, and state abuse are key themes. Finally, alternative political allegiances and local authorities, often outside the auspices of a formal state, will animate discussions.

AFAM 8250a / AFST 9937a / ENGL 6137a, African Urban Cultures: Mediations of the City Stephanie Newell

This course approaches the study of African cities and urbanization through the medium of diverse texts, including fiction, nonfiction, popular culture, film, and the arts, as well as scholarly work on African cities. Through these cultural "texts," attention is given to everyday conceptualizations of the body and the environment, as well as to theoretical engagements with the African city. We study urban relationships as depicted in literature and popular media in relation to Africa's long history of intercultural encounters, including materials dating back to the 1880s and the 1930s. Previously ENGL 937.

Cell Biology

Boyer Center Molecular Medicine (BCMM) 236E, 203.737.1257
http://cellbiology.yale.edu
M.S., M.Phil., Ph.D.

Chair
Gillian Griffiths

Director of Graduate Studies
Thomas Melia (BCMM 254C, 203.785.2165, thomas.melia@yale.edu)

Professors Joerg Bewersdorf, Jonathan Bogan (*Internal Medicine/ Endocrinology*), Christopher Burd, David Calderwood (*Pharmacology*), Michael Caplan (*Cellular and Molecular Physiology*), Daniel Colón-Ramos, Lynn Cooley (*Genetics*), Peter Cresswell (*Immunobiology*), Pietro De Camilli, Jorge Galán (*Microbial Pathogenesis*), Fred Gorelick, Valentina Greco (*Genetics*), Gillian Griffiths, Carl Hashimoto (*Emeritus*), Diane Krause (*Laboratory Medicine*), Thomas Lentz (*Emeritus*), Haifan Lin, Jun Liu (*Microbial Pathogenesis*), Vivek Malhotra (*Adjunct*), Vincent Marchesi (*Pathology*), Thomas Melia, Mark Mooseker (*Molecular, Cellular, and Developmental Biology*), Michael Nathanson (*Internal Medicine/Digestive Diseases*), Karla Neugebauer (*Molecular Biophysics and Biochemistry*), Karin Reinisch, James Rothman, Christian Schlieker (*Molecular Biophysics and Biochemistry*), Martin Schwartz (*Internal Medicine/Cardiology*), Derek Toomre, Felix Weiland (*Adjunct*), Sandra Wolin (*Emerita*), Yongli Zhang

Associate Professors Julien Berro (*Molecular Biophysics and Biochemistry*), Shawn Ferguson, Shangqin Guo, Megan King, Chenxiang Lin, Patrick Lusk, Xiaolei Su, Peter Takizawa, Kirill Volynski (*Adjunct*), Julia von Blume, Siyuan Wang (*Genetics*), Min Wu, Shaul Yogev (*Neuroscience*)

Assistant Professors David Baddeley (*Adjunct*), Kallol Gupta

FIELDS OF STUDY

Fields include membrane traffic and protein sorting, organelle biogenesis, epithelial cell polarity, membrane function in the nervous system (synapse formation and function), neural circuit development, cell biology of protozoan parasites and of pathogen/host interactions, cell biology of the immune response, mRNA biogenesis and localization, RNA folding, non-coding RNAs, stem cells, the cytoskeleton, nuclear structure and dynamics, DNA nanostructures, cellular signaling and motility, cytokinesis. Approaches to these topics include biochemistry, biophysics, molecular biology, crystallography, and single-particle electron microscopy; bacterial, yeast, *Drosophila, C. elegans,* and mouse genetics; immunocytochemistry and electron microscopy and tomography; live cell and super-resolution imaging.

To enter the Ph.D. program, students apply to an interest-based track, usually the Molecular Cell Biology, Genetics, and Development (MCGD) track or the Biochemistry, Quantitative Biology, Biophysics, and Structural Biology (BQBS) track, within the interdepartmental graduate program in Biological and Biomedical Sciences (BBS), https://medicine.yale.edu/bbs.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Students are required to take at least five graduate-level courses. No specific curriculum of courses is required, but CBIO 6020 (Molecular Cell Biology) is recommended for all students to attain a solid foundation in molecular cell biology. Also recommended is a seminar course, such as CBIO 6030 (Seminar in Molecular Cell Biology), in which students can develop the skill for critical analysis of research papers. Students design their own curriculum of courses to meet individual interests and needs, in consultation with the director of graduate studies. During the first year, students participate in three laboratory rotations. In the second year, a committee of faculty members determines whether each student is qualified to continue in the Ph.D. program. There is an oral qualifying examination by the end of the third term. In order to be admitted to candidacy, students must have met the graduate school Honors requirement, maintained a High Pass average in course work, passed the qualifying examination, submitted an approved prospectus, and received a positive evaluation of their laboratory work from the thesis committee. All students are required to present a talk at the departmental progress report series each year after passing the qualifying exam. The remaining degree requirements include completion of the dissertation project, submission for publication of at least one first-author paper to a peer-reviewed journal describing the dissertation research, the writing of the dissertation and its oral defense, the formal submission of copies of the written dissertation to the graduate school, and the deposit of an additional copy with the department.

An important aspect of graduate training in cell biology is the acquisition of teaching skills through participation in courses appropriate for the student's scientific interests. These opportunities can be drawn from a diverse menu of lecture, laboratory, and seminar courses given at the undergraduate, graduate, and medical school levels. Ph.D. students are required to participate in two terms (or the equivalent) of teaching. Students are not expected to teach during their first year.

In addition to all other requirements, students must successfully complete CBIO 9000 and CBIO 9010 (Research Skills and Ethics I and II) prior to the end of their first year of study. In their fourth year of study, all students must successfully complete B&BS 5502 (RCR Refresher for Senior BBS Students).

M.D.–PH.D.

M.D.-Ph.D. students are required to take a total of five graduate-level courses for a grade, including the CBIO 5501/CBIO 5502 sequence (Molecules to Systems), CBIO 6020 (Molecular Cell Biology), and a seminar course that involves the reading and class discussion of research papers. The remaining courses can be in areas such as genetics, neuroscience, immunology, microbiology, pharmacology, and physiology. Students must meet the graduate school requirement of a grade of Honors in two courses, if necessary taking additional courses beyond the five required in the department to fulfill this requirement. Students must also maintain an average grade of High Pass in all courses. One term of teaching is required.

MASTER'S DEGREES

M.Phil. Requirements for the M.Phil. degree are the same as for admission to candidacy (see above).

M.S. This degree is normally granted only to students who are withdrawing from the Ph.D. program. To be eligible for the degree, a student must have completed at least five graduate-level term courses at Yale, including CBIO 6020 (Molecular Cell Biology) and a seminar course, with a grade of Pass and at least one grade of Honors or three of High Pass. In addition to these five courses, the student must have received a Satisfactory grade in the following five courses: CBIO 9000 (Research Skills and Ethics I), CBIO 9010 (Research Skills and Ethics II), CBIO 9110 (First Laboratory Rotation), CBIO 9120 (Second Laboratory Rotation), and CBIO 9130 (Third Laboratory Rotation). Students who are eligible for or who have already received the M.Phil. will not be awarded the M.S.

Prospective applicants are encouraged to visit the BBS website (https://medicine.yale.edu/bbs), MCGD and BQBS tracks. Program materials are available upon request to the Director of Graduate Studies, Department of Cell Biology, Yale University, PO Box 208002, New Haven CT 06520-8002.

COURSES

*** CBIO 4200b / CGSC 4200b / NSCI 4400b / PSYC 4200b, Topics in Clinical Neuroscience** Tyrone Cannon

An overview and examination of the neuroscience of psychiatric illness. We focus on cutting-edge research in humans and animals aimed at understanding the biological mechanisms that underlie psychiatric illness. Although these questions date back to early philosophical texts, only recently have experimental psychologists and neuroscientists begun to explore this vast and exciting domain of study. We discuss the evolutionary and developmental origins of individual differences in human personality, measurement issues, fundamental dimensions of psychopathology, stability/plasticity, heritability, and implications therapeutic interventions as well as the associated broader implications for public policy. A major focus is on the neurobiology of fear and anxiety, including brain circuits, molecular genetic pathways, and epigenetics. A secondary focus is on differences in behavior and biology that confer risk for the development of depression and addiction, including the biological systems involved in hedonic pleasure, motivated goal pursuit, and the regulation of impulses in the face of everyday temptation. Students should have some background in psychology; PSYC 110 and PSYC 160 preferred. SO

CBIO 5501a and CBIO 5502b, Molecules to Systems Peter Takizawa

This full-year course (CBIO 501/CBIO 502) is designed to provide medical students with a current and comprehensive review of biologic structure and function at the cellular, tissue, and organ system levels. Areas covered include structure and organization of cells; regulation of the cell cycle and mitosis; protein biosynthesis and membrane targeting; cell motility and the cytoskeleton; signal transduction; cell adhesion; cell and tissue organization of organ systems. Clinical correlation sessions, which illustrate the contributions of cell biology to specific medical problems, are interspersed in the lecture schedule. Histophysiology laboratories provide practical experience with an understanding of exploring cell and tissue structure. The course is offered only to M.D. and M.D./Ph.D. students.

CBIO 6020a / MB&B 6020a / MCDB 6020a, Molecular Cell Biology Thomas Melia

A comprehensive introduction to the molecular and mechanistic aspects of cell biology for graduate students in all programs. Emphasizes fundamental issues of cellular

organization, regulation, biogenesis, and function at the molecular level. Graduate Prerequisites: Some knowledge of basic cell biology and biochemistry is assumed. Students who have not taken courses in these areas can prepare by reading relevant sections in basic molecular cell biology texts. We recommend Pollard et al., *Cell Biology* (4th ed., 2024), Alberts et al., *Molecular Biology of the Cell* (7th ed., 2022), or Lodish et al., *Molecular Cell Biology* (9th edition, 2021). Undergraduate Prerequisites: This is a graduate-level cell biology class. Any undergraduates wishing to enroll must have already taken MCDB 2050. In addition, undergraduates are strongly encouraged to reach out to the course directors prior to enrollment.

CBIO 6030a / MCDB 603a, Seminar in Molecular Cell Biology Min Wu
A graduate-level seminar in modern cell biology. The class is devoted to the reading and critical evaluation of classical and current papers. The topics are coordinated with the CBIO 6602 lecture schedule. Thus, concurrent enrollment in CBIO 6602 is required. Prerequisites: Any undergraduates wishing to enroll must have already taken MCDB 205. In addition, undergraduates are strongly encouraged to reach out to the course directors prior to enrollment.

CBIO 6600a and CBIO 6601b, Science at the Frontiers of Medicine Fred Gorelick
This full-year graduate seminar (CBIO 6600/CBIO 6601) for first-year M.D./Ph.D. students—an elective course for M.D. students—matches the progression of topics in the eighteen-month preclinical medical school curriculum and emphasizes the connections between basic and clinical science, human physiology, and disease. It is directed by M.D./Ph.D. program faculty, and many class discussions are led by expert Yale School of Medicine faculty members who select the papers to be read. Students explore scientific topics in depth, learn about cutting-edge research, and improve their presentation skills. The curriculum provides a framework for critically reading and analyzing papers drawn broadly from the biomedical sciences; this breadth of knowledge is also leveraged in team-based exercises that promote peer-to-peer teaching and learning. Enrollment limited to students who have taken or are currently taking CBIO 5501/CBIO 5502.

CBIO 6606b, Advanced Topics in Cell Biology Xiaolei Su
This seminar course, which meets once weekly, covers advanced topics in cell biology. Each topic is spread over two or three sessions, which start with an introductory overview and are followed by a discussion of key papers led by an expert in the field. This class is designed for MCGD students as a follow-up to CBIO 6020. Students who do not meet these pre-existing criteria should contact the course coordinator before enrolling. Graduate Prerequisite: CBIO 6020. Undergraduate Prerequisite: Undergraduates are to reach out to the course instructor prior to enrollment for approval. Priority is given to MCGD graduate students.

CBIO 7701b, Illuminating Cellular Function Derek Toomre
The focus of the course is on the technical treatment of light microscopy and its applications. The course provides biology and bioengineering students with the knowledge and skills necessary to design and undertake advanced light microscopy experiments. It covers conceptual elements of fluorescence microscopy imaging and analysis (without going too heavily into the theory and math); new advances in super-resolution modalities; biological applications; and hands-on practical work. Enrollment limited to fifteen.

CBIO 9000a / GENE 9000a / MCDB 9000a, Research Skills and Ethics I Andrew Xiao

This course consists of a weekly seminar that covers ethics, writing, and research methods in cellular and molecular biology as well as student presentations ("rotation talks") of work completed in the first and second laboratory rotations.

CBIO 9010b / GENE 9010b / MCDB 9010b, Research Skills and Ethics II Chenxiang Lin

This course consists of a weekly seminar that covers ethics, writing, and research methods in cellular and molecular biology as well as student presentations ("rotation talks") of work completed in the third laboratory rotation.

CBIO 9110a / GENE 9110a / MCDB 9110a, First Laboratory Rotation Andrew Xiao

First laboratory rotation for Molecular Cell Biology, Genetics, and Development (MCGD) and Plant Molecular Biology (PMB) track students.

CBIO 9120a / GENE 9120a / MCDB 9120a, Second Laboratory Rotation Andrew Xiao

Second laboratory rotation for Molecular Cell Biology, Genetics, and Development (MCGD) and Plant Molecular Biology (PMB) track students.

CBIO 9130b / GENE 9130b / MCDB 9130b / MCDB 913b and MCDB 9130b, Third Laboratory Rotation Andrew Xiao

Third laboratory rotation for Molecular Cell Biology, Genetics, and Development (MCGD) and Plant Molecular Biology (PMB) track students.

Cellular and Molecular Physiology

Sterling Hall of Medicine B147, 203.785.4041
http://medicine.yale.edu/physiology
M.S., M.Phil., Ph.D.

Chair
Michael Caplan

Director of Graduate Studies
David Zenisek (SHM B114, 203.785.6474, david.zenisek@yale.edu)

Professors Nadia Ameen (*Pediatrics*), Peter Aronson (*Internal Medicine/Nephrology*), Angelique Bordey (*Neurosurgery*), Cecilia Canessa, Lloyd Cantley (*Internal Medicine/Nephrology*), Michael Caplan, Alan Dardik (*Surgery*), Jonathan Demb (*Ophthalmology and Visual Science*), Marie Egan (*Pediatrics*), Barbara Ehrlich (*Pharmacology*), Anne Eichmann, Tore Eid (*Laboratory Medicine*), Shuta Ishibe (*Internal Medicine/Nephrology*), Leonard Kaczmarek (*Pharmacology*), Richard Kibbey (*Internal Medicine/Endocrinology*), George Lister (*Pediatrics*), Pramod Mistry (*Internal Medicine/Digestive Diseases; Pediatrics*), Michael Nitabach, Vincent Pieribone, Patricia Preisig (*Internal Medicine/Nephrology*), W. Mark Saltzman (*Biomedical Engineering*), Joseph Santos-Sacchi (*Surgery/Otolaryngology*), Gerald Shulman (*Internal Medicine/Endocrinology*), Fred Sigworth, Susumu Tomita, C. Shan Xu, Xiaoyong Yang (*Comparative Medicine*), Lawrence Young (*Internal Medicine/Cardiology*), David Zenisek, Z. Jimmy Zhou (*Ophthalmology and Visual Science*)

Associate Professors Nii Addy (*Psychiatry*), Sviatoslav Bagriantsev, Nigel Bamford (*Neurology*), Stuart Campbell (*Biomedical Engineering*), Jean-Ju Chung, Julie Goodwin (*Pediatrics/Nephrology*), Elena Gracheva, Erdem Karatekin, Jesse Rinehart, Matthew Rodeheffer (*Comparative Medicine*), Carson Thoreen

Assistant Professors Rui Chang, Ji Yeon Kim (*Urology*), Rachel Perry, Marc Schneeberger, Hongying Shen

FIELDS OF STUDY

Fields of study range from cellular and molecular physiology to integrative medical biology. Areas of current interest include: ion channels, transporters and pumps, membrane biophysics, cellular and systems neurobiology, protein trafficking, epithelial transport, signal transduction pathways, cardiovascular biology, sensory physiology, metabolism, organ physiology, genetic models of human disease, pathophysiology, structural biology of membrane proteins, and physiological genomics.

To enter the Ph.D. program, students typically enter via the Translational Molecular Medicine, Pharmacology, and Physiology (TMMPP) track within the interdepartmental graduate program in Biological and Biomedical Sciences (BBS), https://medicine.yale.edu/bbs.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Formal requirements for the Ph.D. degree include two or three terms of course work, a qualifying examination taken by the end of the second year, submission of a thesis

prospectus, two terms of teaching, and completion and satisfactory defense of the thesis.

Students are expected to design a suitable program of courses in consultation with a faculty adviser. The director of graduate studies (DGS) will provide general oversight of the course selections. These courses will provide a coherent background for the expected area of thesis research and also satisfy the department's subject and proficiency requirements. Students must satisfactorily pass at least six graduate-level courses, including C&MP 5500, C&MP 5630, and either C&MP 5600, C&MP 5580, or C&MP 5700. Also during the first two terms, each student should explore research projects by performing rotations in at least three laboratories to create an informed basis upon which to select a thesis project by the end of the first year. There is no foreign language requirement. The qualifying examination, which must be passed by the end of the student's fourth term, will cover areas of physiology that complement the student's major research interest.

An important dimension of graduate training in Cellular and Molecular Physiology is the acquisition of teaching skills through participation in courses appropriate for the student's academic interests. Ph.D. students are expected to participate in two terms (or the equivalent) of teaching. Students are not expected to teach before passing the qualifying examination.

In addition to all other requirements, students must successfully complete C&MP 5650, The Responsible Conduct of Research, prior to the end of their first year of study; and, in their fourth year of study, all students must successfully complete C&MP 5503, RCR Refresher for Senior BBS Students.

After satisfying the departmental predissertation requirements, passing the qualifying examination, submitting a satisfactory thesis prospectus, and presenting a satisfactory report to the appropriate thesis advisory committee, students are admitted to candidacy. The completed dissertation must describe original research making a significant contribution to knowledge.

HONORS REQUIREMENT

Students must meet the Graduate School's Honors requirement by the end of the fourth term of full-time study. Students must also maintain an overall High Pass average. Student progress toward these goals is reviewed at the end of the second term. Note that Honors grades in only one semester of C&MP 5630 may count towards the requirement and Lab Rotations courses are not counted towards the Honors requirements.

SPECIAL REQUIREMENTS FOR M.D.–PH.D. STUDENTS

M.D.-Ph.D. students must pass at least three graduate-level courses that are not part of the Yale School of Medicine's regular M.D. program, including at least one C&MP course, preferably C&MP 5600 or C&MP 5580. Courses taken toward the M.D. degree can be counted toward the graduate school's Honors requirement, provided that the course carries a graduate course number and the student has registered for it as a graduate course. Two laboratory rotations, each lasting five weeks, and one term of teaching are required.

MASTER'S DEGREES

M.Phil. See Degree Requirements under Policies and Regulations. Awarded to students who have fulfilled all the requirements for the Ph.D. except the prospectus, teaching requirement, and dissertation, normally at the end of the second year. Students are not admitted for this degree.

M.S. Awarded only to students who are not continuing for the Ph.D. degree but who have successfully completed one year of the doctoral program (i.e., passing of at least four graduate-level courses, including two Honors grades, and three successful laboratory rotations). Students are not admitted for this degree. Students who are eligible for or who have already received the M.Phil. will not be awarded the M.S.

Program materials are available upon request to the Department Registrar, Department of Cellular and Molecular Physiology, Yale School of Medicine, PO Box 208026, New Haven CT 06520-8026.

COURSES

C&MP 5500a / BENG 5200a / MCDB 5500a / PHAR 5500 / PTB 5500, Physiological Systems W. Mark Saltzman and Stuart Campbell

The course develops a foundation in human physiology by examining the homeostasis of vital parameters within the body, and the biophysical properties of cells, tissues, and organs. Basic concepts in cell and membrane physiology are synthesized through exploring the function of skeletal, smooth, and cardiac muscle. The physical basis of blood flow, mechanisms of vascular exchange, cardiac performance, and regulation of overall circulatory function are discussed. Respiratory physiology explores the mechanics of ventilation, gas diffusion, and acid-base balance. Renal physiology examines the formation and composition of urine and the regulation of electrolyte, fluid, and acid-base balance. Organs of the digestive system are discussed from the perspective of substrate metabolism and energy balance. Hormonal regulation is applied to metabolic control and to calcium, water, and electrolyte balance. The biology of nerve cells is addressed with emphasis on synaptic transmission and simple neuronal circuits within the central nervous system. The special senses are considered in the framework of sensory transduction. Weekly discussion sections provide a forum for in-depth exploration of topics. Graduate students evaluate research findings through literature review and weekly meetings with the instructor.

C&MP 5503b / PATH 5503b / PHAR 5503b / PTB 5503b, Responsible Conduct of Research, 4th-Year Refresher Staff

The NIH requires that students receive training in the responsible conduct of research every four years. This mandatory course meets that requirement for fourth-year students. The course meets a total of eight hours (four two-hour) sessions. Faculty facilitate discussions based on RCR topics.

C&MP 5511a and C&MP 5512b / PATH 5620a and PATH 5622b / PHAR 5511a and PHAR 5512b / PTB 5620a and PTB 5622b, Laboratory Rotations Staff

TMMPP laboratory rotations, fall term.

C&MP 5610a / PTB 5610a, Medical Research Scholars Program: Mentored Clinical Experience

The purpose of the Mentored Clinical Experience (MCE), an MRSP-specific course, is to permit students to gain a deep understanding of and appreciation for the interface

between basic biomedical research and its application to clinical practice. The MCE is intended to integrate basic and translational research with direct exposure to clinical medicine and patients afflicted with the diseases or conditions under discussion. The course provides a foundation and a critically important forum for class discussion because each module stimulates students to explore a disease process in depth over four ninety-minute sessions led by expert clinician-scientists. The structure incorporates four perspectives to introduce the students to a particular disease or condition and then encourages them to probe areas that are not understood or fully resolved so they can appreciate the value and challenge inherent in using basic science to enhance clinical medicine. Students are provided biomedical resource material for background to the sessions as well as articles or other publicly available information that offers insight to the perspective from the non-scientific world. During this course students meet with patients who have experienced the disease and/or visit and explore facilities associated with diagnosis and treatment of the disease process. Students are expected to prepare for sessions, to participate actively, and to be scrupulously respectful of patients and patient facilities. Prior to one of the sessions students receive guidance as to what they will observe and how to approach the experience; and at the end of the session, the students discuss their thoughts and impressions. All students receive HIPAA training and appropriate training in infection control and decorum relating to patient contact prior to the course.

C&MP 5629a and C&MP 5630b / PATH 5679a and PATH 5680b / PHAR 5501a and PHAR 5502b / PTB 5629a and PTB 5630b, Seminar in Molecular Medicine, Pharmacology, and Physiology Staff

Readings and discussion on a diverse range of current topics in molecular medicine, pharmacology, and physiology. The class emphasizes analysis of primary research literature and development of presentation and writing skills. Contemporary articles are assigned on a related topic every week, and a student leads discussions with input from faculty who are experts in the topic area. The overall goal is to cover a specific topic of medical relevance (e.g., cancer, neurodegeneration) from the perspective of three primary disciplines (i.e., physiology: normal function; pathology: abnormal function; and pharmacology: intervention). Required of and open only to Ph.D. and M.D./Ph.D. students in the Molecular Medicine, Pharmacology, and Physiology track.

C&MP 5650b / PATH 5660b / PHAR 5580b / PTB 5650b, The Responsible Conduct of Research Barbara Ehrlich

Organized to foster discussion, the course is taught by faculty in the Pharmacology, Pathology, and Physiology departments and two or three senior graduate students. Each session is based on case studies from primary literature, reviews, and two texts: Francis Macrina's *Scientific Integrity* and Kathy Barker's *At the Bench*. Each week, students are required to submit a reaction paper discussing the reading assignment. Students take turns leading the class discussion; a final short paper on a hot topic in bioethics is required.

Chemical and Environmental Engineering

17 Hillhouse Avenue, 203.432.4220
M.S., M.Phil., Ph.D.

Chair
John Fortner

Director of Graduate Studies
Mingjiang Zhong (mingjiang.zhong@yale.edu)

Professors Eric Altman, Paul Anastas,* Michelle Bell,* John Fortner, Gary Haller (*Emeritus*), Edward Kaplan, Jaehong Kim, Michael Loewenberg, Jordan Peccia, Lisa Pfefferle, W. Mark Saltzman,* Udo Schwarz,* T. Kyle Vanderlick, Paul Van Tassel, Julie Zimmerman†

Associate Professor Nicole Deziel,* Drew Gentner, Krystal Pollitt*

Assistant Professors Peijun Guo, Amir Haji-Akbari, Shu Hu, David Kwabi, Lea Winter, Yuan Yao,* Mingjiang Zhong

Lecturer Colby Buehler, Yehia Khalil

* A secondary appointment with primary affiliation in another department or school.

† A joint appointment with another school.

FIELDS OF STUDY

Fields include nanomaterials, polymers, interfacial phenomena, energy, water and air quality, enviromnental microbiology, carbon capture, and sustainability.

For degree requirements and courses, see Engineering & Applied Science.

Chemistry

Sterling Chemistry Laboratory, 203.432.3915
http://chem.yale.edu
M.S., Ph.D.

Chair
Nilay Hazari (chemistry.chair@yale.edu)

Director of Graduate Studies
Hailiang Wang (hailiang.wang@yale.edu)

Professors Victor Batista, Gary Brudvig, Robert Crabtree (*Emeritus*), Jason Crawford, Craig Crews,* R. James Cross, Jr. (*Emeritus*), Jonathan Ellman, John Faller (*Emeritus*), Nilay Hazari, Seth Herzon, Patrick Holland, Mark Johnson, William Jorgensen, J. Patrick Loria, James Mayer, J. Michael McBride (*Emeritus*), Scott Miller, Peter Moore (*Emeritus*), Timothy Newhouse, Anna Pyle,* James Rothman,* Martin Saunders (*Emeritus*), Dieter Söll (*Emeritus*),* David Spiegel, Scott Strobel,* John Tully (*Emeritus*), Patrick Vaccaro, Hailiang Wang, Elsa Yan, Frederick Ziegler (*Emeritus*), Kurt Zilm

Associate Professors Stavroula Hatzios,* Sarah Slavoff

Assistant Professors Amymarie Bartholomew, Caitlin Davis, Stacy Malaker, Mingjiang Zhong,* Tianyu Zhu

Lecturers Paul Anastas,* Paul Cooper, Christine DiMeglio, Laura Herder, Jonathan Parr

* A secondary appointment with primary affiliation in another department.

FIELDS OF STUDY

Fields include biophysical chemistry, chemical biology, inorganic chemistry, materials chemistry, organic chemistry, physical chemistry, and theoretical chemistry.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

A foreign language is not required. Five term courses are required within the first two years of residence. Courses are chosen according to the student's background and research area. To be admitted to candidacy a student must (1) receive at least two term grades of Honors, exclusive of those for research and (2) pass the candidacy exam by the end of the second year of study. Remaining degree requirements include completing a formal independent proposal by the end of the fourth year, a written thesis describing the research, and an oral defense of the thesis. The ability to communicate scientific knowledge to others outside the specialized area is crucial to any career in chemistry. Therefore, all students are required to teach a minimum of two terms. Students who require additional support from the graduate school must teach additional terms, if needed, after they have fulfilled the academic teaching requirement. All students are required to take CHEM 5900, Ethical Conduct and Scientific Research, in the fall term of their first year of study.

Ph.D. program materials are available online at https://chem.yale.edu/academics/graduate-program/current-students/forms-steps-for-graduating

MASTER'S DEGREE

M.S. (en route to the Ph.D.) A student must pass at least five graduate-level term courses in the Department of Chemistry, exclusive of seminars and research. In addition, an overall average (exclusive of seminars and research) of High Pass must be maintained in all courses. One full year of residence is required.

COURSES

CHEM 5020a, Fundamentals of Transition Metal Chemistry James Mayer
This half-term course covers the structures and properties of coordination compounds, and strategies for the design and analysis of new compounds. Elements of chelating ligands, spectroscopic methods, and magnetism are addressed. Prerequisites: two terms of organic chemistry and one term of inorganic chemistry (CHEM 252 or equivalent). ½ Course cr

CHEM 5030b, Fundamentals of Organometallic Chemistry Nilay Hazari
A half-term survey of the main principles of organometallic chemistry that enables students to understand basic concepts in the field. It prepares students for CHEM 504, the second half of this course. Prerequisites: two terms of organic chemistry and one term of inorganic chemistry (CHEM 252) or equivalent experience. ½ Course cr

CHEM 5060a, Bioinorganic Spectroscopy Gary Brudvig
This course is an advanced introduction to biological inorganic chemistry with an emphasis on the methods used to characterize the active sites of metalloproteins. The major physical methods used in the determination of molecular structure, bonding, and physical properties of metal ions in proteins are introduced. Prerequisite: a general knowledge of biochemistry and familiarity with both inorganic coordination chemistry and physical chemistry. ½ Course cr

CHEM 5070a, Bioinorganic Mechanisms Gary Brudvig
This course is an advanced introduction to biological inorganic chemistry. An overview of the relevant geometric and electronic structures of metalloprotein active sites is presented and related to each protein's function. The objective is to define and understand the function of metals in biology in terms of structure. Prerequisite: CHEM 506 or permission of the instructor. It is assumed that students have a general knowledge of biochemistry and are familiar with both inorganic coordination chemistry and physical chemistry. ½ Course cr

CHEM 5080a, Materials Chemistry I: Structures and Properties Hailiang Wang
This course is an advanced introduction to materials chemistry. It aims to serve senior undergraduates who are interested in learning and applying chemical principles for materials research and applications. Fundamental principles in solid-state chemistry, including crystal structures and chemical interactions, are taught. Ionics, metal, semiconductor, and polymer materials, including their synthesis, structures, properties, and applications, are discussed. Prerequisites: general chemistry, inorganic chemistry, and physical chemistry, or equivalent experience. ½ Course cr

CHEM 5090a, Materials Chemistry II: Characterization Techniques Hailiang Wang
This course aims to serve graduate and senior undergraduate students from various academic departments who are interested in learning advanced chemistry for

performing materials-related research. Material characterization techniques including X-ray/electron diffraction, electron microscopy and integrated spectroscopy, scanning probe microscopy, X-ray spectroscopy (both lab and synchrotron based), and vibrational spectroscopy (including in-situ techniques) are introduced and discussed, with the focus on understanding fundamental structure-property correlations. Prerequisites: Undergraduate level general chemistry, inorganic chemistry, and physical chemistry, or equivalent level of knowledge. ½ Course cr

CHEM 5100b, Materials Chemistry III: Electrochemistry for Energy and Environment Hailiang Wang

This course aims to serve graduate and senior undergraduate students from various academic departments who are interested in learning electrochemistry and its related materials chemistry for performing energy and environmental research. The most important task of this course is to discuss and understand how the properties of electrochemical energy storage and conversion devices are fundamentally determined by their chemistry. Battery and electrocatalytic reactions that are of current research focus are introduced and discussed in detail. State-of-the-art materials development, structural characterization, electrochemical reaction studies, mechanistic investigation, and reactor engineering related to these reactions are also be covered. Prerequisites: undergraduate-level general chemistry (CHEM 161 and CHEM 165 *or* CHEM 163 and CHEM 167), inorganic chemistry (CHEM 252), and thermodynamics/physical chemistry (CHEM 332) or equivalent level of knowledge. ½ Course cr

CHEM 5110b, Fundamentals of Chemical Crystallography and Diffraction Brandon Mercado

Accurate and precise structure models of small molecules provide critical insight into the function and properties of materials. This course introduces the principles of chemical crystallography, focusing on structure determination by X-ray diffraction. Key topics include diffraction geometry, symmetry elements, space group theory, and solving "the phase problem." With the growing role of electron crystallography in structural analysis, the course will also introduce Microcrystal Electron Diffraction (MicroED) as a complementary technique for determining structures from nanocrystalline materials. By the end of the course, students will have a solid foundation in diffraction principles, including an understanding of how and why crystals produce diffraction patterns. They will develop an appreciation for the chemical significance of these patterns and the distinct advantages and challenges of using X-rays versus electrons to probe crystalline materials. Prerequisite: inorganic chemistry, CHEM 502, or permission of the instructor. ½ Course cr

CHEM 5120b, Crystal Structure Refinement in Chemical Crystallography Brandon Mercado

Determining the connectivity of atoms in unknown compounds is a fundamental challenge in chemistry. This course focuses on the practical aspects of structure modeling and refinement from diffraction data, covering topics such as visualizing electron density, handling molecular disorder, addressing twinning, and preparing results for publication. In addition to single crystal X-ray diffraction, students will explore electron crystallography techniques, with a focus on Microcrystal Electron Diffraction (MicroED) for structure determination of nanometer to micron-sized crystals. By the end of the course, students will have hands-on experience in interpreting and refining structural data across multiple diffraction methods. They will

be equipped to critically evaluate both their own structure models and those published in the literature and structural databases, gaining the expertise needed for high-quality crystallographic analysis. Prerequisite: CHEM 511 or permission of the instructor. ½ Course cr

CHEM 5140b, Molecular Materials: Design, Synthesis, and Properties Amymarie Bartholomew
Materials synthesized from molecular building blocks have an extraordinary range of properties (porosity, magnetism, conductivity, and combinations thereof, etc.), which depend on the molecular components and the manner in which they are assembled. This course introduces ways to understand and predict the properties of molecularly derived materials from their constituent molecules and their covalent, ionic, or spatial interactions upon assembly. The course also introduces techniques used to synthesize and study molecular materials, with the goal of providing students with a holistic understanding of research in this field. Prerequisite: Fundamentals of Transition Metal Chemistry (CHEM 402) or permission of the instructor. ½ Course cr

CHEM 5160a, Organic Structure and Energetics William Jorgensen
The course covers concepts in physical organic chemistry including molecular structure and bonding, conformational energetics, electronic effects, thermochemistry, ring strain, noncovalent interactions, molecular recognition, and host-guest chemistry. Prerequisites: two terms of organic chemistry and two terms of physical chemistry, or related courses, or permission of the instructor. ½ Course cr

CHEM 5170a, Kinetics and Thermodynamics in Organic Systems Scott Miller
The course generally follows CHEM 516. This module covers concepts in physical organic chemistry including acid-base chemistry, advanced issues in stereochemistry, kinetics, and thermodynamics, as well as experiments and techniques employed in mechanistic analysis. Issues in catalysis are addressed throughout. Prerequisites: CHEM 516, two terms of introductory organic chemistry, and two terms of physical chemistry. Permission of the instructor may be sought for potential exceptions. ½ Course cr

CHEM 5200a, Chemical Biology of Nucleic Acids Sarah Slavoff
This course provides a chemical perspective on fundamental concepts and applications in the chemical biology of nucleic acids. Covered topics include nucleic acid synthesis, functional and modified nucleic acids, sequencing, CRISPR/Cas9, and analytical methods. Prerequisites: two terms of organic chemistry. ½ Course cr

CHEM 5210a, Protein Design and Catalysis Jason Crawford
The lecture component of this course largely focuses on protein function, catalysis, and the chemistry and biology of diverse small molecule products. The course also serves to support students in writing an effective NSF style research proposal in chemical biology and communicating its contents to a diverse scientific audience. Prerequisites: Two semesters of undergraduate organic chemistry (CHEM 174/175 and/or CHEM 220/221). A basic understanding of biochemistry and molecular biology is also assumed, but you can "catch up" by carefully and thoroughly reading the course materials and recommended books. ½ Course cr

CHEM 5240a, Chemical Biology of Drug Discovery David Spiegel
This course explores the design and enablement of medicines derived from a convergence of concepts and techniques from chemistry and biology. Topics include:

small molecule drug discovery concepts and tools, drug metabolism, protein therapeutics, hybrid chemical/biologic drugs, and bi-functional molecules. Modern approaches for target discovery and validation are also discussed. The course is not organized around a textbook. Rather, material covered in lectures is the focus of the course and supplementary reading is recommended, mostly from modern research literature. Reading lists are distributed at the outset of the module. Prerequisites: two terms of undergraduate organic chemistry, biochemistry, and molecular biology. ½ Course cr

CHEM 5280b, Natural Products Synthesis Seth Herzon
Survey of natural products syntheses, with an emphasis on those that contain unique strategies, transformations, or reagents. Key transformations are introduced in the context of various syntheses. Retrosynthetic analysis and synthetic planning are discussed. Prerequisites: undergraduate organic chemistry and one term of a graduate course in organic chemistry, or permission of the instructor. ½ Course cr

CHEM 5290b, Total Synthesis Timothy Newhouse
This course is conducted as a seminar. The content focuses on modern strategies and tactics in natural product synthesis with a focus on alkaloids, terpenes, and polyketides. One objective of the course is to introduce strategy level decision making considering multiple approaches to retrosynthetic disconnection. Additionally, a wide variety of methodologies are described and discussed with respect to how they can be implemented in total synthesis. The course draws from primary sources in order for students to develop critical reading and writing skills. Prerequisite: one chemistry course at the 500 level or permission of the instructor. ½ Course cr

CHEM 5320a, Synthetic Methods in Organic Chemistry I Jon Ellman
Compound synthesis is essential to the discovery and development of new chemical entities with a desired property, whether for fundamental study or a more applied goal such as a new pharmaceutical, agrochemical, or material. In this course we emphasize key transformations and principles to provide a framework for the efficient design and synthesis of organic compounds. Prerequisites: two terms of organic chemistry and one term of introductory inorganic chemistry, or related course, or permission of the instructor. ½ Course cr

CHEM 5330a, Synthetic Methods in Organic Chemistry II Jon Ellman
Compound synthesis is essential to the discovery and development of new chemical entities with a desired property, whether that be for fundamental study or for a more applied goal such as a new pharmaceutical, agrochemical, or material. In this course we emphasize key transformations and principles to provide a framework for the efficient design and synthesis of organic compounds. This course builds on the knowledge learned in CHEM 532. Prerequisite: CHEM 532 or permission of the instructor. ½ Course cr

CHEM 5350b, Fundamental Medicinal Chemistry William Jorgensen
The course covers basic concepts of medicinal chemistry including drug structures, properties of drugs, methods of drug discovery, protein-ligand interactions, enzyme inhibition, assays, drug targets, anti-infective agents, virtual and high-throughput screening, structures to avoid (PAINS), structure-based drug design, and metabolism. Prerequisites: undergraduate organic and physical chemistry, or permission of the instructor. ½ Course cr

CHEM 5360b, Computer Simulations of Organic and Biomolecular Systems William Jorgensen
The course covers methods and applications of statistical mechanics and molecular dynamics to model fluid systems including biomolecules in aqueous solution. Topics covered include force fields, Monte Carlo and molecular dynamics theory, simulation of water and other liquids, free-energy methods and applications, QM/MM simulations, protein dynamics, and molecular recognition and design. Prerequisites: undergraduate organic and physical chemistry, or permission of the instructor. ½ Course cr

CHEM 5600La, Advanced Instrumentation Laboratory I Patrick Vaccaro
A laboratory course introducing physical chemistry tools used in the experimental and theoretical investigation of large and small molecules. Modules include electronics, vacuum technology, optical spectroscopy and lasers, and computer programming. ½ Course cr

CHEM 5680b, Advanced Quantum Mechanics Tianyu Zhu
Topics in quantum mechanics that are essential for understanding modern chemistry, physics, and biophysics. Topics include the interaction of radiation with matter and the use of quantized radiation fields and may include time-dependent quantum theory, scattering, semiclassical methods, angular momentum, density matrices, and electronic structure methods. Prerequisite: introductory quantum mechanics or permission of the instructor. ½ Course cr

CHEM 5720b, Introduction to Statistical Mechanics I Victor Batista
An introduction to modern statistical mechanics, starting with fundamental concepts of quantum statistical mechanics to establish a microscopic derivation of statistical thermodynamics. Topics include ensembles; Fermi, Bose, and Boltzmann statistics; density matrices; mean-field theories; phase transitions; chemical reaction dynamics; time-correlation functions; Monte Carlo simulations; and molecular dynamics simulations. Prerequisite: physical chemistry, multivariable calculus, or equivalent experience. ½ Course cr

CHEM 5730b, Introduction to Statistical Mechanics II Victor Batista
An introduction to modern statistical mechanics, starting with fundamental concepts of quantum statistical mechanics to establish a microscopic derivation of statistical thermodynamics. Topics include ensembles; Fermi, Bose, and Boltzmann statistics; density matrices; mean-field theories; phase transitions; chemical reaction dynamics; time-correlation functions; Monte Carlo simulations; and molecular dynamics simulations. Prerequisite: physical chemistry, multivariable calculus, or equivalent experience. ½ Course cr

CHEM 5760a, Fundamentals for Physical Chemistry Mark Johnson
This course reinforces the principles of physics that are most relevant to experimental and theoretical physical chemistry. These include classical electricity and magnetism (with emphasis on the nature of light and the interaction of light with matter), optics, lasers, angular momentum, and atomic structure, including the spin-orbit interaction. The basic theme of the course is to provide students with physical intuition that can bridge the observations of everyday experience to the abstract concepts required for the correct, quantum-mechanical description of atomic-scale phenomena. Prerequisites: two terms of undergraduate physical chemistry (CHEM 328 or CHEM 332, and

CHEM 333; or equivalents); and physics course work covering classical mechanics and electrostatics. ½ Course cr

CHEM 5780a, Molecules and Radiation I: Matrix Methods in Quantum Mechanics Kurt Zilm
This course is an efficient entry to the study of molecular spectroscopy and provides a broad foundation for chemical physicists, biophysicists, and engineers. It covers a general treatment of the quantum mechanics of spectroscopy and specific applications for time-dependent systems. This course focuses on matrix mechanics, perturbation theory, and angular momentum. Prerequisite: previous exposure to quantum mechanics at the level of physical chemistry, or permission of the instructor. ½ Course cr

CHEM 5800b, Foundations and Applications of Nonlinear Spectroscopy Sarah Slavoff
Nonlinear spectroscopy encompasses a broad range of techniques, including coherent Raman and pump-probe experiments, that provide rich insight into the structure and dynamics of matter through interactions with multiple and/or intense light fields. The versatility and power of these methods are evident in the wide range of contexts where they are used to investigate the behavior of molecules, macromolecules, materials, and beyond. This course offers a comprehensive introduction to the theoretical framework and experimental approaches of modern nonlinear spectroscopy. Topics include response functions, lineshapes, dynamics, spectral simulations, as well as experimental considerations and implementations, among others. The goal of the course is to develop core concepts that can be applied to the design and interpretation of spectroscopic experiments more generally. Prerequisite: CHEM 5780 or equivalent exposure to matrix mechanics and time-dependent perturbation theory. Though not required, CHEM 5790 is recommended and may be taken concurrently. ½ Course cr

CHEM 5880b, Optical Spectroscopy: Applications in Biophysics E. Chui-Ying Yan
The course covers basic theory of fluorescence and vibrational spectroscopies and their applications in biophysics. Emphasis is placed on quantitative interpretation of experimental data to gain structural and dynamic information to address biological questions at the molecular level. Topics include fluorescence correlation spectroscopy (FCS); Forster resonance energy transfer (FRET); fluorescence anisotropy; and Raman, infrared, and non-linear optical spectroscopies. Discussions of applications focus on current and classic literature. This course provides foundational knowledge for advanced courses on molecular optical imaging. Prerequisite: undergraduate upper-level physical chemistry or permission of the instructor. ½ Course cr

CHEM 5900a, Ethical Conduct and Scientific Research Paul Cooper
A survey of ethical questions relevant to the conduct of research in the sciences with particular emphasis on chemistry. A variety of issues, including plagiarism, the falsification of data, and financial malfeasance, are discussed, using as examples recent cases of misconduct by scientists. Enrollment is restricted to graduate students in chemistry. 0 Course cr

CHEM 5920b, Biochemical Rates and Mechanisms I J Patrick Loria
An advanced treatment of enzymology. Topics include transition state theory and derivation of steady-state and pre-steady-state rate equations. The role of entropy and enthalpy in accelerating chemical reactions is considered, along with modern methods

for the study of enzyme chemistry. These topics are supplemented with in-depth analysis of the primary literature. Prerequisites: CHEM 332 or equivalent, two terms of organic chemistry, and MATH 115. ½ Course cr

CHEM 5930b, Biochemical Rates and Mechanisms II J Patrick Loria
This course focuses on the role of molecular motions in enzyme function, and on biochemical and spectroscopic methods to interrogate these motions. Examples explore motions ranging from picoseconds to milliseconds and how the timescales and amplitudes of these motions impact catalysis and allostery. Prerequisite: CHEM 592 or permission of the instructor. ½ Course cr

CHEM 5940b, Resonant and Non-Resonant Interaction of Light with Matter Mark Johnson
This course considers the interaction of light with individual molecules and collections of molecules in solutions and solids from the perspective of a classical radiation field interacting with the energy levels that arise from quantized motions. We begin with the generation of light by accelerated charges as described by Maxwell's equations for the electric and magnetic fields. We then consider the polarization states of light, how the oscillating electric field drives the motions of electrons, and how this results in scattering when off-resonant and then evolves into shifts in level populations as the frequency approaches that of the eigenenergies between levels. Classical analogies to quantum mechanical behavior are stressed in the context of the damped-driven electron in a harmonic potential (the so-called Drude model). The kinetics of absorption and emission are discussed in the context of the Einstein treatment that leads to light amplification and laser action. Finally, we develop the "selection rules" that describe what transitions can occur depending on the light polarization and the character of the electronic and nuclear motions. Prerequisite: an upper-level undergraduate physics course in electricity and magnetism or CHEM 576. ½ Course cr

CHEM 5950b, Molecular Spectroscopy and Dynamics Mark Johnson
This course covers the traditional treatment of molecular spectroscopy, including angular momentum coupling and selection rules for electric dipole excitations in atoms and diatomic molecules. It also explores vector aspects of the interaction of light with molecules in the molecular frame, which involves consideration of the polarization states of the light beam. Polyatomic molecules expand the complexity of the interactions through introduction of normal modes and anharmonic couplings both within the ground electronic state and between electronic states. That background is then leveraged to explore intra- and inter-molecular energy flow in molecules when isolated in the gas phase or immersed in solvent. Prerequisite: one graduate-level course in quantum mechanics and/or one semester of molars. ½ Course cr

CHEM 6000a, Research Seminar Staff
Presentation of a student's research results to the student's adviser and fellow research group members. Extensive discussion and literature review are normally a part of the series.

CHEM 7200a, Current Topics in Organic Chemistry Jon Ellman
A seminar series based on invited speakers in the general area of organic chemistry.

CHEM 7300a, Theoretical Chemistry Seminar Tianyu Zhu
A seminar series based on invited speakers in the areas of theoretical chemistry.

CHEM 7400a, Seminar in Chemical Biology Jon Ellman
Seminar in Chemical Biology for graduate level students None

CHEM 7500a, Biophysical and Physical Chemistry Seminar J Patrick Loria
A seminar series based on invited speakers in the areas of biophysical and physical chemistry.

CHEM 7600a, Seminar in Inorganic Chemistry Nilay Hazari
Seminar for graduate students in the inorganic research area of chemistry - invited speakers of this discipline None

CHEM 9800a, Introduction to Research for Long Rotations Staff
During the fall term, first year chemistry graduate students in long rotations are introduced to research during their first laboratory rotation. At the end of the first rotation, students in the course present an oral presentation on their research. The presentation is no longer than ten minutes with a question-and-answer period of no longer than five minutes. Enrollment requires that a student be a first-year graduate student participating in long rotations.

CHEM 9900a, Research Staff
Individual research for Ph.D. degree candidates in the Department of Chemistry, under the direct supervision of one or more faculty members.

Classics

402 Phelps Hall, 203.432.0977
http://classics.yale.edu
M.A., Ph.D.

Chair
Noel Lenski

Director of Graduate Studies
Christina Kraus (dgs.classics@yale.edu)

Professors Egbert Bakker, Kirk Freudenburg, Milette Gaifman (*Classics*; *History of Art*), Verity Harte (*Classics*; *Philosophy*), Brad Inwood (*Classics*; *Philosophy*), Christina Kraus, Noel Lenski (*Classics*; *History*), Pauline LeVen (*Classics*; *Humanities*), J.G. Manning (*Classics*; *History*), James Uden

Associate Professor Andrew Johnston

Assistant Professors Malina Buturović, Alexander Ekserdjian (*Classics*; *History of Art*), Benedek Kruchio, Jessica Lamont, Erika Valdivieso

Senior Lector and Language Program Coordinator James Patterson

Lecturers John Dillon, Timothy Robinson

Affiliated Faculty and Secondary Appointments David Charles (*Philosophy*; *Classics*), John Hare (*Divinity School*), Yii-Jan Lin (*Divinity School*), Teresa Morgan (*Divinity School*), Laura Nasrallah (*Religious Studies*; *Divinity School*), Kathryn Slanski (*Humanities*; *Near Eastern Languages and Civilizations*), George Syrimis (*Hellenic Studies*), Kevin van Bladel (*Near Eastern Languages and Civilizations*)

FIELDS OF STUDY

The degree programs in classics seek to provide an overall knowledge of Greek and Roman civilization. In addition to several specialized combined programs, the degree in classics itself offers two fields of study: classical philology, which focuses on Greek and Latin language and literature, and classical art and archaeology, which explores the material culture of the ancient Mediterranean.

GRADING AND GOOD STANDING

In addition to the graduate school's requirement of Honors grades in at least one yearlong course or two term courses, students must have a High Pass average in the remaining courses. Admission to candidacy for the Ph.D. is granted upon completion of all predissertation requirements not later than the end of the seventh term of study.

The faculty considers experience in the teaching of language and literature to be an important part of this program. Students in Classics typically teach in their third and fourth years of study.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Requirements for the Classical Philology Field of Study

1. Practice translation tests in Greek and Latin on texts assigned from the classical philology Ph.D. reading lists; these are taken before the beginning of the first and third terms and are meant to help students prepare for the qualifying translation exams to be taken before the beginning of the fifth term in the program.
2. A proseminar offering an introduction to the discipline of classics and its various subdisciplines (not for credit).
3. Departmental reading examinations in French (or Italian) and German, or approved Yale courses or examinations that demonstrate reading proficiency in these languages (e.g., by achieving a grade of A in French/German/Italian for Reading Knowledge or by passing proficiency exams administered by Yale's modern language departments). The department will also accept certain certificates of proficiency in French, German, or Italian in lieu of these exams, as listed in the Classics Graduate Handbook. One modern language exam is to be passed by the end of the first year in residence and the second by the end of the second year in residence.
4. A minimum of twelve term courses to include:

   (i) two yearlong survey courses in the history of Greek and Latin literature (four courses in total);

   (ii) at least four seminars, of which two have to be literary seminars in one language and one in the other;

   (iii) one course in ancient history (either an 8000-level seminar or a 6000-level materials course) and one in classical art and archaeology (these may not substitute for the options in [iv]);

   (iv) one course from a selection of philologically oriented options, e.g., Greek and/or Latin language (currently GREK 5995 and LATN 5995), palaeography, papyrology, epigraphy, historical linguistics (these may not substitute for the ancient history or art and archaeology requirements);

   (v) one further course at the 6000, 7000, or 8000 level.
5. Oral examinations in Greek and Latin literature, based on the syllabus covered by the survey courses, drawn from the classical philology Ph.D. reading lists. These are to be taken closely following the surveys in the respective literatures, as follows: the first, at the end of the second term (May of the first year), the second at the end of the fourth term (May of the second year).
6. Translation examinations in Greek and Latin, based on the classical philology Ph.D. reading lists, by the beginning of the fifth term in residence.
7. Special fields oral examinations will occur at the beginning of the sixth term and consist of four areas of special concentration selected by the candidate in consultation with the director of graduate studies (DGS). One of the special fields should be related to the student's chosen dissertation topic; the three other fields are in each of the two ancient languages/cultures; one historical topic, or a topic with historical potential, is advised. For the topic related to the anticipated dissertation area, students must prepare a 3000-word essay in advance of the oral examination.

8. A dissertation prospectus by the end of the sixth term in residence.
9. A dissertation. Once dissertation writing has begun, students will present work in progress from the dissertation at least once per academic year. Research presentations will normally take the form of pre-circulation of a selection of work from the dissertation and a discussion of it with interested faculty or some other research presentation experience approved by the DGS. This is a requirement for remaining in good standing; exemptions from the requirement require support of the dissertation adviser and the approval of the graduate committee.

Requirements for the Classical Art and Archaeology Field of Study

Classical Art at Yale stands out in its integrative approach to the study of the art and material culture of the ancient Mediterranean and beyond. The Program in Classical Art and Archaeology encourages students to consider images and words as equally valid sources for uncovering ancient experiences of the world and thereby prepares them to answer emerging questions in new and exciting ways. Students are encouraged to pursue creative research that is object-oriented and contextually informed, concerned with the actual matter from which something is made and the ways that it would have been understood in the past. The program requirements are designed to support this work.

1. Practice translation tests in Greek and/or Latin, depending on which languages are required for the student's program, on texts taken from the classical art and archaeology reading lists; these are taken before the beginning of the first and third terms and are meant to assess the student's proficiency and progress in the languages.
2. A proseminar offering an introduction to the discipline of classics and its various subdisciplines (not for credit).
3. Departmental reading examinations in Italian (or French) and German, or approved Yale courses or examinations that demonstrate reading proficiency in these languages (e.g., by achieving a grade of A in French/German/Italian for Reading Knowledge or by passing proficiency exams administered by Yale's modern language departments). The department will also accept certain certificates of proficiency in French, German, or Italian in lieu of these exams, as listed in the Classics *Graduate Handbook*. One modern language exam is to be passed by the end of the first year in residence and the second by the end of the second year in residence.
4. A minimum of twelve term courses:

   (i) a minimum of six courses in Greek and/or Roman art and archaeology or methods (at least four must be seminars);

   (ii) at least one course in a related field in the history of art (e.g., Medieval or Renaissance);

   (iii) at least one course in Greek or Roman history, epigraphy, palaeography, numismatics, or papyrology;

   (iv) of the remaining four courses, at least two should be seminars in Greek or Latin literature.

5. Translation examinations in Greek and/or Latin, based on the classical art and archaeology Ph.D. reading lists, by the beginning of the fifth term in residence. Students who elect to read one of the lists in translation must demonstrate competence in that language, usually by passing at least one 5000-level course in that language.
6. Written and oral examinations in classical art and archaeology and the texts on the reading list read in translation, normally by the beginning of the sixth term, normally to be taken over the course of a week:

   (i) a written examination comprising (a) identifications of works of art and architecture and (b) essays taken under exam conditions;

   (ii) an oral exam in four special interest topics of Greek and Roman art and architecture with specific topics agreed upon in advance by the candidate, advisor, and the DGS in Classics. Consideration is normally given to the probable dissertation topic and the way in which preparation for the orals might enhance the writing of the dissertation prospectus.
7. A dissertation prospectus, normally by the end of the sixth term in residence.
8. A dissertation. Once dissertation writing has begun, students will present work in progress from the dissertation at least once per academic year. Research presentations will normally take the form of pre-circulation of a selection of work from the dissertation and a discussion of it with interested faculty or some other research presentation experience approved by the DGS. This is a requirement for remaining in good standing; exemptions from the requirement require support of the dissertation adviser and the approval of the graduate committee.

COMBINED PROGRAMS

Classics and Comparative Literature

REQUIREMENTS FOR THE PH.D. DEGREE IN CLASSICS AND COMPARATIVE LITERATURE

Students are admitted with a primary home in either Comparative Literature or Classics. Prerequisites for admission through the Department of Classics are the same as for classical philology. For admissions requirements in the Department of Comparative Literature, consult the DGS of that department.

1. Practice translation tests in Greek and Latin on texts assigned from the classics and philology Ph.D. reading lists; these are taken before the beginning of the first and third terms and are meant to help students prepare for the qualifying translation exams to be taken before the beginning of the fifth term in the program.
2. A proseminar offering an introduction to the discipline of classics and its various subdisciplines (not for credit).
3. A minimum of twelve term courses:

   (i) at least six in classics, which include two yearlong surveys (four courses) in the history of Greek and Latin literature and two 8000-level seminars;

   (ii) at least six courses in comparative literature; of these at least four courses should be on postclassical literature, and one may be the comparative literature proseminar. The course work across the two programs should include at least two

courses on literary theory or methodology and at least one course each in poetry, narrative fiction, and drama.

4. Literary proficiency in German and in one other modern language, to be demonstrated by the end of the second year in residence.
5. Oral examinations in Greek and Latin literature, based on the syllabus covered by the survey courses, drawn from the classical philology Ph.D. reading lists. These are to be taken closely following the surveys in the respective literatures, as follows: the first, at the end of the second term (May of the first year), the second at the end of the fourth term (May of the second year).
6. Translation examinations in Greek and Latin, based on the classical philology Ph.D. reading lists, by the beginning of the fifth term in residence.
7. An oral examination in the Department of Comparative Literature on six topics appropriate to both disciplines, selected in consultation with the two directors of graduate studies, balancing a range of kinds of topics and including poetry, narrative fiction, and drama and at least one significant cluster of postclassical texts, before or at the start of the sixth term (no later than mid-January). One of the topics studied will be related to the student's dissertation topic.
8. A dissertation prospectus, by the end of the sixth term in residence. The prospectus must be approved by the DGS in each department and by the Comparative Literature prospectus committee. At least one dissertation committee member must come from the Comparative Literature core faculty.
9. A dissertation. Once dissertation writing has begun, students will present work in progress from the dissertation at least once per academic year. Research presentations will normally take the form of pre-circulation of a selection of work from the dissertation and a discussion of it with interested faculty or some other research presentation experience approved by the DGS. This is a requirement for remaining in good standing; exemptions from the requirement require support of the dissertation adviser and the approval of the graduate committee.

Classics and Early Modern Studies

Admission requirements are the same as for classical philology. Students are admitted to the Department of Classics first and then apply during the second term of their first year to participate in the Combined Program in Classics and Early Modern Studies.

REQUIREMENTS FOR THE COMBINED PH.D. DEGREE IN CLASSICS AND EARLY MODERN STUDIES

1. Practice translation tests in Greek and Latin on texts assigned from the classical philology Ph.D. reading lists; these are taken before the beginning of the first and third terms and are meant to help students prepare for the qualifying translation exams to be taken before the beginning of the fifth term in the program;
2. A proseminar offering an introduction to the discipline of classics and its various subdisciplines, to be taken in the first year in residence (not for credit);
3. Departmental reading examinations in French (or Italian) and German, or approved Yale courses or examinations that demonstrate reading proficiency in these languages (e.g., by achieving a grade of A in French/German/Italian for Reading Knowledge or by passing proficiency exams administered by Yale's modern language departments). The department will also accept certain certificates of

proficiency in French, German, or Italian in lieu of these exams, as listed in the Classics *Graduate Handbook*. The first (in either language) is to be passed by the end of the first year; the other may be passed at any time before submission of the dissertation; students are, however, encouraged to complete this requirement as early in the program as possible.

4. A minimum of twelve term courses, with the following stipulations:

   (i) two yearlong survey courses in the history of Greek and Latin literature (four courses in total);

   (ii) four courses prescribed by Early Modern Studies, including EMST 7000, which counts for a single course;

   (iii) four other graduate courses in CLSS. In addition, EMST 8000 (Early Modern Colloquium) must be taken in the second and third terms in the program and EMST 9000 (the prospectus workshop) in the fourth term in the program. Neither of these two courses (EMST 8000 and EMST 9000) count towards the minimum course requirement;

   (iv) one course from a selection of philologically oriented options, e.g., Greek and/or Latin language (currently GREK 5995 and LATN 5995), palaeography, papyrology, epigraphy, historical linguistics;

   (v) one further course at the 6000, 7000, or 8000 level.

5. Oral examinations in Greek and Latin literature, based on the syllabus covered by the survey courses, drawn from the classical philology Ph.D. reading list. These are to be taken closely following the surveys in the respective literatures, as follows: the first, at the end of the second term (May of the first year), the second at the end of the fourth term (May of the second year);
6. Translation examinations in Greek and Latin, based on the classical philology Ph.D. reading list, by the beginning of the fifth term in residence;
7. Four special field exams to be taken in the fall of the third year (fifth term in residence); two of these must be at least partly in a classical field and two must be at least partly in an early modern field.
8. A dissertation prospectus by the end of the sixth term in residence. The procedures for approval of the prospectus are as for the philology program, but at least one member of the EMST faculty, as approved by the DGS in Early Modern Studies, must be on the prospectus approval committee (which is a committee of the whole faculty in Classics); the prospective thesis committee, the DGS, and the EMST faculty member must approve of the prospectus.
9. A dissertation. Once dissertation writing has begun, students will present work in progress from the dissertation at least once per academic year. Research presentations will normally take the form of pre-circulation of a selection of work from the dissertation and a discussion of it with interested faculty or some other research presentation experience approved by the DGS. This is a requirement for remaining in good standing; exemptions from it require the support of the dissertation adviser and the approval of the graduate committee.

Classics and History

The combined degree program in classics and history, with a concentration in ancient history, is offered by the Departments of Classics and History for students wishing to pursue graduate study in the history of the ancient Mediterranean and western Eurasia. Students are admitted with a primary home in either History or Classics.

The combined degree in classics and history offers students a comprehensive education in the fundamental skills and most current methodologies in the study of the ancient Greek and Roman Mediterranean and its interaction with Eurasian and African cultures and landscapes. Its object is to train leaders in research and teaching by preparing them to handle the basic materials of ancient history through mastery of traditional linguistic and technical skills. At the same time, the combined degree in classics and history encourages students to rediscover, reshape, and repurpose traditional and nontraditional source materials using the most up-to-date and sophisticated tools at the historian's disposal.

Students are called on to complete course work in two ancient languages, historical theory, intra- and interdisciplinary skills, and fundamental research seminars. Interdisciplinary expertise is fostered through the annual seminar coordinated through the Yale Program for the Study of Ancient and Premodern Cultures and Societies (Archaia) and through required study in ancillary fields. Exams are rigorous and aimed at helping students hone skills and explore new terrain in ancient studies. Students are encouraged to take advantage of Yale's superior collections and library resources in order to explore new avenues in their learning and approaches to historical problems. Yale's outstanding faculty in classics, history, and related disciplines, such as Near Eastern languages and cultures, religious studies, art history, and anthropology, work together to ensure broad and deep learning that will enable our students to become world leaders in the field.

REQUIREMENTS FOR THE COMBINED PH.D. DEGREE IN CLASSICS AND HISTORY

1. Practice translation tests in Greek and/or Latin, depending on which languages are required for the student's program, based on texts assigned from the appropriate classics and history Ph.D. reading lists; these are taken before the beginning of the first and third terms and are meant to help students prepare for the qualifying translation exams to be taken before the beginning of the fifth term in the program.
2. A proseminar offering an introduction to the discipline of classics and its various subdisciplines, to be taken in the first year in residence (not for credit).
3. Departmental reading examinations in German, and in either French or Italian, or approved Yale courses or examinations that demonstrate reading proficiency in these languages (e.g., by achieving a grade of A in German/French/Italian for Reading Knowledge or by passing proficiency exams administered by Yale's modern language departments). The department will also accept certain certificates of proficiency in French, German, or Italian in lieu of these exams, as listed in the Classics *Graduate Handbook*. One modern language exam is to be passed by the end of the first year in residence and the second by the end of the second year in residence.
4. A minimum of twelve term courses, including:

(i) the historical methods and theory course HIST 5000, Approaching History;

(ii) the Archaia core seminar (CLSS 7000 or equivalent);

(iii) two graduate-level courses in two separate ancient languages. For students who are admitted in Classics, these must be Greek and Latin. Students who are admitted through History must study either Greek or Latin, and they may study both but may also choose another ancient language to fulfill this requirement. The surveys of Greek and Latin literature offered by Classics are encouraged but not mandatory for fulfillment of this requirement;

(iv) two skills courses. These may include topics selected from epigraphy (epigraphy courses may be used to fulfill the language requirement concurrently); archaeology; art history; papyrology; numismatics; digital data, GIS, digital humanities, vel sim.; an advanced course in a non-classical ancient language (no more than one such course may be used in fulfillment of this requirement). Students are also encouraged to take advantage of educational opportunities outside of Yale (American Numismatic Society Summer Seminar; an archaeological excavation, e.g., the Gabii project);

(v) four courses (at least two of which must be research seminars) in the history of the ancient Mediterranean world; historical courses that have a heavy skill component may be used concurrently to fulfill the skills requirement;

(vi) two courses outside of ancient Mediterranean history, to be taken in programs outside of the Department of Classics; these are meant to introduce students to different historical periods, regions, and methodologies. Possibilities include (but are not limited to): social sciences (economics, anthropology, sociology, environmental science, statistics); religion (religious studies, Divinity School, Jewish studies); Near Eastern languages and civilizations (Egyptian language, Hebrew, Aramaic, Syriac, Arabic); anthropology and archaeology; physical and biological sciences (paleoclimatology, ecology and forestry, genetics, medicine).

5. Translation examinations in two ancient languages. For students admitted through Classics, these must be Greek and Latin. For students admitted through History, at least one must be either Greek or Latin. Greek and Latin examinations will be based on the classics and history Ph.D. reading lists and will consist of a choice of eight passages in each language. For each language, students will be required to translate four of the eight passages, to include one verse passage, one documentary text (epigraphy/papyrology), and two passages of prose from literary sources. Some History students may find that expertise in another language—such as Hebrew, Aramaic/Syriac, Demotic, Coptic, Classical Armenian, a Persic language, or Sanskrit—is most beneficial for their research and teaching trajectory. Reading lists for these nonclassical languages will be devised by the student in collaboration with the faculty adviser and other relevant member(s) of the Yale faculty and fixed in writing no later than the end of the fourth term in residence. Examinations in these languages will also consist of a choice of eight passages, of which students must translate four, to be set and evaluated by faculty expert in the given language. Translation exams in all languages must be taken at the beginning of the fifth term in residence.
6. A general examination in ancient history during the third year and no later than the end of the sixth term in residence. This is to be broken into one major and two or

three minor fields. For the major field, students must prepare an 8,000-word essay in advance of the oral examination. For each of the minor fields, students must prepare a syllabus for an undergraduate class.

7. A dissertation prospectus by the end of the sixth term in residence.
8. A dissertation. By the end of their ninth term, students are required to submit a chapter of their dissertation, which will be discussed with the student by the committee in a chapter conference.

Classics and Philosophy

The Classics and Philosophy Program is a combined program, offered by the Departments of Classics and Philosophy, for students wishing to pursue graduate study in ancient philosophy. The combined program is overseen by an interdepartmental committee currently consisting of Verity Harte, David Charles, and Brad Inwood together with the DGS in Classics and the DGS in Philosophy.

REQUIREMENTS OF THE CLASSICS TRACK OF THE CLASSICS AND PHILOSOPHY PROGRAM

1. Practice translation exams in Greek and Latin on texts assigned from the classics and philosophy Ph.D. reading lists; these are taken before the beginning of the first and third terms and are meant to help students prepare for the qualifying translation exams to be taken before the beginning of the fifth term in the program.
2. A proseminar offering an introduction to the discipline of classics and its various subdisciplines (not for credit).
3. Departmental reading examinations in French (or Italian) and German, or approved Yale courses or examinations that demonstrate reading proficiency in these languages (e.g., by achieving a grade of A in French/German/Italian for Reading Knowledge or by passing proficiency exams administered by Yale's modern language departments). The department will also accept certain certificates of proficiency in French, German, or Italian in lieu of these exams, as listed in the Classics *Graduate Handbook*. One modern language exam is to be passed by the end of the first year in residence and the second by the end of the second year in residence.
4. A minimum of fourteen term courses, of which

   (i) at least four should be in ancient philosophy, including at least two involving original language work;

   (ii) of ten remaining courses, five should be in classics, five in philosophy, including (a) of five in classics, either two terms of history of Greek literature or two terms of history of Latin literature are required, and two courses at 5000/7000-level in Greek or Latin; and (b) of five in philosophy, one in history of philosophy other than ancient philosophy, three in nonhistorical philosophy. It is recommended that students without formal training in logic take a logic course appropriate to their philosophical background.
5. Translation examinations in Greek and Latin, based on the classics and philosophy Ph.D. reading lists for the classics track of the program, by the beginning of the fifth term in residence.

6. Oral examinations in Greek and Latin literature, based on the classics and philosophy Ph.D. reading lists for the classics track of the program, by the end of the fifth term in residence and consisting of one hourlong oral examination on nonphilosophical Greek and Latin works from the list (which may be taken in two parts, one half-hour exam on Greek and one half-hour exam on Latin) and one hourlong oral examination on philosophical Greek and Latin works from the list, to be completed by the end of the fifth term in residence. Students may choose to take the nonphilosophical Greek and/or Latin half-hour component of their oral examination in conjunction with taking the history of Greek or Latin literature, along with the classical philology cohort, in May of the year in which the corresponding history is taken.
7. One of the two qualifying papers required for the Ph.D. in philosophy by the end of the sixth term in residence; this paper should be on a philosophical topic other than ancient philosophy.
8. Oral examinations/special fields in two areas of concentration selected by the candidate in consultation with the DGS in Classics and the program committee, one of which must be in ancient philosophy and which will in addition include a written component, while the other must cover a classical topic other than ancient philosophy, by the end of the sixth term in residence.
9. A dissertation prospectus, by the end of the seventh term in residence.
10. A dissertation. For students on the classics track: once dissertation writing has begun, students will present work in progress from the dissertation at least once per academic year. Research presentations will normally take the form of precirculation of a selection of work from the dissertation and a discussion of it with interested faculty or some other research presentation experience approved by the DGS. This is a requirement for remaining in good standing; exemptions from the requirement require support of the dissertation adviser and the approval of the graduate committee.

THE CLASSICAL NEAR EAST

For information about the Ph.D. specialization in the classical Near East, please contact Professor Kevin van Bladel in the Department of Near Eastern Languages and Civilizations.

ARCHAIA GRADUATE CERTIFICATE

The Yale Program for the Study of Ancient and Premodern Cultures and Societies (Archaia) offers a graduate certificate. For further information, see Archaia, under Non-Degree-Granting Programs, Councils, and Research Institutes.

MASTER'S DEGREE

M.A. The Department of Classics does not admit students for a terminal master's degree. Students who successfully complete the course requirements of their program with an average grade of High Pass will be awarded the M.A. degree.

Program materials are available upon request to the Director of Graduate Studies, Department of Classics, Yale University, PO Box 208266, New Haven CT 06520-8266; dgs.classics@yale.edu.

COURSES

CLSS 5031a / MDVL 5071a / MHHR 5031a, Introduction to Latin Paleography Hannelore Segers

Latin paleography from the fourth century CE to ca. 1500. Topics include the history and development of national hands; the introduction and evolution of Caroline minuscule, pre-gothic, gothic, and humanist scripts (both cursive and book hands); the production, circulation, and transmission of texts (primarily Latin, with reference to Greek and Middle English); advances in the technical analysis and digital manipulation of manuscripts. Seminars are based on the examination of codices and fragments in the Beinecke Library; students select a manuscript for class presentation and final paper.

CLSS 6000a, Proseminar: Classical Studies Christina Kraus

An introduction to the bibliography and disciplines of classical scholarship. Faculty address larger questions of method and theory, as well as specialized subdisciplines such as linguistics, papyrology, epigraphy, paleography, and numismatics. Required of all entering graduate students.

CLSS 6201a, Graduate Latin Survey I Christina Kraus

A survey of Latin literature from the earliest texts to the sixth century CE, with the main focus on the period from the second century BCE to the second century CE. Diachronic, synchronic, generic, and topical models of organization. Prepares for the comprehensive examinations in Classics for those majoring in both literatures or concentrating on Latin. Prerequisite: at least two term courses in Latin numbered in the 4000s.

CLSS 7247a, Roman Declamation James Uden

In ancient Rome, declamation was the assumption of stock characters to debate fictional scenarios. It was a longstanding part of ancient pedagogy; teenage boys played out similar scenarios for hundreds of years as part of their training in rhetoric. It also became a mode of leisure for adult men at various points at Roman history—although that sort of declamation always had an air of deviance about it, since elite men were indulging in a sort of fictional roleplay that was beneath the dignity of "real" oratory. In this course, we examine Roman declamation through close study of the declamation scenarios and quotations preserved by Seneca the Elder in the early first century CE. We try to answer some fascinating but difficult questions. Why did Romans teach future orators and politicians through roleplay? What pleasure was there in the process? And what exactly did declamation teach? Was it merely skills of rhetoric? Or did it teach ethics too—the ability to imagine oneself as someone else?

CLSS 7345a, Narratology, Linguistics, and Greek (and Roman) Narrative Egbert Bakker

In this seminar we study the important literary (sub)discipline of narratology from two vantage points: (1) we ask to what extent a critical paradigm that was developed for the study of modern(ist) narrative is (or is not) meaningful for the study of ancient narrative and (2) we systematically explore the narratological potential of linguistic markers (tense, particles, deictics). Students write a final paper in which narratology is brought to bear on a passage/work/author/genre of their choice (in either Greek or Latin).

CLSS 7435a / HIST 6048a, Greek Social History (600–250 BCE): New Approaches Jessica Lamont
This advanced seminar introduces students to new ways of researching ancient Greek social history, with a focus on communities across the ancient Greek world between c. 600 and 250 BCE, from Sicily to Thasos to the northern Black Sea. Newly published inscriptions and epigraphic corpora drive and structure the course. Major topics of study include: ancient Greek oracles (Delphi, Dodona, dice oracles), divination, women, religious cults and ritual practice, sacred laws, "magical" rites (spells, curses, and incantations), Greek colonization, north Aegean Thasos, and more.

CLSS 7485a, Being Greek in the Roman Empire Andrew Johnston and Benedek Kruchio
What did it mean to be Greek under the Roman empire? How did Greeks construct and negotiate their cultural identity at a time when democracy, the autonomous city state, and Greek dominance in the Mediterranean were things of the distant past? Our seminar grapples with these questions from historical and literary perspectives, engaging with a wide range of material from the first four centuries AD: historiography (e.g., Cassius Dio), rhetoric (Dio Chrysostom, Philostratus, Libanius), satire (Lucian), philosophy (Plutarch, Basil of Caesarea), prose fiction (Achilles Tatius), and poetry (Claudian). The course investigates how Greeks under Rome mobilized the Classical past to understand and fashion their relationship to the present; we explore the institutions, contents, methods, and politics of imperial Greek education and the rhetorical performance culture often labelled as "the Second Sophistic." Prerequisites: solid knowledge of Greek and Latin and a general familiarity with the history of the Roman Empire.

CLSS 7680b / HIST 6002b / MDVL 7002b, Human Migration in Antiquity Noel Lenski
This course examines the processes of human migration in premodern societies with an emphasis on ancient Rome. It explores voluntary and forced migrations, their motivations, processes, and outcomes. Particular attention is paid to sources and problems in the period of late antiquity, when human migration helped drive the collapse of the Roman Empire.

CLSS 7909b / PHIL 6683b, Plato's Metaphysics Tim Clarke
A broad look at central topics in Plato's metaphysics followed by in-depth study of the conception of reality underlying the classificatory method at work in his *Sophist*, *Statesman*, and *Philebus*. Prerequisite: previous study of ancient philosophy, Plato's philosophy.

CLSS 7923a / PHIL 8886a, Aristotle: Physics 2 Brad Inwood and Tim Clarke
The class reads and discusses the Greek text of Aristotle's *Physics* book 2, which sets out the foundational concepts of his natural philosophy, with particular focus on his theory of causal explanation. This book is also important for its discussion of the nature of chance or luck and teleology. This is a core course for the combined Ph.D. program in Classics and Philosophy. It is open to all graduate students in Philosophy or Classics who have suitable preparation in Attic Greek and some prior knowledge of ancient philosophy. Others interested in taking or attending the class must have prior permission of the instructors.

CLSS 9900a and CLSS 9901a, Directed Reading Staff
By arrangement with faculty. Taken SAT/UNSAT.

GREK 5025a, Homer's *Iliad* Egbert Bakker
Reading of selected books of the *Iliad,* with attention to Homeric language and style, the Homeric view of heroes and gods, and the reception of Homer in antiquity.

LATN 5465a, Martial James Uden
Martial is a major author in a miniature mode. Over 1500 of Martial's Latin epigrams survive across fifteen books of poetry, and they offer concise, witty summations of every conceivable aspect of Roman life in the late first century CE. His corpus includes gift-tags, commemorations of public monuments, odes to patrons, and praise and blame of a shifting set of emperors. For some institutions—such as the Roman baths—Martial is our *only* substantial source of evidence in Latin literature. In reading his short poems, we can build a detailed picture of everyday Roman life, one poem at a time. From an aesthetic perspective, though, Martial presents a challenge. How do we read the work *en masse* of an author devoted to the fleeting, ephemeral, and small?

LATN 5525a, Readings in Roman Environmental Thought Kirk Freudenburg
An advanced Latin course (with L5 credit) focusing on ancient literary depictions of Roman encounters with the natural world. Through close readings of Latin texts, the course examines how the Romans exploited their natural surroundings not only as physical resources but also as resources for human thought. The focus is on how ancient thinkers, living lives that were largely city-bound and detached from nature, structured their thoughts about the lives they lived (and about human existence more generally) by reference to their nonhuman surroundings: creatures, plants, and places, some of which existed in the real world (in places far off, largely unknown and elsewhere; in places penetrated, explored, and/or told of), others of which existed entirely in the imagination, whether as inherited lore, or as places and creatures invented ad hoc by individuals and groups to get certain kinds of cultural work done. We look not only at the how and what, but at the why of nature's encoding via culture, and vice versa (their symbiosis), paying special attention to conceptions of man and nature, natural history, agriculture, diet, human work (in the fields of war and on farms), waters, forests, bees, and flowers.

Comparative Literature

Humanities Quadrangle, 3rd floor, 203.432.2760
http://complit.yale.edu
M.A., M.Phil., Ph.D.

Chair
Jing Tsu

Director of Graduate Studies
Marta Figlerowicz

Professors Rüdiger Campe, Martin Hägglund, Hannan Hever, Pericles Lewis, Ayesha Ramachandran, Shawkat Toorawa, Katie Trumpener, Jing Tsu, Jane Tylus, Jesús Velasco

Associate Professors Robyn Creswell, Marta Figlerowicz, Moira Fradinger

Assistant Professor Samuel Hodgkin

Lecturers Peter Cole, Jan Hagens, Matthew Morrison, Candace Skorupa

Emeritus Dudley Andrew, Peter Brooks, Peter Demetz, Carol Jacobs, David Quint

Affiliated Faculty R. Howard Bloch (*French*), Francesco Casetti (*Film and Media Studies*), Michael Denning (*American Studies*), Alice Kaplan (*French*), Tina Lu (*East Asian Languages and Literatures*), John MacKay (*Slavic Languages and Literatures*), Jane Mikkelson, Maurice Samuels (*French*), Ruth Bernard Yeazell (*English*)

FIELDS OF STUDY

The Department of Comparative Literature introduces students to the study and understanding of literature beyond linguistic or national boundaries; the theory, interpretation, and criticism of literature; and its interactions with adjacent fields like visual and material culture, linguistics, film, psychology, law, and philosophy. The comparative perspective invites the exploration of such transnational phenomena as literary or cultural periods and trends (Renaissance, Romanticism, Modernism, postcolonialism) or genres and modes of discourse. Students may specialize in any cultures or languages, to the extent that they are sufficiently covered at Yale. The Ph.D. degree qualifies candidates to teach comparative literature as well as the national literature(s) of their specialization.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Students must successfully complete fourteen term courses, including the departmental proseminar (CPLT 5150) and at least six further courses listed under the departmental heading. The student's overall schedule must fulfill the following requirements: (1) at least one course in literature before 1300, philology, or linguistics; one course in literature between 1300 and 1800; one course in literature after 1800; (2) three courses in literary theory or methodology; (3) at least one course each in poetry, narrative fiction, and drama; (4) course work that deals with texts from three literatures, one of which may be anglophone; and (5) a substantive focus on one or two national

or language-based literatures. Any course may be counted for several requirements simultaneously.

In their fourth term, students must submit a revised seminar paper, selected in consultation with the DGS, no later than April 1. These papers will be circulated to all members of the faculty. The DGS will assign the paper to one faculty member who will write a short evaluation, shared with the student, focused on the questions of whether it shows an ability to: (a) write clearly; (b) conduct independent research at a high level; and (c) develop coherent scholarly arguments.

Languages Students must develop literary proficiency in four languages, including English and at least one other modern language. Students are also expected to meet a philological requirement in one of three ways: by learning to read an ancient or medieval language (such as Latin, Greek, Sanskrit, classical Chinese, Old Church Slavonic, etc.); by learning to read an Indigenous or Aboriginal language (Nahuatl, Quechua, Tlingit, Alyawarr, etc.); or by proficiency from languages from three different language families besides English (e.g. German plus Russian plus Arabic; Hindi plus Igbo plus Swahili; Chinese plus Hebrew plus Portuguese, etc.) The fulfillment of the requirement will be demonstrated for each language by a written exam consisting of a translation of a literary or critical text, to be held by the end of the sixth term; or by an equivalent level in the student's coursework.

Orals An oral examination to be taken in the third year of studies, demonstrating both the breadth and specialization as well as the comparative scope of the student's acquired knowledge. The examination consists of six topics that include texts from at least three national literatures and several historical periods (at least one modern and one premodern). The texts discussed should also include representatives of the three traditional literary genres (poetry, drama, narrative fiction).

Having passed the orals, the student will identify a dissertation committee of three members, at least one of whom must belong to the department's core or affiliate faculty.

Prospectus The dissertation prospectus will be submitted to the DGS by April 1 of the student's sixth term, after having been reviewed and approved by the student's dissertation committee. A standing faculty committee will hold a conference with the student before the end of the term. Any revisions required by that committee must be submitted before the beginning of the student's fourth year.

Ph.D. Dissertation After submission of the prospectus, the student's time is devoted mainly to the dissertation, which completes the degree. It is expected that students will periodically pass their work along to members of their dissertation committee. The first chapter must be submitted to the committee by February 1 of the fourth year of study, followed by a chapter conference before the end of that year.

Admission to candidacy for the Ph.D. is granted after six terms of residence and the completion of all requirements (courses, languages, orals, prospectus) except the dissertation and teaching.

Teaching Training in teaching, through teaching fellowships, is an important part of every student's program. Normally students will teach in their third and fourth years. If needed, teaching is also available in the sixth year.

COMBINED PH.D. PROGRAMS

Comparative Literature and Classics

Prerequisites for admission through the Department of Classics are the same as for classical philology. For admission requirements in the Department of Comparative Literature, consult the DGS of that department.

Coursework Students concentrating in comparative literature and classics are required to complete thirteen graduate term courses, including the proseminars in classics (taken pass-fail, not for credit) and in comparative literature. Students must also take a minimum of twelve term courses. At least six must be in classics, including (a) two yearlong surveys (four courses) in the history of Greek and Latin literature and (b) two 800-level seminars. And at least six courses must be in comparative literature; of these, at least four courses should be on postclassical literature. The coursework across the two programs should include at least two courses on literary theory or methodology, and at least one course each in poetry, narrative fiction, and drama.

Please note that students in this combined program are required to take a total of thirteen graduate courses, rather than Comparative Literature's standard fourteen, to offset the additional time and effort they spend preparing for their Greek and Latin examinations (see below).

Languages To assess each student's proficiency and progress in both key languages, two diagnostic translation examinations each in Greek and Latin are to be taken before the beginning of the first and third terms. Literary proficiency in German and one other modern language must be passed by the end of the second year. Literary proficiency in English, Greek, and Latin must be demonstrated by coursework.

Written exam By the beginning of the fifth term, translation examinations in Greek and Latin literature, based on the Classics Ph.D. reading list.

Orals *Classics*: oral examinations in Greek and Latin literature, based on the Classics Ph.D. reading list. These are to be taken closely following the surveys in the respective literatures, as follows: the first, at the end of the second term (May of the first year), the second at the end of the fourth term (May of the second year). *Comparative Literature*: oral examination in six topics appropriate to both disciplines, balancing a range of kinds of topics and including poetry, narrative fiction, and drama, and at least one significant cluster of postclassical texts, to be taken before or at the start of the sixth term, no later than in mid-January. Lists will be worked out with individual examiners, primarily under the guidance of the Comparative Literature DGS, but also with the approval of the Classics DGS, and must be submitted by the end of the fourth term. One of the topics studied will be relevant to the student's planned dissertation topic.

Prospectus The prospectus must be approved by the DGS in each department (and by the Comparative Literature prospectus committee) by the end of the sixth term in residence. At least one dissertation committee member must come from the Comparative Literature core faculty.

Dissertation At the end of each year, each dissertation student will presubmit, then discuss their work in progress in a Classics "chapter colloquium" discussion with interested faculty.

Comparative Literature and Early Modern Studies

The Department of Comparative Literature offers, in conjunction with the Early Modern Studies Program, a combined Ph.D. in Comparative Literature and Early Modern Studies. For further details, see Early Modern Studies.

Comparative Literature and Film and Media Studies

Applicants to the combined program must indicate on their application that they are applying both to the program in Film and Media Studies and to Comparative Literature. All documentation within the application should include this information.

Coursework Students in the combined program are required to complete fifteen graduate term courses. In comparative literature, the proseminar and at least five further courses, including at least one course in literary theory or methodology beyond the proseminar; at least one course each in poetry, narrative fiction, and drama; two courses before 1900, including at least one before 1800; a wide range of courses with a focus on one or two national or language-based literatures; and at least two courses with the grade of Honors. In Film and Media Studies, one core seminar (FILM 6010) and four additional seminars. Additionally, students must devote one of their course papers to questions of film and/or media history/historiography.

Languages At least two languages (besides English) with excellent reading ability.

Orals By October 1 of the third year, students must have fulfilled an assignment related to foundational texts and films. During this third year, they must also pass the six-field Comparative Literature oral examination, with at least one examiner from the core Comparative Literature faculty; at least three fields involving literary topics, and readings including poetry, fiction, and drama; the other topics may be on film or film-related subjects; some lists may combine film and literature.

Prospectus and Dissertation At least one dissertation director must be from Comparative Literature and at least one from Film and Media Studies (in some cases, a single adviser may fulfill both roles). The prospectus must be approved by the Comparative Literature subcommittee and ratified by the Film and Media Studies Executive Committee. Before it is submitted, the dissertation must pass a defense of method (with at least one examiner from the graduate Film and Media Studies committee, and at least one member from Comparative Literature).

MASTER'S DEGREES

M.Phil. See Degree Requirements under Policies and Regulations.

M.A. Students who withdraw from the Ph.D. program may be eligible to receive the M.A. degree if they have met the requirements and have not already received the M.Phil. degree. For the M.A., students must successfully complete ten courses with at least two grades of Honors and a maximum of three grades of Pass and the demonstration of proficiency in two of the languages, ancient or modern, through coursework or departmental examinations. Candidates in combined programs will be awarded the M.A. only when the master's degree requirements for both programs have been met.

Program materials are available upon request to the Director of Graduate Studies, Department of Comparative Literature, Yale University, PO Box 208251, New Haven CT 06520-8251, or sabrina.whiteman@yale.edu.

COURSES

CPLT 5004a, Proseminar in Translation Studies Robyn Creswell and Alice Kaplan
This graduate proseminar combines a historically minded introduction to Translation Studies as a field with a survey of its interdisciplinary possibilities. The proseminar is composed of several units (Histories of Translation; Geographies of Translation; Scandals of Translation), each with a different approach or set of concerns, affording the students multiple points of entry to the field. The Translation Studies coordinator provides the intellectual through-line from week to week, while incorporating a number of guest lectures by Yale faculty and other invited speakers to expose students to current research and practice in different disciplines. The capstone project is a conference paper-length contribution of original academic research. Additional assignments throughout the term include active participation in and contributions to intellectual programming in the Translation Initiative.

CPLT 5020a / GMAN 5020a, Capitalism as a Form of Life Rahel Jaeggi
The critique of capitalism is thriving. But what, exactly, is the problem with capitalism? Is it flawed, unjust, irrational, or harmful? Is it evil or foolish—or does it simply fail to function? In other words, on what grounds can capitalism be criticized? Setting aside the simplistic accusation of individual greed, three distinct strategies of critique can be identified. First, there is the functional critique: capitalism, as a social and economic system, is inherently dysfunctional and prone to crises. The second is the moral critique, which argues that capitalism relies on exploitation and perpetuates injustice. The third is the ethical critique, which claims that life under capitalism is fundamentally alienating or impoverished, preventing individuals from achieving true human flourishing. These three accusations are as old as capitalism itself. They appear not only in "progressive" or emancipatory movements but also in nostalgic and conservative responses to the profound social changes capitalism has brought about. They are found in theoretical debates, political manifestos, literature, and film. This course explores these three lines of critique through a philosophical lens as well as through an examination of literature and films that engage with the issue. The central idea—that capitalism is not merely an economic system but a pervasive way of life that as such warrants critique—is made vivid and comprehensible through this exploration. Readings include Max Weber, Karl Marx, Werner Sombart, Georg Simmel, Theodor W. Adorno, Jürgen Habermas, Nancy Fraser, Upton Sinclair, Bertold Brecht, Thomas Piketty, Kim Stanley Robinson, and Quinn Slobodian.

CPLT 5065a / GMAN 5060a, Bad Books Kirk Wetters
Traditional humanities education always focused on "greatness"—but there is no denying the critical value and sometimes even the enjoyment of poor performances. In a world governed by norms and standards (against the appearance of laxness and relativism), "badness" and amateurism are inevitable. "Bad" works can be extremely popular and influential (e.g., in the cases of pseudoscience, misinformation, racism, antisemitism). The "bad" archive contributes to a reevaluation of critical standards, forms of official and unofficial censorship, freedom of speech and the function of taboos. The course explores famous works that have been considered aesthetically, morally, ideologically and politically pernicious (stopping short, however, of screeds

and manifestos like Hitler's *Mein Kampf*). Nevertheless, this course warrants a strong content warning. The range of our considerations is partly based on the students' wishes and judgments.

CPLT 5140a / ENGL 5040a / GMAN 5140a, What the University Was Paul North
After this course, you might not know exactly where the university is going, but you should be able to say what it was once supposed to be, in its "modern" inception in Germany and in latter day materializations around the planet. The course is the interpretation of a particular dream. Who dreamed the dream of an institution that could be anywhere and contain everything important? How did its theorists think the unique nexus of power, economics, histories, and architecture that is, ideally at least, the university? How did they imagine it, given that it is a highly conflictual entity, riding the forefront of some transformations and at the same time codifying and regulating knowledges and social potentials? We read texts from the global archive called "critical university studies," concentrating on articulations of the problems in theoretical texts. These include Kant's *Conflict of the Faculties*, Schiller's *Letters on Aesthetic Education*, Nietzsche's *Anti-Education*, Derrida's *Eyes of the University*, Willy Thayer's *Non-Modern Crisis of the Modern University*, Fred Moten and Stefano Harney's *Undercommons*, and Roderick Ferguson's *The Reorder of Things*.

CPLT 5240b / GMAN 6500b, Critique and Crisis Kirk Wetters
In our time, when everyone is suspected of being hypercritical, it is not surprising that the limits of critique, its function, and institutional location are called to question. The idea of "post-critique" has been much discussed in recent years. This course develops critical models, primarily from the German tradition, in order to show the great variety of options available beyond the "hermeneutics of suspicion." Topics include post-critique, the history of critique/criticism, the Romantic concept of critique, traditional vs. critical theory, historicism, philology vs. hermeneutics, science (*Wissenschaft*) vs. the critique of positivism. Main protagonists include Kant, Schiller, Schlegel, Nietzsche, Dilthey, Max Weber, Lukács, Husserl, Benjamin, Adorno, Koselleck, Szondi, Gadamer, Gumbrecht, Latour, Felski.

CPLT 5490a / RUSS 6609a, Memory and Memoir in Russian Culture Jinyi Chu
How do we remember and forget? How does memory transform into narrative? Why do we read and write memoirs and autobiography? What can they tell us about the past? How do we analyze the roles of the narrator, the author, and the protagonist? How should we understand the ideological tensions between official historiography and personal reminiscences, especially in twentieth-century Russia? This course aims to answer these questions through close readings of a few cultural celebrities' memoirs and autobiographical writings that are also widely acknowledged as the best representatives of twentieth-century Russian prose. Along the way, we read literary texts in dialogue with theories of memory, historiography, and narratology. Students acquire the theoretical apparatus that will enable them to analyze the complex ideas, e.g., cultural memory and trauma, historicity and narrativity, and fiction and nonfiction. Students acquire an in-depth knowledge of the major themes of twentieth-century Russian history—e.g., empire, revolution, war, Stalinism, and exilic experience—as well as increased skills in the analysis of literary texts. Students with knowledge of Russian are encouraged to read in the original. All readings are available in English.

CPLT 5550a / ENGL 6535a / MDVL 6035a, Postcolonial Middle Ages Marcel Elias
This course explores the intersections and points of friction between postcolonial studies and medieval studies. We discuss key debates in postcolonialism and medievalists' contributions to those debates. We also consider postcolonial scholarship that has remained outside the purview of medieval studies. The overall aim is for students, in their written and oral contributions, to expand the parameters of medieval postcolonialism. Works by critics including Edward Said, Homi Bhabha, Leela Gandhi, Lisa Lowe, Robert Young, and Priyamvada Gopal are read alongside medieval romances, crusade and jihād poetry, travel literature, and chronicles.

CPLT 6010a / NELC 6350a, The Education of Princes: Medieval Advice Literature of Rulership and Counsel Shawkat Toorawa
In this course we read "mirrors for princes," a type of political writing by courtiers and advisors. The genre flourished in the courts of medieval Europe and the Islamic world. We learn about the ethical and moral considerations that guided (or were meant to guide) rulers in their conduct, in the formulation of their policies, and about theories of rule and rulership. The works we read are from several cultural, religious, and political traditions, and include: Christine de Pizan, *A Medieval Woman's Mirror of* Honor; Einhard, *Life of Charlemagne*; Erasmus, *Education of a Christian Prince*; Ibn al-Muqaffa', *Kalilah and Dimnah,* John of Salisbury, *Policraticus: Book of the Statesman*; Machiavelli, *The Prince*; Nizam al-Mulk, *The Book of Government.* All texts are in English translation. Instructor permission required.

CPLT 6121a, Translating Theory Marta Figlerowicz
This is an advanced workshop for students with a special interest in translating theoretical and philosophical works. Over the course of the term, we collectively translate all the essays in the legendary 1966 issue of the French journal *Communications*, whose contributors include Roland Barthes, Umberto Eco, and Tzvetan Todorov. The finished translation will be published in *Narrative*, the flagship journal of the International Society for the Study of Narrative, with the course members listed as collective co-translators. Advanced knowledge of French or Italian.

CPLT 6180b / GMAN 7090b / JDST 7680b, Walter Benjamin's Critical Theory Paul North
Careful analysis of central texts in Benjamin's oeuvre in the context of his philosophical, political, and literary reading.

CPLT 6220a / AMST 6622a and AMST 6623b, Working Group on Globalization and Culture Michael Denning
A continuing yearlong collective research project, a cultural studies "laboratory." The group, drawing on several disciplines, meets regularly to discuss common readings, develop collective and individual research projects, and present that research publicly. The general theme for the working group is globalization and culture, with three principal aspects: (1) the globalization of cultural industries and goods, and its consequences for patterns of everyday life as well as for forms of fiction, film, broadcasting, and music; (2) the trajectories of social movements and their relation to patterns of migration, the rise of global cities, the transformation of labor processes, and forms of ethnic, class, and gender conflict; (3) the emergence of and debates within transnational social and cultural theory. The specific focus, projects, and directions of the working group are determined by the interests, expertise, and ambitions of the members of the group, and change as its members change. The working group is open

to doctoral students in their second year and beyond. Graduate students interested in participating should contact michael.denning@yale.edu.

CPLT 6351a / AFST 6351a / FILM 6450, The Nigerian "Video Novel" and Nollywood Staff

The course introduces students to an emerging genre of the Nigerian novel in which writers adopt narrative repurposing strategies that invite transcription and adaptation to films. This evolving "Nigerian visual novel" or "video novel," is defined by its loosely structured, tabloid-themed and reader-friendly style, all reflecting the craft of Nollywood films, a thriving video film culture that emerged in the 1990s and has remained popular globally. Through the study of Nollywood films alongside new Nigerian fiction, the course examines the techniques adopted by writers to accommodate the aesthetics of popular culture, to revive a declining readership, and to make literature more sellable. As these novels win literature prizes and find their way onto syllabi, the implications they have for our understanding of the African literary canon is discussed. Students view selected Nollywood movies and read a number of novels in the new genre in order to appraise the extent to which the serious and the sensuous intersect in this remaking of literariness. Seminar discussions are accompanied by short lectures in which concepts such as "trans-mediality," "reverse-adaptation," "screen-to-page," "appropriation," and "quotation" are discussed to build an understanding of how the "new" approach reconfigures Nigerian novels.

CPLT 6570a / PORT 6520a, Clarice Lispector: The Short Stories Kenneth David Jackson

This course is a seminar on the complete short stories of Clarice Lispector (1920–1977), a master of the genre and one of the major authors of twentieth-century Brazil known for existentialism, mysticism, and feminism.

CPLT 6640a / ITAL 6990a, Taking Leave: Meditations on Art, Death, and the Afterlife from the Bible to the Twentieth Century Jane Tylus and Bruce Gordon

This seminar seeks to contextualize leave-taking within the explicitly religious and artistic contexts of Western culture. We open with readings from ancient texts from Mesopotamian, Greek, Latin, and Judaic cultures, and end with the U.S. Civil War. And in between we spend considerable time on the ways in which the advent of Christianity and, in turn, the Reformation, Counter-Reformation, and modern worlds influenced the practices and understanding of leave-taking. En route we explore how, for example, Catholicism sought to extend life into the third realm of Purgatory, why the Reformation sought to undo those imaginative excursions, and the extent to which the different faiths of figures such as Michelangelo, Shakespeare, and John Donne produced radically different kinds of finished—and unfinished—works. As we explore the transformative potential of the goodbye in literary and religious works, we also engage with more recent discussions from theologians, theorists, and therapists about grieving, transitions, and letting go. Our objectives are: to strive to understand the important role that leave-takings play in the history of Christianity and artistic expression, especially between 1300–1850; to probe the difference between religious faiths of early modernity with respect to rituals of saying goodbye and the afterlife; to sharpen our skills as readers, spectators, and listeners of works that engage with complex questions regarding the meaning of one's life and one's lifework; and to contextualize our readings within contemporary conversations about dying, grief, and letting go. Area V and Area III.

CPLT 6891a, Introduction to Critical Sleep Studies: The Politics of Sleep and Sleeplessness Moira Fradinger

Although we spend approximately one third of our lives asleep, since the industrial revolution and the emergence of uninterrupted city lighting, industrialized societies seem to have developed an ambivalent relation to sleep: both protected and devalued for the sake of higher standards of productive work. The devaluation of sleep, in particular, has produced, during the twentieth and the first two decades of the twenty-first centuries, an array of social, political, and medical discourses to study the impact of changing patterns of sleep and sleeplessness at the global level. This seminar studies topics in the politics and cultures of sleep and sleeplessness, which posit sleep as a human practice. As any human practice, it is framed by cultural and political settings, so that how, when, why, where, and who sleeps vary across sectors of society, across past and present and across world cultures. We study historical, literary, philosophical, sociological, political, and filmic texts. A cultural, social, and political understanding of sleep and sleeplessness can reveal how sleep has been transformed into a bodily site upon which social values are imposed, social surveillance is enacted, ideas about "normality" are instrumentalized, resulting in a demand that humans adapt to human-made changing conditions of production, rather than universally unchanging health needs.

CPLT 7290b / AFST 9965b / FREN 9650b, On Violence: Politics and Aesthetics across the Maghreb Jill Jarvis

This humanities laboratory investigates North African literary texts and other aesthetic works that document, theorize, and disrupt forms of state violence. How might these works—as well as our practices as humanities scholars, critics, curators, co-creators—run counter to state-sanctioned memory projects or compel rethinking practices of testimony, archiving, and justice in the face of enduring colonial occupation, institutionalized racism, and the state-sponsored violence that continues to take place on scales or in forms that are difficult to frame or fathom? Works by Fanon, Djebar, Kateb, Mechakra, Meddeb, Rahmani, Mouride, Hawad, Binebine, and many others. The seminar is an RITM Humanities Laboratory designed to cultivate new forms of collaborative and experimental humanities scholarship. See Canvas page for a more complete description. Conducted in English. Prerequisite: reading knowledge of French.

CPLT 7880b / GMAN 5710b, Robert Musil's *Man without Qualities:* The End of the Novel Rudiger Campe

Musil's gigantic *Man without Qualities* (published 1930–33, 1943) is one of the quintessential modernist (interwar) European novels. After looking into Musil's earlier narrative experiments, the course begins with the close reading of part I of the novel and then focuses on the main strands of its narrative network: modernization and mysticism; the end of old Europe and the rise of fascism; the Vienna Circle's epistemology and the legal doctrine of accountability; love and violence. The intertwining of essay and narration in the novel, the theory of the novel in the novel, and the question of prose as form are at the core of the course. Readings in English or German. Discussions in English.

CPLT 8220b / AMST 6623b, Working Group on Globalization and Culture Staff

A continuing yearlong collective research project, a cultural studies "laboratory." The group, drawing on several disciplines, meets regularly to discuss common

readings, develop collective and individual research projects, and present that research publicly. The general theme for the working group is globalization and culture, with three principal aspects: (1) the globalization of cultural industries and goods, and its consequences for patterns of everyday life as well as for forms of fiction, film, broadcasting, and music; (2) the trajectories of social movements and their relation to patterns of migration, the rise of global cities, the transformation of labor processes, and forms of ethnic, class, and gender conflict; (3) the emergence of and debates within transnational social and cultural theory. The specific focus, projects, and directions of the working group are determined by the interests, expertise, and ambitions of the members of the group, and change as its members change. There are a small number of openings for second-year graduate students. Students interested in participating should contact michael.denning@yale.edu.

CPLT 8355a / SPAN 8355a, Ciencia Ficción, Fantasía y Neogótico en la Narrativa Hispanoamericana Contemporánea Anibal González-Pérez
Graduate-level study of the speculative incorporation of scientific ideas and themes in twentieth and twenty-first century from Argentina, Bolivia, Chile, Cuba, Ecuador, Mexico, and Peru. Reading and discussion of twentieth-century precursors and founders of Spanish American science fiction, such as Jorge Luis Borges, Adolfo Bioy Casares, Hugo Correa, Angélica Gorodischer, Leopoldo Lugones, Pablo Palacio, and Clemente Palma. Followed by examples of "techno-writing," utopias, dystopias, and possible futures proposed by late twentieth and early twenty-first-century authors such as José B. Adolph, César Aira, Luis Carlos Barragán, Alberto Chimal, Liliana Colanzi, Mariana Enríquez, Yuri Herrera, Samantha Schweblin, Jorge Volpi, and Yoss, among others. Topics to be examined include posthumanism, ecofiction, and sociopolitical satire. *Taught in Spanish.*

CPLT 8810a / ENGL 6860a / WGSS 9960a, Literary Theory Caleb Smith
What is literary theory today, and what is its history? The aim of the course is to introduce students to central concepts in theory and explore their relation to method. We examine the variety of approaches available within the field of literary studies, including older ones such as Russian formalism, Critical Race Theory, New Criticism, deconstruction, Marxism, and psychoanalysis, as well as newer ones like actor-network theory and digital humanities research. We explore the basic tenets and histories of these theories in a way that is both critical and open-minded, and discuss their comparative advantages and pitfalls. The focus is on recurrent paradigms, arguments, and topics, and on transhistorical relations among our various schools of literary-theoretical thought. Readings might include work by René Wellek, Paul de Man, Jacques Derrida, Gayatri Spivak, Bruno Latour, Judith Butler, Northrop Frye, Fred Moten, and many others.

CPLT 8980a / FREN 8980a, Fin-de-siècle France Maurice Samuels
The course examines major French literary and artistic movements of the last decades of the nineteenth century (Naturalism, Decadence, Symbolism) in their cultural context. Weekly reading assignments pair literary texts with contemporary theoretical/medical/political discourse on such topics as disease, crime, sex, poverty, colonialism, nationalism, and technology. Literary authors include Barbey, Mallarmé, Maupassant, Rachilde, Villiers, and Zola. Theorists include Bergson, Freud, Krafft-Ebing, Le Bon, Nordau, Renan, and Simmel. Some attention also paid to the visual arts. Prerequisite: reading knowledge of French.

CPLT 9013a / FILM 6900a / SPAN 6330a, Third Cinema: Arts and Politics in Latin America Moira Fradinger

This seminar studies the articulation of art and politics proposed by the world renowned film movement usually identified as "Third Cinema" that took shape in Latin America roughly between 1955 and 1982. Continental in scope, the movement has also been called "New Latin American Cinema" joining the "new waves" of the global sixties and expanding its influence throughout the countries of the Non-Aligned Movement. The seminar examines the category of "Third cinema," first formulated in Solanas's and Getino's 1969 "Manifesto Towards a Third Cinema" and opposed to "First Cinema" (Hollywood) and "Second Cinema" ("cinema d'auteur" or independent film art). The manifesto's political thinking will be framed in terms of contemporary political ideas about "the third way" or "the non-aligned third world" as well as put in dialogue with an array of film manifestos emerging at this time in the region. The seminar engages concepts such as "imperfect cinema," "urgent cinema," "cinema novo," "aesthetics of hunger," "liberation cinema"; the "camera as expropiator of image-weapons," and so forth. The seminar casts a wide net in terms of the corpus, which includes a minimum of two films per week, from countries such as Argentina, Chile, Uruguay, Brazil, Bolivia, Peru, Colombia, Venezuela, Haiti, Cuba, and Mexico. Taught in English; knowledge of Spanish and Portuguese is not required but certainly useful.

CPLT 9053a / EALL 8230a / EAST 8220a, Topics in Sinophone and Chinese Studies Jing Tsu

This recurring graduate research seminar and symposium examines different areas, periods, genres, and conceptual frameworks in Chinese and Sinophone studies. The topic this year is 1950s–2020. Prerequisite: reading fluency in modern and semi-classical Chinese. Enrollment is restricted; no auditors.

CPLT 9170a / ENGL 920 / FILM 6010a, Foundations of Film and Media John MacKay

The course sets in place some undergirding for students who want to anchor their film interest to the professional discourse of this field. A coordinated set of topics in film theory is interrupted first by the often discordant voice of history and second by the obtuseness of the films examined each week. Films themselves take the lead in our discussions.

Computational Biology and Biomedical Informatics

100 College St., cbb-registrar@yale.edu
http://cbb.yale.edu
M.S., Ph.D.

Directors of Graduate Studies
Mark Gerstein (Bass 432A, 203.432.6105, cbb-dgs@yale.edu)
Steven Kleinstein (300 George St., Suite 505, 203.785.6685, cbb-dgs@yale.edu)

Professors Frederick Altice (*Internal Medicine*; *Infections Diseases*; *Epidemiology of Microbial Diseases*), Marcus Bosenberg (*Dermatology*; *Pathology*), Cynthia Brandt (*Emergency Medicine*; *Anesthesiology*), Joseph Chang (*Statistics and Data Science*), Kei-Hoi Cheung (*Emergency Medicine*; *Anesthesiology*), Ronald Coifman (*Mathematics*; *Computer Science*), Stephen Dellaporta (*Molecular, Cellular, and Developmental Biology*), Rong Fan (*Biomedical Engineering*; *Pathology*), Richard Flavell (*Immunobiology*), Joel Gelernter (*Psychiatry*; *Genetics*), Mark Gerstein (*Biomedical Informatics*; *Molecular Biophysics and Biochemistry*; *Computer Science*; *Statistics and Data Science*), Antonio Giraldez (*Genetics*), Jeffrey Gruen (*Genetics*; *Investigative Medicine*; *Pediatrics*), Murat Gunel (*Neurosurgery*; *Genetics*), Ira Hall (*Genetics*), Amy Justice (*Internal Medicine*; *Public Health*), Naftali Kaminski (*Internal Medicine*), Steven Kleinstein (*Pathology*; *Immunobiology*), Yuval Kluger (*Pathology*), Harlan Krumholz (*Internal Medicine*; *Investigative Medicine*; *Public Health*), Haifan Lin (*Cell Biology*; *Genetics*), Shuangge (Steven) Ma (*Biostatistics*), Zongming Ma (*Statistics and Data Science*), Andrew Miranker (*Molecular Biophysics and Biochemistry*; *Chemical and Environmental Engineering*), James Noonan (*Genetics*; *Neuroscience*), Corey O'Hern (*Mechanical Engineering and Materials Science*; *Applied Physics*; *Physics*), Xenophon Papademetris (*Biomedical Informatics and Data Science*; *Radiology and Biomedical Imaging*), Lajos Pusztai (*Internal Medicine*), Anna Pyle (*Molecular, Cellular, and Developmental Biology*; *Chemistry*), David Stern (*Pathology*), Hemant Tagare (*Radiology and Biomedical Imaging*; *Biomedical Engineering*), Jeffrey Townsend (*Public Health*; *Ecology and Evolutionary Biology*), John Tsang (*Immunobiology*), Hua Xu (*Biomedical Informatics and Data Science*), Heping Zhang (*Biostatistics*; *Statistics and Data Science*), Hongyu Zhao (*Biostatistics*; *Statistics and Data Science*), Steven Zucker (*Computer Science*; *Electrical Engineering*; *Biomedical Engineering*)

Associate Professors Julien Berro (*Molecular Biophysics and Biochemistry*), Sidi Chen (*Genetics*; *Neurosurgery*), Forrest Crawford (*Biostatistics*; *Ecology and Evolutionary Biology*), Samah Jarad (*Emergency Medicine*; *Biostatistics*), Smita Krishnaswamy (*Genetics*; *Computer Science*), Bluma Lesch (*Genetics*), Jun Lu (*Genetics*), Ted Melnick (*Biostatistics*; *Emergency Medicine*), Kathryn Miller-Jensen (*Engineering and Applied Science*), John Murray (*Psychiatry*; *Neuroscience*; *Physics*), Renato Polimanti (*Psychiatry*), Edward Stites (*Laboratory Medicine*), Andrew Taylor (*Emergency Medicine*), Zuoheng (Anita) Wang (*Biostatistics*), Yize Zhao (*Biostatistics*)

Assistant Professors Arnaud Augert (*Pathology*), David Braun (*Medical Oncology*), Purushottam Dixit (*Biomedical Engineering*), Salil Garg (*Laboratory Medicine*; *Pathology*), Leying Guan (*Biostatistics*), Mary-Anne Hartley (*Biomedical*

Informatics and Data Science), Albert Higgins-Chen (*Psychiatry*; *Pathology*), Jeffrey Ishizuka (*Internal Medicine*; *Medical Oncology*; *Pathology*), Rohan Khera (*Internal Medicine, Cardiovascular Medicine*; *EPH Biostatistics*), Monkol Lek (*Genetics*), Benjamin Machta (*Physics*), Robert McDougal (*Biostatistics*), Jacob Musser (*Molecular, Cellular, and Developmental Biology*), C. Brandon Ogbunu (*Ecology and Evolutionary Biology*), Carlos Oliveira (*Pediatrics*; *Infectious Diseases*), Steven Reilly (*Genetics*), Wade Schulz (*Laboratory Medicine*), Serena Tucci (*Anthropology*), David van Dijk (*Internal Medicine, Cardiology*; *Computer Science*), Rex Ying (*Computer Science*), Jack Zhang (*Molecular Biophysics and Biochemistry*)

FIELDS OF STUDY

Computational biology and biomedical informatics (CB&B) is a rapidly developing multidisciplinary field. The past two decades have witnessed a revolution in the biological and biomedical sciences driven by the development of technologies such as high-dimensional phenotypic profiling, next-generation sequencing, macromolecular structure determination and high-resolution imaging, wearable sensor devices, and large-scale electronic health records. These data-generation technologies demand new computational analysis approaches, which, in turn, have given rise to the field of computational biology and biomedical informatics (CB&B).

The Yale Computational Biology and Biomedical Informatics program combines research training opportunities in a range of different fields within the biological and biomedical sciences, in addition to the computational sciences, applied mathematics, statistics, and data science. The scope and balance of a student's program are highly individualized. Each student in the CB&B program develops, with the assistance of faculty advisers, a specific program of coursework, independent reading, and research that gives a depth of coverage and fits their background, interests, and career goals.

To enter the Ph.D. program, students apply to the CB&B Track within the interdepartmental graduate program in Biological and Biomedical Sciences (BBS), https://medicine.yale.edu/bbs.

INTEGRATED GRADUATE PROGRAM IN PHYSICAL AND ENGINEERING BIOLOGY (PEB)

Students applying to one of the tracks of the Biological and Biomedical Sciences program may simultaneously apply to be part of the PEB program. See the description under Non-Degree-Granting Programs, Councils, and Research Institutes for course requirements, and http://peb.yale.edu for more information about the benefits of this program and application instructions.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

With the help of a faculty advisory committee, each student plans a program that includes courses, seminars, laboratory rotations, and independent reading. Students are expected to gain competence in three core areas: (1) computational biology and biomedical informatics, (2) biological sciences, and (3) informatics (including computer science, applied mathematics, statistics, and data science). While the courses taken to satisfy the core areas of competency may vary considerably, all students are required to take the following courses: CB&B 7400 and CB&B 7520 . CB&B requires a minimum of ten course credits. Completion of the core curriculum will typically

take three to four terms, depending in part on the prior training of the student. With approval of the CB&B director of graduate studies (DGS), students may take one or two undergraduate courses to satisfy areas of minimum expected competency. Students will typically take two to three courses each term and three research rotations (CB&B 7110, CB&B 7120, CB&B 7130) during the first year. In addition to all other requirements, students must successfully complete IBIO 6010, Fundamentals of Research: Responsible Conduct of Research, (or another course that covers the material) prior to the end of their first year of study. After the first year, students will start working in the laboratory of their Ph.D. thesis supervisor. Students must pass a qualifying examination normally given no later than the end of the third year. There is no foreign language requirement. Students will serve as teaching assistants in two terms. In their fourth year of study, all students must successfully complete CB&B 5030, RCR Refresher Course.

M.D.-PH.D. STUDENTS

Students pursuing the joint M.D.-Ph.D. degrees must satisfy the course requirements listed above for Ph.D. students. With approval of the DGS, some courses taken toward the M.D. degree can be counted toward the ten required course credits. Such courses must have a graduate course number, and the student must register for them as graduate courses (in which grades are received). Laboratory rotations are available but not required. One teaching assistantship is required.

MASTER'S DEGREE

Terminal Master's Degree Program Students can be admitted for a terminal M.S. degree in Computational Biology and Biomedical Informatics with the goal of gaining competency in three core areas: (1) computational biology and biomedical informatics, (2) biological and medical sciences, and (3) informatics (including computer science, applied mathematics, statistics, and data science). This is a two-year program and is not part of the BBS program. Students must complete twelve courses at Yale, including at least four graduate CB&B courses (including CB&B 7400 and CB&B 7520), two graduate courses in the biological and medical sciences, three graduate courses in areas of informatics, and three additional courses in any of the three core areas. In addition, M.S. students must take a one-term graduate seminar on research ethics and attend a CB&B seminar series. Finally, students must meet all of the graduate school's requirements for the two-year terminal M.S. degree. We also discourage auditing courses, which do not satisfy the degree requirements.

Terminal M.S. degree students are also expected to complete an M.S. project, write a research paper describing it, and defend the project in a seminar where they present the project and answer questions about the project as well as demonstrate breadth knowledge of their coursework and track of study. The paper is evaluated by the student's research supervisor and a second reader from the CB&B faculty. Students are expected to identify a faculty member to supervise the M.S. project by the end of the first year or early in the second year. Completion of the research paper is facilitated by enrolling in CB&B 7140 and CB&B 7150.

M.S. (en route to the Ph.D.) Students enrolled in the Ph.D. program may be awarded an M.S. degree en route as they satisfy the requirements for the Ph.D. degree. To qualify for the awarding of the en route M.S. degree a student must (1) complete

two years (four terms) of study in the Ph.D. program; (2) complete the required coursework for the Ph.D. program, with ten required course credits taken at Yale including three successful research rotations; and (3) meet the graduate school's grade requirements.

CB&B 5030b, Responsible Conduct of Research, Refresher Course Steven Kleinstein
The NIH requires that students receive training in the responsible conduct of research every four years. This course meets that requirement for fourth-year students.

CB&B 5620b / AMTH 765b / ENAS 5620b / INP 562b / INP 7562b / MB&B 5620b / PHYS 5620b, Modeling Biological Systems II Thierry Emonet, Jing Yan, and Damon Clark
This course covers advanced topics in computational biology. How do cells compute, how do they count and tell time, how do they oscillate and generate spatial patterns? Topics include time-dependent dynamics in regulatory, signal-transduction, and neuronal networks; fluctuations, growth, and form; mechanics of cell shape and motion; spatially heterogeneous processes; diffusion. This year, the course spends roughly half its time on mechanical systems at the cellular and tissue level, and half on models of neurons and neural systems in computational neuroscience. Prerequisite: a 200-level biology course or permission of the instructor.

CB&B 5750a, Bioinformatics Applications in Biomedicine Jihoon Kim
This course covers the latest advances in bioinformatics in the context of human diseases. Students learn background knowledge and practical skills to analyze omics data for human disease research. By the end of this course, students should be able to: (1) process bioinformatics data with linux-based pipelines and data tools, (2) apply exploratory data analysis techniques in Python and R, (3) perform analysis of DNA, RNA, and protein data, and (4) conduct a biobank-scale analysis using the platform such as the All of Us Research Workbench.

CB&B 5800a, Bioinformatics Algorithms in Genomics Haoyu Cheng
This course introduces key algorithms used in computational genomics, with a focus on both classical bioinformatics methods and emerging machine learning and deep learning approaches. Topics covered include sequence alignment, genome assembly and comparative genomics, variant identification and analysis, and gene expression and regulation, along with advanced techniques for specialized applications such as cancer genomics. Through hands-on exercises and projects, students gain practical experience in implementing algorithms and analyzing real-world genomic data. By the end of the course, students are prepared to conduct independent genomic analyses or develop novel bioinformatics algorithms to tackle emerging challenges in genomics.

CB&B 6340a, Computational Methods for Informatics Robert McDougal
This course introduces the key computational methods and concepts necessary for taking an informatics project from start to finish: using APIs to query online resources, reading and writing common biomedical data formats, choosing appropriate data structures for storing and manipulating data, implementing computationally efficient and parallelizable algorithms for analyzing data, and developing appropriate visualizations for communicating health information. The FAIR data-sharing guidelines are discussed. Current issues in big health data are discussed, including successful applications as well as privacy and bias concerns. This course has a

significant programming component, and familiarity with programming is assumed. Prerequisite: CPSC 223 or equivalent, or permission of the instructor.

CB&B 6380a, Clinical Database Management Systems and Ontologies Kei-Hoi Cheung and George Hauser

This course introduces database and ontology in the clinical/public health domain. It reviews how data and information are generated in clinical/public health settings. It introduces different approaches to representing, modeling, managing, querying, and integrating clinical/public health data. In terms of database technologies, the course describes two main approaches—SQL database and non-SQL (NoSQL) database—and shows how these technologies can be used to build electronic health records (EHR), data repositories, and data warehouses. In terms of ontologies, it discusses how ontologies are used in connecting and integrating data with machine-readable knowledge. The course reviews the major theories, methods, and tools for the design and development of databases and ontologies. It also includes clinical/public health use cases demonstrating how databases and ontologies are used to support clinical/public health research.

CB&B 6470a / GENE 6450a, Statistical Methods in Human Genetics Hongyu Zhao

Probability modeling and statistical methodology for the analysis of human genetics data are presented. Topics include population genetics, single locus and polygenic inheritance, linkage analysis, quantitative trait analysis, association analysis, haplotype analysis, population structure, whole genome genotyping platforms, copy number variation, pathway analysis, and genetic risk prediction models. Offered every other year. Prerequisites: genetics; BIS 505; S&DS 541 or equivalent; or permission of the instructor.

CB&B 6550a / GENE 6550a, Stem Cells: Biology and Application In-Hyun Park

This course is designed for first-year or second-year students to learn the fundamentals of stem cell biology and to gain familiarity with current research in the field. The course is presented in a lecture and discussion format based on primary literature. Topics include stem cell concepts, methodologies for stem cell research, embryonic stem cells, adult stem cells, cloning and stem cell reprogramming, and clinical applications of stem cell research. Prerequisites: undergraduate-level cell biology, molecular biology, and genetics.

CB&B 6663b / AMTH 5520b / CPSC 5520b / GENE 6630b, Deep Learning Theory and Applications Smita Krishnaswamy

Deep neural networks have gained immense popularity within the past decade due to their success in many important machine-learning tasks such as image recognition, speech recognition, and natural language processing. This course provides a principled and hands-on approach to deep learning with neural networks. Students master the principles and practices underlying neural networks, including modern methods of deep learning, and apply deep learning methods to real-world problems including image recognition, natural language processing, and biomedical applications. Course work includes homework, a final exam, and a final project—either group or individual, depending on enrollment—with both a written and oral (i.e., presentation) component. The course assumes basic prior knowledge in linear algebra and probability. Prerequisites: CPSC 202 and knowledge of Python programming.

CB&B 7110a and CB&B 7120b and CB&B 7130b, Lab Rotations Steven Kleinstein
Three 2.5–3-month research rotations in faculty laboratories are required during the first year of graduate study. These rotations are arranged by each student with individual faculty members.

CB&B 7140a, Research Paper in Computational Biology and Biomedical Informatics Anthony Lisi and Hua Xu
This two-semester single credit pass/fail course must be completed as part of the terminal M. S. degree program in computational biology and biomedical informatics (CB&B). Students work with a faculty supervisor in designing their project and writing their research paper. The syllabus details the intended scope and process for writing the research paper. In the broadest terms, the research paper must be of publishable quality and defensible in a public scientific forum. The student's research supervisor is responsible for managing the intended product. The preferred format of the research paper for students is one that is in the style and length of a publishable, peer-reviewed paper, templated based on the journal submission. Prerequisite: second year enrollment in program.

CB&B 7400a, Introduction to Health Informatics Tsung-Ting Kuo and Andrew Loza
The course provides an introduction to clinical and translational informatics. Topics include (1) overview of biomedical informatics, (2) design, function, and evaluation of clinical information systems, (3) clinical decision-making and practice guidelines, (4) clinical decision support systems, (5) informatics support of clinical research, (6) privacy and confidentiality of clinical data, (7) standards, and (8) topics in translational bioinformatics. Permission of the instructor required.

CB&B 7520b / CPSC 7520b / MB&B 7520b / MB&B 753 / MB&B 754 / MCDB 7520b, Biomedical Data Science: Mining and Modeling Mark Gerstein and Matthew Simon
Biomedical data science encompasses the analysis of gene sequences, macromolecular structures, and functional genomics data on a large scale. It represents a major practical application for modern techniques in data mining and simulation. Specific topics to be covered include sequence alignment, large-scale processing, next-generation sequencing data, comparative genomics, phylogenetics, biological database design, geometric analysis of protein structure, molecular-dynamics simulation, biological networks, normalization of microarray data, mining of functional genomics data sets, and machine-learning approaches to data integration. Prerequisites: biochemistry and calculus, or permission of the instructor.

Computer Science

A.K. Watson Hall, 203.432.1246
http://cpsc.yale.edu
M.S., M.Phil., Ph.D.

Chair
Holly Rushmeier

Directors of Graduate Studies
Lin Zhong (lin.zhong@yale.edu)

Professors Dana Angluin (*Emerita*), James Aspnes, Dirk Bergemann,* Abhishek Bhattacharjee, Yang Cai, Ronald Coifman,* Aaron Dollar,* Julie Dorsey, Joan Feigenbaum, Michael Fischer, Robert Frank,* David Gelernter, Mark Gerstein,* Theodore Kim, John Lafferty,* Rajit Manohar,* Ruzica Piskac, Vladimir Rokhlin,† Holly Rushmeier, Brian Scassellati, Martin Schultz (*Emeritus*), Zhong Shao, Avi Silberschatz, Daniel Spielman,† Phillipp Strack,* Leandros Tassiulas,* Nisheeth Vishnoi, Y. Richard Yang, Lin Zhong, Steven Zucker†

Associate Professors Julian Jara-Ettinger,* Amin Karbasi,* Smita Krishnaswamy,† Charalampos Papamanthou, Robert Soulé

Assistant Professors Ian Abraham,* Kim Blenman,* Hoon Cho,* Arman Cohan, Yongshan Ding, Benjamin Fisch, Tesca Fitzgerald, Anurag Khandelwal, Alex Lew, Quanquan Liu, Tom McCoy,* Daniel Rakita, Katerina Sotiraki, David van Dijk,* Marynel Vázquez, Andre Wibisono, Alex Wong, Zhuoran Yang,* Zhitao Ying, Manolis Zampetakis, Fan Zhang

Senior Lecturers James Glenn, Scott Petersen, Michael Shah, Stephen Slade

Lecturers Timos Antonopoulos, Timothy Barron, Xiuye Chen, Ozan Erat, Harry Jain, Kyle Jensen,* Janet Kayfetz, Dylan McKay, Cody Murphey, Sohee Park, Brad Rosen, Alan Weide, Cecillia Xie

* A secondary appointment with primary affiliation in another department or school.

† A joint appointment with another department.

FIELDS OF STUDY

Algorithms and computational complexity, artificial intelligence, data networking, databases, graphics, machine learning, programming languages, robotics, scientific computing, security and privacy, and systems.

RESEARCH FACILITIES

The department operates a high-bandwidth, local-area computer network-based mainly on distributed workstations and servers with internet connections. Laboratories contain specialized equipment for graphics, robotics, systems, and vision research. Various printers, including color printers, as well as image scanners, are also available. The primary educational facility consists of a large cluster of personal computers. This facility is used for courses and unsponsored research by computer science majors and

first-year graduate students. Access to computing, through both the workstations and remote login facilities, is available to everyone in the department.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

There is no foreign language requirement. To be admitted to candidacy, a student must

1. pass ten courses (including CPSC 6900 and CPSC 6910) with at least two grades of Honors, the remainder at least High Pass, including three advanced courses in an area of specialization;
2. take six advanced courses in areas of general computer science;
3. successfully complete a research project in CPSC 6900, CPSC 6910, and submit a written report on it to the faculty;
4. pass a qualifying examination in an area of specialization;
5. be accepted as a thesis student by a regular department faculty member;
6. serve as a teaching assistant for two terms; and
7. submit a written dissertation prospectus, with a tentative title for the dissertation.

Grades of Pass will not count toward the Ph.D. To satisfy the distribution requirement (requirement 2 above), the student must take one course in programming languages or systems, one programming-intensive course, two theory courses, and two in application areas. In order to gain teaching experience, all graduate students are required to serve as teaching assistants for two terms during their first three years of study. All requirements for admission to candidacy must be completed prior to the end of the third year. In addition to all other requirements, students must successfully complete CPSC 9910, Ethical Conduct of Research, prior to the end of their first year of study. This requirement must be met prior to registering for the second year of study.

MASTER'S DEGREES

M.Phil. See Degree Requirements under Policies and Regulations.

M.S. (en route to the Ph.D.) To qualify for the M.S., the student must pass eight courses at the 5000 level or above from an approved list. An average grade of at least High Pass is required, with at least one grade of Honors.

Terminal Master's Degree Program Students may also be admitted to a terminal master's degree program directly. There are two options for the terminal master's degree:

- *Terminal Master's Degree Program (coursework-only option)* The requirements are the same as for the M.S. en route to the Ph.D. This program is normally completed in one year, but a part-time program may be spread over as many as four years.
- *Terminal Master's Degree Program (thesis option)* To qualify for the M.S. thesis option the student must (1) pass six courses at the 5000 level or above from an approved list with an average grade of at least High Pass and with at least one grade of Honors; (2) complete a research thesis, generally in the second year (in the event that the student fails to be accepted by a thesis adviser by the beginning of the second year, they may complete the M.S. degree by taking two approved courses in each term instead of one); and (3) serve as a teaching assistant for four terms. This program is normally completed in two years.

For additional information, visit http://cpsc.yale.edu or email cs-admissions@cs.yale.edu.

COURSES

CPSC 5130b, Computer System Security Timothy Barron
Overview of the principles and practice behind analyzing, designing, and implementing secure computer systems. The course covers problems that have continued to plague computer systems for years as well as recent events and research in this rapidly evolving field. Students learn to think from the perspective of an adversary, to understand systems well enough to see how their flaws could be exploited, and to consequently defend against such exploitation. The course offers opportunities for hands-on exploration of attacks and defenses in the contexts of web applications, networks, and system-level software. It also addresses ethical considerations and responsibilities associated with security research and practice.

CPSC 5150b, Law and Large Language Models Ruzica Piskac and Scott Shapiro
This course is intended for computer science and law students interested in how artificial intelligence can be applied to legal reasoning. It combines basic AI theory with practical project work, focusing on using tools like large language models (LLMs) and other AI technologies for tasks common in legal practice. Students learn how to automate case summarization, draft legal memos and briefs, simulate oral arguments for better argumentation skills, and assist in the preparation of pro-se motions for self-represented litigants. The course emphasizes hands-on experience, helping students build real-world skills in applying AI in legal settings. Our goal is to bring together students from computer science and from law and match them together in the teams. Each team works on a project that automates a specific aspect of the legal process or legal reasoning, focusing on practical, real-world applications. In addition to all standard course requirements, graduate students need to present a recent, relevant research paper in class. Prerequisites: basic coding skills, including knowledge of Python; interest in Large Language Models (LLMs); basic understanding of linear algebra and calculus; familiarity with basic probability (e.g., likelihood, averages) and simple statistical concepts (like mean and variance).

CPSC 5160a, Lattices and Post-Quantum Cryptography Katerina Sotiraki
This course explores the role of lattices in modern cryptography. In the last decades, novel computational problems, whose hardness is related to lattices, have been instrumental in cryptography by offering: (a) a basis for "post-quantum" cryptography, (b) cryptographic constructions based on worst-case hard problems, and (c) numerous celebrated cryptographic protocols unattainable from other cryptographic assumptions. This course covers the foundations of lattice-based cryptography from fundamental definitions to advanced cryptographic constructions. More precisely, we introduce the Learning with Error (LWE) and the Short Integer Solutions (SIS) problems and study their unique properties, such as the fact that their average-case hardness is based on the worst-case hardness of lattice problems. Next, we cover lattice constructions of advanced cryptographic primitives, such as fully homomorphic encryption and signature schemes. Finally, we introduce some notions of quantum cryptography and explore the role of lattices in this area. Overall, this course offers insights on the foundations and recent advancements in lattice-based cryptography. Prerequisites: CPSC 467/567 or equivalent and linear algebra.

CPSC 5190a or b, Full Stack Web Programming Alan Weide
This course introduces students to a variety of advanced software engineering and programming techniques in the context of full-stack web programming. The focus of the course includes both client- and server-side programming (and database programming), client/server communication, user interface programming, and parallel programming.

CPSC 5200b, Computer Architecture Abhishek Bhattacharjee
This course offers a treatment of computer architectures for high-performance and power/energy-efficient computer systems. Topics include the foundations of general-purpose computing, including instruction set architectures, pipelines, superscalar and out-of-order execution, speculation, support for precise exceptions, and simultaneous multi-threading. We also cover domain-specific hardware (e.g., graphics processing units), and ongoing industry efforts to elevate them to the status of first-class computing units. In tandem, we cover topics relevant to both general-purpose and domain-specific computing, including memory hierarchies, address translation and virtual memory, on-chip networks, machine learning techniques for resource management, and coherence techniques. If time permits, we study the basics of emerging non-classical computing paradigms like neuromorphic computing. Overall, this course offers insights on how the computing industry is combating the waning of traditional technology scaling via acceleration and heterogeneity. Prerequisites: Courses similar to CPSC 323, 223, and 202. This is a programming-intensive course, so comfort with large programming projects is essential.

CPSC 5210a, Compilers and Interpreters Zhong Shao
Compiler organization and implementation: lexical analysis, formal syntax specification, parsing techniques, execution environment, storage management, code generation and optimization, procedure linkage, and address binding. The effect of language-design decisions on compiler construction.

CPSC 5230b, Operating Systems Anurag Khandelwal
The design and implementation of operating systems. Topics include synchronization, deadlocks, process management, storage management, file systems, security, protection, and networking.

CPSC 5240b, Parallel Programming Techniques Quanquan Liu
Practical introduction to parallel programming, emphasizing techniques and algorithms suitable for scientific and engineering computations. Aspects of processor and machine architecture. Techniques such as multithreading, message passing, and data parallel computing using graphics processing units. Performance measurement, tuning, and debugging of parallel programs. Parallel file systems and I/O.

CPSC 5261a, Building AI Infra Systems Y. Richard Yang
This course covers the design, deployment, operations, and optimization of infrastructure systems that power large-scale modern AI systems such as large-language models (LLMs). It takes an all-resources view, considering AI infrastructure components spanning compute, memory, storage, network, data, and energy resources. Focusing on core AI infrastructure design goals including efficiency, scalability, and stability, the course studies not only the basic mechanisms but also the complete systems to realize the goals. Labs and a capstone project form the core of the

course. Prerequisite: CPSC 323, or an equivalent course in systems programming. A background in AI is highly recommended.

CPSC 5270a, C++ Programming for Stability, Security, and Speed Michael Fischer
Computer programming involves both abstraction and practice. Lower-level programming courses focus on learning how to correctly implement algorithms for carrying out a task. This course treats a computer program as an artifact with additional attributes of practical importance including execution efficiency, clarity and readability, redundancy, safety in the face of unexpected or malicious environments, and longevity—the ability to evolve over time as bugs are discovered and requirements change. This course is taught using modern C++.

CPSC 5310a, Computer Music: Algorithmic and Heuristic Composition Scott Petersen
Study of the theoretical and practical fundamentals of computer-generated music. Music and sound representations, acoustics and sound synthesis, scales and tuning systems, algorithmic and heuristic composition, and programming languages for computer music. Theoretical concepts are supplemented with pragmatic issues expressed in a high-level programming language.

CPSC 5320b, Computer Music: Sound Representation and Synthesis Scott Petersen
Study of the theoretical and practical fundamentals of computer-generated music, with a focus on low-level sound representation, acoustics and sound synthesis, scales and tuning systems, and programming languages for computer music generation. Theoretical concepts are supplemented with pragmatic issues expressed in a high-level programming language. Prerequisite: ability to read music.

CPSC 5330b, Computer Networks Y. Richard Yang
An introduction to the design, implementation, analysis, and evaluation of computer networks and their protocols. Topics include layered network architectures, applications, transport, congestion, routing, data link protocols, local area networks, performance analysis, multimedia networking, network security, and network management. Emphasis on protocols used in the Internet.

CPSC 5350b, Building an Internet Router Robert Soule
Over the course of the term, students build a fully functioning Internet router. Students design the control plane in Python on a Linux host and design the data plane in the new P4 language on the bmv2 software switch. To provide context and background for the design of their router, students read a selection of papers to get both a historical perspective and exposure to current research in networking. Prerequisite: CPSC 533.

CPSC 5370a, Database Systems Avi Silberschatz
An introduction to database systems. Data modeling. The relational model and the SQL query language. Relational database design, integrity constraints, functional dependencies, and natural forms. Object-oriented databases. Implementation of databases: file structures, indexing, query processing, transactions, concurrency control, recovery systems, and security.

CPSC 5380a, Big Data Systems: Trends and Challenges Anurag Khandelwal
Today's Internet-scale applications and cloud services generate massive amounts of data. At the same time, the availability of inexpensive storage has made it possible for these services and applications to collect and store every piece of data they generate, in the hopes of improving their services by analyzing the collected data. This introduces

interesting new opportunities and challenges designing systems for collecting, analyzing, and serving the so-called big data. This course looks at technology trends that have paved the way for big data applications, surveys state-of-the-art systems for storage and processing of big data, and considers future research directions driven by open research problems. Our discussions span topics such as cluster architecture, big data analytics stacks, scheduling and resource management, batch and stream analytics, graph processing, ML/AI frameworks, and serverless platforms and disaggregated architectures.

CPSC 5390a, Software Engineering Timos Antonopoulos
Introduction to building a large software system in a team. Learning how to collect requirements and write a specification. Project planning and system design. Increasing software reliability: debugging, automatic test generation. Introduction to type systems, static analysis, and model checking.

CPSC 5391b, Advanced Software Engineering Timos Antonopoulos
This course builds on CPSC 439/539, Software Engineering, with a focus on (a) building systems that scale well and (b) the technical infrastructure and approaches that would guide or inform entrepreneurship/business decisions. During the whole semester, teams work on a term-length software project of students' design, most often a continuation of the project they worked on during CPSC 439/539. There is an extra seminar for the graduate students, where they are assigned topics based on relevant recent research papers published at the top conferences. The topics closely correspond to the lectures covered in the course. The graduate students prepare twenty-minute presentations of those papers and present them in the class. Grading also reflects an expectation of additional sophistication. Prerequiste: After CPSC 539 or similar. Students have to have a working product they built during CPSC 539 or similar course to further develop during this course.

CPSC 5410a, Verifiable, Private, Decentralized Computing in the Age of AI Ben Fisch
You type your question into ChatGPT and get back a response. How do you trust its accuracy? Perhaps you have reviewed the latest published benchmark results for GPT-4, or trust that others have. But how do you know the response you are getting from OpenAI's servers is the true output of GPT-4? Perhaps due to a bug or system overload your question was handled by a weaker AI model. Or worse, perhaps the servers were hacked by someone maliciously giving you incorrect results. And, how do you trust that the sensitive questions you are sending to ChatGPT will not be leaked or used against you? This is a course in cryptographic proof systems. In the digital world today, we trust services to perform many kinds of computations on our data, from managing financial ledgers and databases to complex analytics, such as large-language model (LLM) inference. We trust these services not only to operate correctly, but also to keep our information private. Cryptographic systems allow us to remove this trust. A "succinct" cryptographic proof enables a service to attach a small certificate on the correctness of its computation which can be verified easily on a low-power device, even if the original computation was extremely complex. The proof of some ML computation that was run for hours on a GPU farm can fit in an email and take just milliseconds to verify on a mobile device! Beyond correctness, a "zero-knowledge" proof system enables us to prove knowledge of secret information, including hidden inputs to a computation that achieves a certain output. For instance, OpenAI could prove that the response is the true output of GPT-4 (a proprietary

model) without revealing sensitive details about the model itself. In industry, the market for cryptographic proofs is currently around $75 million and projected to reach $10 billion by 2030, according to some estimates. Cryptographic proofs have become the leading technology for scaling blockchains and achieving privacy in cryptocurrencies. Verifiable and zero-knowledge computing also create an important foundation for decentralizing AI services. Training and serving large models currently require vast resources, leading to centralization. Decentralized ML networks offer a compelling alternative—letting many independent operators contribute incremental work to the overall task using their own resources big or small, from a single GPU to a server cluster, and earn a share of the payments clients make to use the service. In such a setting it is critical to verify that operators contribute incremental work correctly. Or, they may use private data to jointly train an ML model. Succinct zero-knowledge proofs would enable these operators to prove correctness of their work without revealing sensitive data. We cover some of the other challenges and directions in decentralized model training and inference, such as reducing the amount of data that needs to be communicated between physically distributed islands of hardware and the potential role of reinforcement learning.

CPSC 5420a, Theory of Computation Dylan McKay
This course first introduces core, traditional ideas from the theory of computation with more modern ideas used in the process, including basic ideas of languages and automata. Building on the core ideas, the course then covers a breadth of topics in modular units, where each unit examines a new model and potentially a new perspective on computation. Topics may include: basic notions of Complexity Theory, provability and logic, circuits and non-uniform computation, randomized computation, quantum computation, query-based computation, notions of machine learning, compression, and algebraic models of computation. Additional topics might be introduced in lectures or student projects, according to student interests, including mechanism design, voting schemes, cryptography, biological computation, distributed computation, and pseudorandomness. Prerequisite: One of CPSC 365, 366, or 368 is required. This course is a proof-based theory course and mathematical maturity is expected.

CPSC 5440b, Real-World Cryptography Fan Zhang
Cryptography provides strong security and privacy guarantees in well-defined mathematical models, but applying it to real-world systems is an art—one that must account for performance, cost, evolving adversarial threats, and even user behavior. This course aims to impart the art of designing and applying cryptography in the real world, by examining select advanced cryptographic tools used in practice. Topics include secure channels, identity and credentials, anonymity, end-to-end encrypted messaging, and Trusted Execution Environments (TEEs). Graduate students undertake a semester-long research project and present at the end of the semester. Students are expected to be familiar with concepts in computer security and cryptography (e.g., from CPSC 4130, CPSC 4670, or similar courses). To set the stage, we go over the content of Katz and Lindell (https://www.cs.umd.edu/~jkatz/imc.html) in the first few lectures at a quick pace.

CPSC 5460a, Data and Information Visualization Holly Rushmeier
Visualization is a powerful tool for understanding data and concepts. This course provides an introduction to the concepts needed to build new visualization systems,

rather than to use existing visualization software. Major topics are abstracting visualization tasks, using visual channels, spatial arrangements of data, navigation in visualization systems, using multiple views, and filtering and aggregating data. Case studies to be considered include a wide range of visualization types and applications in humanities, engineering, science, and social science. Prerequisite: CPSC 223.

CPSC 5470a, Introduction to Quantum Computing Yongshan Ding
This course introduces the fundamental concepts in the theory and practice of quantum computing. Topics covered include information processing, quantum programming, quantum compilation, quantum algorithms, and error correction. The objective of the course is to engage students in applying fresh thinking to what computers can do. We establish an understanding of how quantum computers store and process data, and we discover how they differ from conventional digital computers. We anticipate this course will be of interest to students working in computer science, electrical engineering, physics, or mathematics. Students must be comfortable with programming, discrete probability, and linear algebra. Prior experience in quantum computing is useful but not required.

CPSC 5490b, Quantum Information Systems Yongshan Ding
Quantum information systems encompass the hardware, software, and networking systems that are designed to encode, store, process, and distribute quantum information. In this course, students get a complete view of such information systems and explore the current advancement associated with building practical quantum computers and networks. This course is structured as four modules: quantum information theory, quantum processor, quantum memory, and quantum network. Students are asked to read and discuss selected research papers. Prerequisite: CPSC 547, PHYS 345 or equivalent. This course is intended for advanced undergraduates who are familiar with basic quantum computation and information. We anticipate this course will be of interest to students working in computer science, electrical engineering, or physics.

CPSC 5510b, The User Interface David Gelernter
The user interface (UI) in the context of modern design, where tech has been a strong and consistent influence from the Bauhaus and U.S. industrial design of the 1920s and 1930s through the IBM-Eames design project of the 1950s to 1970s. The UI in the context of the windows-menus-mouse desktop, as developed by Alan Kay and Xerox in the 1970s and refined by Apple in the early 1980s. Students develop a detailed design and simple implementation for a UI.

CPSC 5520b / AMTH 5520b / CB&B 6663b / GENE 6630b, Deep Learning Theory and Applications Smita Krishnaswamy
Deep neural networks have gained immense popularity within the past decade due to their success in many important machine-learning tasks such as image recognition, speech recognition, and natural language processing. This course provides a principled and hands-on approach to deep learning with neural networks. Students master the principles and practices underlying neural networks, including modern methods of deep learning, and apply deep learning methods to real-world problems including image recognition, natural language processing, and biomedical applications. Course work includes homework, a final exam, and a final project—either group or individual, depending on enrollment—with both a written and oral (i.e., presentation) component.

The course assumes basic prior knowledge in linear algebra and probability. Prerequisites: CPSC 202 and knowledge of Python programming.

CPSC 5540a, Software Analysis and Verification Ruzica Piskac
Introduction to concepts, tools, and techniques used in the formal verification of software. State-of-the-art tools used for program verification; detailed insights into algorithms and paradigms on which those tools are based, including model checking, abstract interpretation, decision procedures, and SMT solvers.

CPSC 5550a, Algorithmic Game Theory Manolis Zampetakis
A mathematically rigorous investigation of the interplay of economic theory and computer science, with an emphasis on the relationship of incentive-compatibility and algorithmic efficiency. Particular attention to the formulation and solution of mechanism-design problems that are relevant to data networking and Internet-based commerce.

CPSC 5580b, Automated Decision Systems Stephen Slade
People make dozens of decisions every day in their personal and professional lives. What would it mean for you to trust a computer to make those decisions for you? It is likely that many of those decisions are already informed, mediated, or even made by computer systems. Explicit examples include dating sites like match.com or recommendation systems such as Amazon or Netflix. Most Internet ads on sites like Google or Facebook are run by real-time-bidding (RTB) systems that conduct split-second auctions in the hopes of getting your attention. Driverless cars offer the promise of safer highways. Corporations and other enterprises invest in decision support systems to improve the quality of their products and services. This course considers the spectrum of automated decision models and tools, examining their costs and effectiveness. Examples come from a variety of fields including finance, risk management, credit-card fraud, robotics, medicine, and politics.

CPSC 5590a, Building Interactive Machines Marynel Vazquez
This advanced course brings together methods from machine learning, computer vision, robotics, and human-computer interaction to enable interactive machines to perceive and act in a variety of environments. Part of the course examines approaches for perception with different sensing devices and algorithms; the other part focuses on methods for decision-making and applied machine learning for control. The course is a combination of lectures, state-of-the-art reading, presentations and discussions, programming assignments, and a final team project. Prerequisites: CPSC 570 and understanding of probability, differential calculus, linear algebra, and planning (in Artificial Intelligence). Programming assignments require proficiency in Python and high-level familiarity with C++. Students who do not fit this profile may be allowed to enroll with the permission of the instructor.

CPSC 5626a, Scalable and Private Graph Algorithms Quanquan Liu
What techniques can we use to deal with modern real-world data with billions of data points? How do we account for strong adversaries that violate the privacy of users providing this data? This course provides students with the knowledge to tackle research questions in these domains. We propose answers and techniques to these broad questions from an algorithmic standpoint, presenting foundational topics such as: (1) the parallel, distributed, and streaming models and algorithmic techniques commonly used within these models; (2) differential privacy and mechanisms for

private data analysis; and (3) implementation techniques, tools, and examples that demonstrate the practicality of these algorithms in real-world systems. This course focuses on advanced topics in practical graph algorithms with provable guarantees beyond the sequential model used in most introductory algorithms classes. Specific topics include local graph techniques for problems such as maximal matching, independent set, k-core decomposition, densest subgraphs, and coloring as well as global techniques for problems like connectivity, shortest paths, and spanners. Introductory lectures also feature techniques used beyond graph algorithms. Students are asked to read and present influential recent research papers on these topics. Papers come from prominent CS theory conferences such as STOC, FOCS, SODA as well as database and data mining conferences like VLDB, PODS, and WWW. In addition to these presentations, students also work on a final project which may be theoretical or implementation-based. The course also features voluntary open problem sections where we discuss (known) practice problems and open-ended research questions related to the topics in this course in a collaborative group setting.

CPSC 5630b / ECON 5565b, Algorithms via Convex Optimization Nisheeth Vishnoi
Convex optimization has played a major role in the recent development of fast algorithms for problems arising in areas such as theoretical computer science, discrete optimization, and machine learning. The approach is to first formulate the problem as a continuous (convex) optimization problem, even if the problem may be over a discrete domain, adapt or develop deterministic or randomized continuous-time dynamical systems to solve it, and then design algorithms for the problem via appropriate discretizations. The goal of this course is to design state-of-the-art algorithms for various classical discrete problems through the use of continuous optimization/sampling. The algorithmic applications include maximum flow in graphs, maximum matching in bipartite graphs, linear programming, submodular function minimization, and counting problems involving discrete objects such as matroids. We present approaches gradient descent, mirror descent, interior-point methods, and cutting plane methods. A solid background in calculus, linear algebra, and probability is recommended. It is intended for students who are comfortable with proofs.

CPSC 5640a, Algorithms and their Societal Implications Nisheeth Vishnoi
Today's society comprises humans living in an interconnected world that is intertwined with a variety of sensing, communicating, and computing devices. Human-generated data is being recorded at unprecedented rates and scales, and powerful AI and ML algorithms, which are capable of learning from such data, are increasingly controlling various aspects of modern society: from social interactions. These data-driven decision-making algorithms have a tremendous potential to change our lives for the better, but, via the ability to mimic and nudge human behavior, they also have the potential to be discriminatory, reinforce societal prejudices, violate privacy, polarize opinions, and influence democratic processes. Thus, designing effective tools to govern modern society which reinforce its cherished values such as equity, justice, democracy, health, privacy, etc. has become paramount and requires a foundational understanding of how humans, data, and algorithms interact. This course is for students who would like to understand and address some of the key challenges and emerging topics at the aforementioned interplay between computation and society. On the one hand, we study human decision-making processes and view them through the lens of computation, and on the other hand we study and address the limitations of artificial decision-making

algorithms when deployed in various societal contexts. The focus is on developing solutions through a combination of foundational work such as coming up with the right definitions, modeling, algorithms, and empirical evaluation. The current focus is on bias and privacy, with additional topics including robustness, polarization, and democratic representation. The grade will be based on class participation and a project. The project grade will be determined by a midterm and endterm report/presentation. The course has four primary modules: (1) Data: human-generated data; data collection and aggregation; (2) Decision-Making Algorithms: human decision-making algorithms; traditional algorithmic decision-making models and methods; machine learning-based decision-making models and methods; (3) Bias: socio-technical contexts and underlying computational problems; definitions of fairness; interventions for ensuring fairness; human biases through the lens of computation; privacy; need for definitions of privacy; differential privacy; beyond differential privacy; (4) Other topics: robustness; polarization; elections and social choice. Solid mathematical and programming background is necessary to enroll in this course. CPSC 365 and S&DS 251 are recommended.

CPSC 565ob, Theory of Distributed Systems James Aspnes
Models of asynchronous distributed computing systems. Fundamental concepts of concurrency and synchronization, communication, reliability, topological and geometric constraints, time and space complexity, and distributed algorithms.

CPSC 566ob, Web3, Blockchains, and Cryptocurrencies Ben Fisch
This course is an introduction to blockchain systems, such as Bitcoin and Ethereum. We begin with a brief history of blockchains and an overview of how they are being used today before launching into foundational topics, including distributed consensus, smart contracts, cryptographic building blocks from signatures to authenticated datastructures, and the economics of blockchains. We then cover advanced topics including the scalability and interoperability of blockchain systems and applications such as "decentralized finance" (DeFi). The lectures and assignments engage students in both theoretical and applied aspects of blockchain systems. The course assumes background in various fundamental areas of CS, including discrete math, probability, algorithms, data structures, cryptography, and networks.

CPSC 567oa, Introduction to Cryptography Charalampos Papamanthou
This course introduces modern symmetric and public-key cryptography as well as their broad applications, both from a theoretical and practical perspective. There is an initial emphasis on fundamental cryptographic primitives (e.g., block ciphers, pseudorandom functions, pseudorandom generators, one-way functions), their concrete efficiency and implementation, as well as their security definitions and proofs. Ways of combining such primitives that lead to more complex objects used to secure today's internet (e.g., via TLS), such as key exchange, randomized encryption, message authentication codes, and digital signatures are also studied. The last part of the course is devoted to modern and more advanced applications of cryptography (some of which are deployed at scale today), such as authenticated data structures, zero-knowledge proofs, oblivious RAM, private information retrieval, secret sharing, distributed consensus, and cryptocurrencies. (e.g, Bitcoin).

CPSC 5671b, Advanced Topics in Cryptography: Cryptography and Computation
Charalampos Papamanthou
Traditional cryptography is mostly concerned with studying the foundations of securing communication via, for example, encryption and message authentication codes. This class studies the applications of cryptography in securing *computation*. Topics include, but not limited to, fundamental results and most recent progress in oblivious computation and private information retrieval (PIR), zero-knowledge proofs, secure computation, consensus algorithms, searchable encryption, and lattice-based cryptography. The class focuses both on theory and applications. This is an advanced course, which requires mathematical maturity as well as comfort with programming. The course also assumes prior knowledge of fundamental notions in cryptography. Prerequisite: CPSC 4670 or equivalent.

CPSC 5680b, Computational Complexity Dylan McKay
Introduction to the theory of computational complexity. Basic complexity classes, including polynomial time, nondeterministic polynomial time, probabilistic polynomial time, polynomial space, logarithmic space, and nondeterministic logarithmic space. The roles of reductions, completeness, randomness, and interaction in the formal study of computation.

CPSC 5690a, Randomized Algorithms James Aspnes
Beginning with an introduction to tools from probability theory including some inequalities like Chernoff bounds, the course covers randomized algorithms from several areas: graph algorithms, algorithms in algebra, approximate counting, probabilistically checkable proofs, and matrix algorithms.

CPSC 5700a, Artificial Intelligence Tesca Fitzgerald
Introduction to artificial intelligence research, focusing on reasoning and perception. Topics include knowledge representation, predicate calculus, temporal reasoning, vision, robotics, planning, and learning.

CPSC 5710a, Trustworthy Deep Learning Rex Ying
In recent years, deep learning has seen applications in many fields, from science and technology, to finance, humanity, and businesses. However, real-world, high-impact machine learning applications demand more than just model performance. In particular, deep learning models are often required to be "trustworthy," so that domain experts can trust that the models consistently behave in a way that corresponds to their domain knowledge. For example, medical experts would expect a deep learning diagnosis model to be able to explicitly utilize medical domain knowledge in its prediction; an insurance company would expect a decision on insurance price to be explainable in terms of risk factors; a financial company would expect its fraud detection model to be robust to adversarial attacks; a physicist would expect models to provide consistency with the underlying laws. This course introduces various fields of trustworthy deep learning, including model robustness, defenses for adversarial attacks, interpretability, explainability, fairness, privacy, domain adaptation, rules, and constraints. The course covers some of these aspects in the context of graph neural networks but also covers many other ML models in general deep learning, natural language processing, and computer vision. Prerequisites: a course in linear algebra and multi-variable calculus and familiarity with PyTorch and other common Python

libraries such as Numpy, Sklearn. Deep learning courses such as CPSC 452 or 453 are recommended.

CPSC 5740a, Computational Intelligence for Games James Glenn
A seminar on current topics in computational intelligence for games, including developing agents for playing games, procedural content generation, and player modeling. Students read, present, and discuss recent papers and competitions, and complete a term-long project that applies some of the techniques discussed during the term to a game of their choice.

CPSC 5750a / ECE 5750a / INP 7575a, Computational Vision and Biological Perception Steven Zucker
An overview of computational vision with a biological emphasis. Suitable as an introduction to biological perception for computer science and engineering students, as well as an introduction to computational vision for mathematics, psychology, and physiology students.

CPSC 5770b, Natural Language Processing Arman Cohan
This course provides a deep dive into modern Natural Language Processing (NLP), with a strong focus on Language Modeling. The curriculum spans both foundational concepts and cutting-edge developments in the field. The course begins with core neural network concepts in NLP, covering word embeddings, sequence modeling, and attention mechanisms. Building on these foundations, we explore transformer architectures and their evolution, including early transformer language models like BERT, GPT and T5. The course examines how these models enable sophisticated language understanding and generation through pre-training and transfer learning. The latter portion covers contemporary advances: Large Language Models (LLMs), multi-modal integration, parameter-efficient fine-tuning, evaluation, multi-agent systems, reasoning, and model compression. We'll analyze the capabilities and limitations of current systems while discussing emerging research directions.

CPSC 5780b, Computer Graphics Theodore Kim
Introduction to the basic concepts of two- and three-dimensional computer graphics. Topics include affine and projective transformations, clipping and windowing, visual perception, scene modeling and animation, algorithms for visible surface determination, reflection models, illumination algorithms, and color theory.

CPSC 5790b, Advanced Topics in Computer Graphics Julie Dorsey
An in-depth study of advanced algorithms and systems for rendering, modeling, and animation in computer graphics. Topics vary and may include reflectance modeling, global illumination, subdivision surfaces, NURBS, physically based fluids systems, and character animation.

CPSC 5791a, Building Game Engines Michael Shah
This course teaches the fundamentals of building a reusable software architecture by building games. This is a programming-intensive course where the end product of this course is a data-driven game engine that students work in small teams to implement in a systems programming language (e.g. C, C++, D, etc.). Students apply data structures, algorithms, and systems programming skills in the domain of games. Discussion and implementation of the components of a game engine may include: resource management (allocators, resource managers, serialization), abstraction (design patterns, game objects, scripting, graphics layers), graphics management

algorithms (scene graphs, level of detail), physics (linear algebra, collision detection and resolution algorithms), artificial intelligence (e.g. pathfinding,decision making), and performance (concurrency, parallelism, math). Students work on a final course project for their portfolio. Prerequisite: previous experience with data structures and systems programming comparable to CPSC 223 and CPSC 323.

CPSC 5792b, Real-Time 3D Computer Graphics Programming Michael Shah
This course teaches the fundamentals of real-time 3D computer graphics programming using a systems programming language (e.g. C, C++, D, etc.). Students interested in making 3D games, virtual reality applications, simulations, medical visualizations, and other interactive applications are the target audience. Throughout the course students also learn about co-processors (e.g. GPUs) for hardware accelerated graphics, and program in a graphics API enabling hardware accelerated graphics. Students apply a sampling of mathematics in the domain of geometry, trigonometry, linear algebra, and calculus in order to generate photo and non-photorealistic images in real-time. Additional topics may include: geometry processing, scene organization, texturing techniques, advanced lighting techniques, compute shaders, and topics in performance.

CPSC 5800a, Introduction to Computer Vision Alex Wong
This course focuses on fundamental topics in computer vision. We begin with the image formation process and discuss the role of camera models and intrinsic calibration in perspective projection. Basic image processing techniques (i.e. filtering) is introduced. After which, we discuss techniques to describe an image, from edges to feature descriptors and methods to establish correspondences between different images of the same scene. The course additionally covers topics in recognition (i.e. image classification, segmentation, detection, etc.) and reconstruction (i.e. stereo, structure-from-motion, optical flow). Machine learning and deep learning based methods in a subset of the topics covered are also introduced. Students get hands-on experience in implementing the techniques covered in the class and applying them to real world datasets and applications. Students taking this course must have successfully passed courses in data structures and object-oriented programming (e.g. CPSC 223a or equivalent courses) and foundational mathematical tools such as discrete math and linear algebra (e.g. CPSC 202 or equivalent courses). It is recommended that students have taken or successfully passed calculus (e.g. MATH 112, MATH 115, MATH 120, or equivalent courses) and linear algebra (e.g. MATH 225, or equivalent courses). A background in statistics, machine learning and deep learning is useful but not required. Experience in programming with Python is preferable, as we use it for assignments and projects. Familiarity with Google Colab and numerical and image processing packages (i.e. NumPy, SciPy, and Sci-kit Image) is helpful throughout the course.

CPSC 5810b, Introduction to Machine Learning Alex Wong
This course focuses on fundamental topics in machine learning. We begin with an overview of different components of machine learning and types of learning paradigms. We introduce a linear function, discuss how one can train a linear function on a given dataset, and utilize it to tackle classification and regression problems. We then consider kernel methods to enable us to solve nonlinear problems. Additionally, we introduce the concept of generalization error and overfitting. We discuss the role of regularization and extend linear regression to ridge regression. We also cover topics in optimization, beginning from gradient descent and extending it to stochastic gradient descent and its momentum variant. We also cover the concept of alternating

optimization and topics within it. We introduce the curse of dimensionality and discuss topics on dimensionality reduction. Finally, we conclude the course with neural networks: how to build them using the topics discussed, how to optimize them, and how to apply them to solve a range of machine learning tasks. Prerequisites: Courses in data structures and object-oriented programming (e.g. CPSC 223a or equivalent courses), foundational mathematical tools such as discrete math and linear algebra (e.g. CPSC 202 or equivalent courses), calculus (e.g. MATH 112, MATH 115, MATH 120, or equivalent courses), linear algebra (e.g. MATH 225, or equivalent courses), and artificial intelligence (e.g. CPSC 370/570). A background in statistics is useful but not required. Experience in programming with Python and familiarity with Google Colab and numerical and image processing packages (i.e. NumPy, SciPy) is helpful.

CPSC 583ob, Deep Learning on Graph-Structured Data Rex Ying
Graph structure emerges in many important domain applications, including but not limited to computer vision, natural sciences, social networks, languages, and knowledge graphs. This course offers an introduction to deep learning algorithms applied to such graph-structured data. The first part of the course is an introduction to representation learning for graphs and covers common techniques in the field, including distributed node embeddings, graph neural networks, deep graph generative models, and non-Euclidean embeddings. The first part also touches upon topics of real-world significance, including auto-ML and explainability for graph learning. The second part of the course covers important applications of graph machine learning. We learn ways to model data as graphs and apply graph learning techniques to problems in domains including online recommender systems, knowledge graphs, biological networks, physical simulations and graph mining. The course covers many deep techniques (graph neural networks, graph deep generative models) catered to graph structures. We cover basic deep learning tutorials in this course. Knowledge of graphs as a data structure, and understanding of basic graph algorithms are essential for applying machine learning to graph-structured data. Familiarity with Python and important libraries such as Numpy and Pandas are helpful. A foundation of deep neural networks is highly recommended. Experience in machine Learning and Graph Theory are welcomed as well.

CPSC 584ob, Introduction to Human-Computer Interaction Marynel Vazquez
This course introduces students to the interdisciplinary field of human-computer interaction (HCI), with particular focus on human-robot interaction (HRI). The first part of the course covers principles and techniques in the design, development, and evaluation of interactive systems. It provides students with an introduction to UX design and user-centered research. The second part focuses on the emergent filed of HRI and several other nontraditional interfaces, e.g., AR/VR, tangibles, crowdsourcing. The course is organized as a series of lectures, presentations, a midterm exam, and a term-long group project on designing a new interactive system. Prerequisites: CPSC 201 and CPSC 202 or equivalents. Students who do not fit this profile may be allowed to enroll with permission of the instructor.

CPSC 585oa, Applied Planning and Optimization Daniel Rakita
This course introduces students to concepts, algorithms, and programming techniques pertaining to planning and optimization. At a high level, the course teaches students how to break down a particular problem into a state-space or a state-action space, how to select an effective planning or optimization algorithm given the problem at hand, and

how to ultimately apply the selected algorithm to achieve desired outputs. Concepts are solidified through grounded, real-world examples (particularly in robotics, but also including machine learning, graphics, biology, etc.). These examples come in the form of programming assignments, problem sets, and a final project. General topics include discrete planning, sampling-based path planning, optimization via matrix methods, linear programming, computational differentiation, non-linear optimization, and mixed integer programming. After the course, students are able to generalize their knowledge of planning and optimization to any problem domain. Knowledge of linear algebra and calculus is expected. Students should be familiar with matrix multiplication, derivatives, and gradients.

CPSC 586ob, Probabilistic Machine Learning Andre Wibisono
This course provides an overview of the probabilistic frameworks for machine learning applications. The course covers probabilistic generative models, learning and inference, algorithms for sampling, and a survey of generative diffusion models. This course studies the theoretical analysis of the problems and how to design algorithms to solve them. This course familiarizes students with techniques and results in literature and prepares them for research in machine learning. Prerequisites: Knowledge of machine learning, linear algebra, probability, and calculus.

CPSC 587ob, 3D Spatial Modeling and Computing Daniel Rakita
Several areas of computer science and related fields must model and compute how objects are situated in three-dimensional space over time, such as robotics, computer vision, computer graphics, computational physics, computational biology, aerospace engineering, and so on. This course teaches students how to computationally model the spatial configuration of and spatial relationships between objects over time. Topics covered include various methods for representing spatial configurations and transformations (such as transformation matrices, Euler angles, unit quaternions, dual quaternions, etc.), hierarchical chaining of spatial transformations, derivatives of spatial representations with respect to time, computing intersections and penetration depths between objects in space, interpolating over spatial representations (such as using splines), signal processing over spatial transformations, optimizing over spatial representations, and more. To develop these concepts rigorously, we draw from linear algebra, calculus, topology, Lie theory, and geometric algebra. Real-world examples from robotics, computer vision, and computer graphics are utilized to solidify these concepts, with programming assignments, problem sets, and a final project that allows students to apply what they have learned. Interactive visual aids created by the instructor are an integral part of lectures to help students connect mathematical concepts with spatial phenomena. Prerequisites: Undergraduate students should have taken CPSC 202 and CPSC 223. All students should have proficiency in programming with mathematical reasoning. A background in linear algebra and calculus is recommended but not required.

CPSC 589ob, Robot Learning Tesca Fitzgerald
This course explores methods for grounding machine learning algorithms in embodied, interactive robots. We cover topics including learning from demonstration, active learning, inverse reinforcement learning, representations for modeling high-level and low-level task information, and human factors for designing learning interactions. Students are asked to read and present research papers on these topics from top publication venues in AI, machine learning, robotics, and human-robot interaction.

Students also complete lab assignments in which they implement and evaluate state-of-the-art methods for interactive robot learning on a physical robot arm. Prerequisite: CPSC 370/470/570 or an equivalent AI course (requires approval by instructor). Recommended: an introductory machine-learning course such as S&DS 265 or CPSC 481.

CPSC 6110a, Topics in Computer Science and Global Affairs Joan Feigenbaum and Ted Wittenstein

This course focuses on "socio-technical" problems in computing and international relations. These are problems that cannot be solved through technological progress alone but rather require legal, political, or cultural progress as well. Examples include but are not limited to cyber espionage, disinformation, ransomware attacks, and intellectual-property theft. This course is offered jointly by the SEAS Computer Science Department and the Jackson School of Global Affairs. It is addressed to graduate students who are interested in socio-technical issues but whose undergraduate course work may not have addressed them; it is designed to bring these students rapidly to the point at which they can do research on socio-technical problems. Prerequisites: Basics of cryptography and computer security (as covered in Yale's CPSC 467), networks (as covered in Yale's CPSC 433), and databases (as covered in Yale's CPSC 437) helpful but not required.

CPSC 6120b, Topics in Algorithmic Game Theory Yang Cai

The course focuses on algorithms and the complexity of equilibrium computation as well as its connection with learning theory and optimization. As many recent machine learning approaches have moved from an optimization perspective to an "equilibration" perspective, where a good model is framed as the equilibrium of a game. The intersection of game theory, learning theory, and optimization is becoming increasingly relevant. The goal of the course is to cover the fundamentals and bring students to the frontier of this active research area. Prerequisites: A course in algorithms (CPSC 365 or 366) and a course in probability theory (MATH/S&DS 241). A course in algorithmic game theory (CPSC 455/555) is helpful but not required.

CPSC 6130a, Digital Identity Infrastructure Michael Fischer

A digital identity system establishes a connection between a real person and an internet platform such as an online banking site or a social media platform. Current digital identity systems utilize an ad hoc collection of password-based and multi-factor authentication methods. The inconsistency of these methods leads to user confusion, inconvenience, lack of interoperability, poor privacy properties, and degraded security. Data breaches, account takeovers, and privacy violations have become the norm. Efforts to combat these abuses have only been marginally effective. This course presents design principles for an internet-wide digital identity standard to ameliorate most of these problems. It is based on established principles of commerce and law from the non-digital world such as isolation of sensitive data, distributed trust, rules of evidence, and dispute-resolution procedures. A network of trusted agents maintain a distributed blockchain of transactions that provide evidence of authorization of internet transactions and assign responsibility for breaches of trust. Helpful but not required: basics of cryptography and computer security (as covered in Yale's CPSC 4670), distributed computing (as covered in Yale's CPSC 4650), and networks (as covered in Yale's CPSC 4330). Instructor permission required.

CPSC 6400b / AMTH 640b / MATH 6400b, Topics in Numerical Computation Vladimir Rokhlin
This course discusses several areas of numerical computing that often cause difficulties to non-numericists, from the ever-present issue of condition numbers and ill-posedness to the algorithms of numerical linear algebra to the reliability of numerical software. The course also provides a brief introduction to "fast" algorithms and their interactions with modern hardware environments. The course is addressed to Computer Science graduate students who do not necessarily specialize in numerical computation; it assumes the understanding of calculus and linear algebra and familiarity with (or willingness to learn) either C or FORTRAN. Its purpose is to prepare students for using elementary numerical techniques when and if the need arises.

CPSC 6440a / MATH 7440, Geometric and Topological Methods in Machine Learning Smita Krishnaswamy
This course provides an introduction to geometric and topological methods in data science. Our starting point is the manifold hypothesis: that high dimensional data live on or near a much lower dimensional smooth manifold. We introduce tools to study the geometric and topological properties of this manifold in order to reveal relevant features and organization of the data. Topics include: metric space structures, curvature, geodesics, diffusion maps, eigenmaps, geometric model spaces, gradient descent, data embeddings and projections, and topological data analysis (TDA) in the form of persistence homology and their associated "barcodes." We see applications of these methods in a variety of data types. Prerequisites: MATH 225 or 226; MATH 255 or 256; MATH 302 and CPSC 112. Students who completed MATH 231 or 250 may substitute another analysis course level 300 or above in place of MATH 302. Familiarity with algorithms/programming is beneficial.

CPSC 6900a, Independent Project I Lin Zhong
Independent Project I. By arrangement with faculty.

CPSC 6910a, Independent Project II Staff
By arrangement with faculty.

CPSC 6920a, Independent Project Staff
Individual research for students in the M.S. program. Requires a faculty supervisor and the permission of the director of graduate studies.

CPSC 6930a, MS Thesis Research I Holly Rushmeier
First term of thesis research for students in the two-year MS program in Computer Science None

CPSC 6940a, MS Thesis Research II Holly Rushmeier
Second term of thesis research for students in the two-year MS program in Computer Science.

CPSC 7520b / CB&B 7520b / MB&B 7520b / MB&B 753 / MB&B 754 / MCDB 7520b, Biomedical Data Science: Mining and Modeling Mark Gerstein and Matthew Simon
Biomedical data science encompasses the analysis of gene sequences, macromolecular structures, and functional genomics data on a large scale. It represents a major practical application for modern techniques in data mining and simulation. Specific topics to be covered include sequence alignment, large-scale processing, next-generation sequencing data, comparative genomics, phylogenetics, biological database design,

geometric analysis of protein structure, molecular-dynamics simulation, biological networks, normalization of microarray data, mining of functional genomics data sets, and machine-learning approaches to data integration. Prerequisites: biochemistry and calculus, or permission of the instructor.

CPSC 7760b, Topics in Industrial AI Applications Xiuye (Sue) Chen
This seminar aims to familiarize students with cutting-edge topics in industrial AI research and their practical applications. We will explore a broad range of topics such as large language models, image generation, ML/AI systems considerations, autonomous vehicles, robotics, recommender systems, ambient intelligence, and AI applications in the life sciences and healthcare. Most sessions will be devoted to in-depth discussions of one to two key papers on modern AI applications. We will also feature a series of industry guest speakers, providing students with the opportunity to learn directly from practicing experts. In this seminar, students are expected to present papers, actively participate in class discussions, and work either individually or in groups on a final project that emphasizes the practical implementation of AI techniques. Students should be familiar enough with ML/AI concepts to read academic papers, and comfortable with programming to run open source code in the ML/AI space.

CPSC 9900a, Ethical Conduct of Research for Master's Students Yoehan Oh
This course forms a vital part of research ethics training, aiming to instill moral research codes in graduate students of computer science, math, and applied math. By devling into case studies and real-life examples related to research misconduct, students will grasp core ethical principles in research and academia. The course also offers an opportunity to explore the societal impacts of research in computer science, math, and applied math. This course is designed specifically for first-year graduate students in computer science/applied math/math. Successful completion of the course necessitates in-person attendance on eight occasions; virtual participation will not fulfill this requirement. In cases where illness, job interviews, or unforeseen circumstances prevent attendance, makeup sessions will be offered. This course is 0 credits for YC students. 0 Course cr

CPSC 9910a / MATH 9910a, Ethical Conduct of Research Yoehan Oh
This course forms a vital part of research ethics training, aiming to instill moral research codes in graduate students of computer science, math, and applied math. By delving into case studies and real-life examples related to research misconduct, students grasp core ethical principles in research and academia. The course also offers an opportunity to explore the societal impacts of research in computer science, math, and applied math. This course is designed specifically for first-year graduate students in computer science, applied math, and math. Successful completion of the course necessitates in-person attendance on eight occasions; virtual participation does not fulfill this requirement. In cases where illness, job interviews, or unforeseen circumstances prevent attendance, makeup sessions are offered. 0 Course cr

CPSC 9920a or b, Academic Writing Staff
This course is an intensive analysis of the principles of excellent writing for Ph.D. students and scientists preparing a range of texts including research papers, conference posters, technical reports, research statements, grant proposals, correspondence, science and industry blogs, and other relevant documents. We look at the components of rhetorical positioning in the development of a clear, interesting, and rigorous science research paper. Some of the sub-genres we analyze and practice include the

introduction, literature review, methodology, data commentary, results/discussion, conclusion, and abstract. In addition to the research paper, we practice other types of texts including research statements, requests for funding, bio-data statements, and blogs. We also discuss how writers can develop content and fluency as well as strategies for redrafting and editing. Students receive detailed feedback on their writing with a focus on clarity, precision, tone, and readability. o Course cr

Early Modern Studies

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Director of Graduate Studies
Erika Valdivieso

Affiliated Faculty Marisa Bass, Lauren Benton, Paola Bertucci, Dominique Brancher, Paul Bushkovitch, Rudiger Campe, Allison Caplan, Edward Cooke, Ivano Dal Prete, Michael Della Rocca, Fabian Drixler, Claudia Dumitru, Maura Dykstra, Carlos Eire, Paul Freedman, Supriya Gandhi, Alessandro Giammei, Bruce Gordon, Samuel Hodgkin, K. David Jackson, Nicholas Jones, Christina Kraus, Noel Lenski, Volker Leppin, Tina Lu, Alan Mikhail, Jane Mikkelson, Feisal Mohammed, Isaac Nakhimovsky, Morgan Ng, Catherine Nicholson, Catalina Ospina, Jessica Peritz, Mark Peterson, Ayesha Ramachandran, Kishwar Rizvi, Pierre Saint-Amand, Stuart Schwartz, Nicole Sheriko, Nicola Suthor, Shawkat Toorawa, Katie Trumpener, Jane Tylus, Erika Valdivieso, Jesús Velasco, Lisa Voigt, Mimi Yiengpruksawan

FIELDS OF STUDY

Early Modern Studies offers a combined Ph.D. degree that integrates concentration in a partner department with interdisciplinary study of the historical period between 1350 and 1800, a temporal range that recognizes "early modernity" as manifested differently and at different times across the world. The program's scope is global, transnational, transcultural, and committed to a vision of an interlinked world with many, varied, locally-inflected transitions to modernity. Inclusive in scholarship and teaching, the combined degree encourages students to forge connections to diverse disciplinary frameworks, geographic conjunctures, and institutional structures. Current partner departments are: Classics, Comparative Literature, English Language and Literature, French, Germanic Languages and Literatures, History, History of Science and Medicine, History of Art, Music, Italian Studies, Near Eastern Languages and Literatures, and Spanish and Portuguese.

Admissions This is a combined degree program. Students must first apply to the doctoral program of one of the partner departments; if accepted, they can then apply to the Program in Early Modern Studies during their second term of graduate study at Yale. Admission to the combined degree in early modern studies thus occurs after the student has already matriculated in the graduate school. Upon acceptance to the combined degree, students are normally enrolled as such from their second year of graduate study.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Students are subject to the combined Ph.D. supervision of the Early Modern Studies program and the relevant partner department. The student's course of study is decided in consultation with an adviser, the director of graduate studies (DGS) in early modern studies, and the DGS in the partner department.

As detailed below, requirements for the combined degree vary slightly to accommodate the requirements of the individual partner departments, but all candidates for the combined degree are expected to meet the following requirements:

Timing and Completion of Courses The total number of courses for the combined degree in Early Modern Studies remains the same as that of the partner department's Ph.D. program. Students in the combined degree have the option of taking some of their coursework in their third year in the program. Within that scope, students must incorporate the courses listed below:

1. EMST 7000, Workshop in Early Modern Studies: This one-semester seminar, taken in the first term of the combined degree, provides an introduction to key questions in the field of early modern studies. The workshop includes extensive discussion of revising writing for publication, peer review, and a series of guest presentations from faculty affiliated with the program.
2. EMST 8000, EMST 8001, Early Modern Colloquium: Taken as two half-credit courses in the second and third term of the combined degree. Students attend regular research presentations by scholars within and beyond Yale. This course does not count towards the total number of courses required for the Ph.D. by the partner department.
3. Three elective courses in early modern studies of which at least *one* course must be taken outside the student's primary department. One of the courses may be an interdisciplinary course (i.e. a relevant course in the sciences, social sciences, or other relevant topic outside the traditional humanities).
4. EMST 9000, Professional Skills Workshop for Early Modern Studies: This course is taken in the student's fourth term of the combined degree as a one-semester course designed to support students as they begin to form their dissertation projects. Skills covered include abstract writing, preparing fellowship applications, interviewing, and presenting, with a focus on how to communicate the contribution of an interdisciplinary dissertation project to a range of audiences. This funded workshop also culminates in a conference and offers each student the opportunity to invite one scholar to campus from outside Yale for one-on-one mentoring on their developing research and career goals.

In general, it is expected that courses in early modern studies constitute about one-third of the student's doctoral coursework. We expect that most students in the combined degree will take more courses in the field as relevant to their specific area of research specialization.

Language Requirement The language requirement follows the student's primary department requirements. However, students in the combined degree have flexibility with regard to the completion of language requirements, in negotiation with the partner department.

Qualifying Exams Qualifying exams will follow the student's primary department; however, a significant portion of the student's exam lists must be on early modern topics. See guidelines for individual partner departments below.

Prospectus and Admission to Candidacy Procedures for the submission and approval of prospectuses follow the student's primary department; at least one faculty member

affiliated with the Program in Early Modern Studies must be on the committee. Upon completion of all predissertation requirements, including the prospectus, students are admitted to candidacy for the combined Ph.D. degree. Admission to candidacy must be completed by the beginning of the fourth year.

Dissertation The parameters for the dissertation will follow the student's primary department. At least one faculty member affiliated with the Program in Early Modern Studies must be on the committee. Students in the joint degree are also generally encouraged to have at least one faculty adviser outside their home department.

Teaching Student's teaching assignments will primarily be determined by the home department. However, all students in the combined degree will be permitted additional flexibility in the completion of teaching requirements: students may complete their required four terms of teaching in years two, three, or four of their graduate program. In addition, students will typically assist in the teaching of *at least one* course in early modern studies. A Graduate Professional Development Opportunity in a relevant area (museums, libraries, collections, etc.) may be substituted for this requirement.

SPECIFIC REQUIREMENTS BY PARTNER DEPARTMENT

Details for the combined degree with specific affiliate departments are listed below.

Classics

Students are admitted to the Classics department first, and then apply during the second term of graduate study to participate in the Combined Program in Classics and Early Modern Studies.

REQUIREMENTS FOR THE PH.D. IN CLASSICS AND EARLY MODERN STUDIES

1. Practice translation tests in Greek and Latin on texts assigned from the classical philology reading lists; these are taken before the beginning of the first and third terms and are meant to help students prepare for the qualifying translation exams to be taken before the beginning of the fifth term in the program (7. below).
2. A proseminar offering an introduction to the discipline of classics and its various subdisciplines, to be taken in the first year in residence (not for credit).
3. Departmental reading examinations in French (or Italian) and German, or approved Yale courses or examinations that demonstrate reading proficiency in these languages (e.g., by achieving a grade of A in French/German/Italian for Reading Knowledge or by passing proficiency exams administered by Yale's modern language departments). The department will also accept certain certificates of proficiency in French, German, or Italian in lieu of these exams, as listed in the Classics *Graduate Handbook*. The first (in either language) is to be passed by the end of the first year; the other may be passed at any time before submission of the dissertation; students are, however, encouraged to complete this requirement as early in the program as possible.
4. A minimum of twelve term courses, with the following stipulations:

   (a) two yearlong survey courses in the history of Greek and Latin literature (four courses in total);

   (b) four courses prescribed by Early Modern Studies, including EMST 7000 which counts for a single course;

(c) four other graduate courses in CLSS. In addition, EMST 8000 (Early Modern Colloquium) must be taken in the second and third terms in the program and EMST 9000 (the prospectus workshop) in the fourth term in the program. Neither of these two courses (EMST 8000 and EMST 9000) count towards the minimum course requirement; and

(d) one course from a selection of philologically oriented options, e.g., Greek and/or Latin language (currently GREK 5995 and LATN 5995), palaeography, papyrology, epigraphy, historical linguistics; (e) one further course at the 6000, 7000, or 8000 level.

5. Oral examinations in Greek and Latin literature, based on the syllabus covered by the survey courses, drawn from the classical philology Ph.D. reading list. These are to be taken closely following the surveys in the respective literatures, as follows: the first, at the end of the second term (May of the first year), the second at the end of the fourth term (May of the second year).
6. Translation examinations in Greek and Latin, based on the classical philology Ph.D. reading list, by the beginning of the fifth term in residence.
7. Four special field exams to be taken in the fall of the third year (fifth term in residence); two of these must be at least partly in a classical field and two must be at least partly in an early modern field.
8. A dissertation prospectus by the end of the sixth term in residence. The procedures for approval of the prospectus are as for the philology program, but at least one member of the EMST faculty, as approved by the DGS in Early Modern Studies, must be on the prospectus approval committee (which is a committee of the whole in Classics); the prospective thesis committee, the DGS, and the EMST faculty member must approve of the prospectus.
9. A dissertation. Once dissertation writing has begun, students will present work in progress from the dissertation at least once per academic year. Research presentations will normally take the form of pre-circulation of a selection of work from the dissertation and a discussion of it with interested faculty, or some other research presentation experience approved by the DGS. This is a requirement for remaining in good standing; exemptions from it require the support of the dissertation adviser and the approval of the graduate committee.

Comparative Literature

Coursework Students are required to complete fourteen term courses, at least seven of these (including CPLT 5150, Proseminar in Comparative Literature) in the Department of Comparative Literature. Students must take at least four courses in early modern studies (offered in several departments), including the core seminar (EMST 7000); at least one of these courses must be taken outside Comparative Literature. At least three of a student's overall list of courses must be in literary theory, criticism, or methodology; at least one course each in poetry, narrative fiction, and drama; and at least one course each in ancient or medieval literature and Enlightenment or modern literature. These requirements can overlap with the requirements of the Early Modern Studies program. At least two courses must be completed with the grade of Honors. In general, students should take a wide range of courses with a focus on one or two national or language-based literatures.

Languages Students must demonstrate proficiency in three languages apart from English, one of which must fulfill the philological requirement in Comparative Literature. The languages chosen should be relevance to the student's chosen area of research and should be determined in consultation with the DGSs in Comparative Literature and Early Modern Studies.

Orals Qualifying exams follow the format in Comparative Literature; however, a significant portion of the student's exam lists must be on early modern topics. The exact number will be determined in consultation with the DGSs in Comparative Literature and Early Modern Studies.

Prospectus and Dissertation The prospectus should be completed in September of the fourth year. Procedures regarding the dissertation will follow departmental practice, however at least one member of the dissertation committee must be an affiliate of the Program in Early Modern Studies.

English Language and Literature

Doctoral students in English Language and Literature may apply in the second term of graduate study to the Program in Early Modern Studies, to pursue a combined Ph.D. degree in English and early modern studies. All requirements for the Ph.D. in English apply, with the following adjustments.

Coursework In years one and two, a student in the combined program will complete ten seminars in English, including ENGL 9090, The Teaching of English, two courses on early modern texts and/or topics, one course in each of two out of three additional historical periods (medieval, eighteenth- and/or nineteenth- century, twentieth- and/or twenty-first century), and two seminars in early modern studies, including EMST 7000, Workshop in Early Modern Studies, and one seminar outside of English. Students also participate in EMST 8000/EMST 8001, Early Modern Studies Colloquium.

Qualifying Examination Students will follow the usual procedures for oral qualifying exams in English, with the additional requirement that at least two of their four lists must concentrate on early modern texts and topics.

Prospectus In addition to enrolling in ENGL 9093, the English Department Prospectus Workshop, in fall, third-year students in the combined program will enroll in EMST 9000.

Dissertation Committee At least one faculty member affiliated with the Program in Early Modern Studies must be on the committee. The chair of the committee will be from the English Department, but students in the combined program are encouraged to include at least one faculty member from outside of English on their committees.

French

Students are admitted to the Department of French first and then apply during the second term of the first year to participate in the combined program.

Coursework Fourteen courses at the graduate level are required. These correspond to the requirements of the Department of French and those of the Early Modern Studies Program. Of the courses taken in French, one must be FREN 6100,

Introduction to Old French. Three others (elective) must fall within early modern periods (1350 to 1800) including one course outside of the department (History, History of Art, Music, Religious Studies, Philosophy, etc.). There are three required early modern studies courses: EMST 7000, Workshop in Early Modern Studies; EMST 8000/EMST 8001, Early Modern Colloquium; and EMST 9000, a professional skills workshop to be taken in the third year.

Languages Two languages appropriate to the field are required and can be satisfied in the variety of ways presented in the Department of French Rules and Regulations and following the timeline outlined in the document.

Qualifying Examination An oral qualifying examination must take place as early as possible in the third year of study, before spring recess at the latest. The examination will consist of five topics; at least three must be in the early modern field.

Dissertation A formal prospectus is to be presented by the end of the sixth term (third year) of study. The prospectus committee will consist of three faculty members, including the dissertation director(s) and at least one member in the field outside of French. Once approved by the committee, the prospectus will be submitted to the graduate faculty of the Department of French for a vote on final approval and advancement to candidacy. More than one dissertation adviser is permitted and indeed encouraged, but the principal adviser will normally be in the Department of French. The official readers of the finished dissertation need not be members of the original prospectus committee but will include at least one member of the Department of French and one member of EMST.

Germanic Languages and Literatures

Coursework The required number of courses and timeline for coursework follows the Department of Germanic Languages and Literature guidelines. Students also enroll in EMST 7000 and EMST 8000/EMST 8001, and they enroll in EMST 9000 during the spring of year three. These courses do not count towards the total number of courses required for the Ph.D. in Germanic languages and literature.

Language Requirement The language requirement follows the Germanic Languages and Literature department requirements.

Qualifying Examination Qualifying exams follow the Department of Germanic Languages and Literature requirements with the added requirement that two out of the four exam fields must be on early modern topics.

Dissertation At least one faculty member affiliated with the Program in Early Modern Studies must be on the dissertation committee.

Teaching A student's teaching assignments are determined by the Department of Germanic Languages and Literature, with every effort made to assign a student to at least one course (or course equivalent) in early modern studies.

History

Coursework The required number of courses and timeline for coursework follows the Department of History guidelines for history students in the combined program. In general, it is expected that courses in early modern studies constitute about one-

third of the student's doctoral coursework, and at least one course with an early modern focus must be taken outside the student's primary department. Students will also enroll in EMST 7000 and EMST 8000/EMST 8001, neither of which count towards the total number of courses required for the Ph.D. in history. In the spring of third year, students in the Department of History are also encouraged, but not required, to enroll in EMST 9000.

Advising A student's academic adviser is a member in the Department of History. A student may also choose to have as co-adviser a faculty member affiliated with the Program in Early Modern Studies who is not affiliated with History.

Language Requirement The language requirement follows the Department of History requirements.

Qualifying Exams Qualifying exams will follow the Department of History requirements with one added requirement that at least half the exam content must be about early modern subjects (the equivalent of one and a half fields if the student completes three fields, two fields if the student completes four fields).

Prospectus and Admission to Candidacy Procedures for the prospectus follow Department of History guidelines. At least one faculty member affiliated with the Program in Early Modern Studies must be on the committee. Upon completion of all predissertation requirements, including the prospectus, students are admitted to candidacy for the combined Ph.D. degree.

Dissertation At least one faculty member affiliated with the Program in Early Modern Studies must be on the dissertation committee.

Teaching A student's teaching assignments are determined by the Department of History, with every effort made to assign a student to at least one course (or course equivalent) in early modern studies.

History of Art

Doctoral students in the history of art may apply in the second term of graduate study to the Program in Early Modern Studies to pursue a combined Ph.D. degree in the history of art and early modern studies. All requirements for the Ph.D. in the history of art apply, with the following adjustments.

Coursework History of art students in the combined program take the same number of courses as those on the regular history of art track. In years one and two, a student in the combined program completes ten seminars in the history of art, including HSAR 5500, the First Year Colloquium, and three seminars on early modern topics, as well as EMST 7000, Workshop in Early Modern Studies. Students also participate in EMST 8000/EMST 8001, Early Modern Studies Colloquium.

Second-Year Paper Requirement The qualifying paper is to be submitted for consideration according to the policies of the Department of the History of Art, typically in the second term of the second year.

Languages The language requirement will follow the Department of History of Art requirements.

Qualifying Examination Students will follow the usual procedures for oral qualifying exams in history of art, with the additional requirement that three of their four lists must concentrate on early modern texts and topics (between 1350 and 1800).

Prospectus Students in the combined program enroll in EMST 9000, the Early Modern Studies Professional Skills Workshop, during the spring of their third year in support of their development of the dissertation prospectus.

Dissertation Committee At least one faculty member affiliated with the Program in Early Modern Studies must be on the committee. The chair of the committee will be in the History of Art, but students in the combined program are encouraged to include at least one faculty member from outside of History of Art on their committees.

History of Science and Medicine

Admission to the HSHM/EMST is a competitive process. HSHM Ph.D. students who wish to enroll in the Program in Early Modern Studies apply during their second term at Yale. They need their adviser's approval and a letter of support from the HSHM DGS.

REQUIREMENTS FOR THE HSHM/EMST PH.D. DEGREE

1. In addition to fulfilling the HSHM requirements as specified in this bulletin, students in the combined program will take:
   a. EMST 7000, Workshop in Early Modern Studies
   b. EMST 8000/EMST 8001, Early Modern Colloquium
   c. Three elective courses in early modern studies, of which at least one course must be taken outside the student's primary department. One of the courses may be an interdisciplinary course (i.e., a relevant course in the sciences or social sciences or other relevant topic outside the traditional humanities). These three courses can count toward the HSHM requirements, whether as electives or HSHM seminars.
   d. EMST 9000, Professional Skills Workshop for Early Modern Studies
2. Other EMST Requirements:
   a. *Language Requirement*: same as HSHM language requirements
   b. *Qualifying Exams*: Qualifying exams will follow the student's primary department. A significant portion of the student's exam lists must be on early modern topics.
   c. *Prospectus and Admission to Candidacy*: At least one faculty member affiliated with the Program in Early Modern Studies must be on the committee
   d. *Dissertation*: At least one faculty member affiliated with the EMST Program must be on the committee.
   e. *Teaching*: Student's teaching assignments will primarily be determined by the home department. However, all students in the combined degree will be permitted additional flexibility in the completion of teaching requirements: students may complete their required four terms of teaching in years two, three, or four of their graduate program. In addition, students will typically assist in the teaching of *at least one course* in early modern studies.

Italian Studies

Coursework The required number of courses and timeline for coursework follows the Department of Italian Studies guidelines. Of the required courses taking for Italian studies, two must fall within the early modern period (1350–1800), and students are also encouraged to take an additional course toward the departmental requirements in another field (e.g history, history of art, music, religious studies, philosophy, etc.). Students also enroll in EMST 7000 and EMST 8000/EMST 8001, neither of which count towards the total number of courses required for the Ph.D. in Italian studies. In the spring of year three, Italian studies students are strongly encouraged to participate in EMST 9000.

Language Requirement The language requirement follows the Department of Italian Studies requirements.

Qualifying Examination Qualifying exams follow the Department of Italian Studies requirements with one added requirement that two out of the three exam fields must be on early modern topics.

Dissertation At least one faculty member affiliated with the Program in Early Modern Studies must be on the dissertation committee.

Teaching A student's teaching assignments are determined by the Department of Italian Studies, with every effort made to assign a student to at least one course (or course equivalent) in early modern studies.

Music

Coursework The required number of courses and timeline for coursework follows Department of Music guidelines for students in the combined program. In general, it is expected that courses in early modern studies constitute about one-third of the student's doctoral coursework, and at least *one* course with an early modern focus must be taken outside the student's primary department.

Students will also enroll in the following three courses: EMST 7000 (Workshop in Early Modern Studies), EMST 8000/EMST 8001 (Early Modern Colloquium), and EMST 9000 (Professional Skills Workshop). These courses are all graded SAT/UNSAT and do not count toward the total number of courses required for the Ph.D. in music.

Advising A student's academic adviser will be a member in the Department of Music. A student may also choose to have as coadviser a faculty member affiliated with the Program in Early Modern Studies who is not affiliated with Music.

Qualifying Exams One of the two qualifying exams required by the department must be on an early modern topic.

Prospectus and Admission to Candidacy Procedures for the prospectus will follow Department of Music guidelines. At least one faculty member affiliated with the Program in Early Modern Studies must be on the committee. Upon completion of all predissertation requirements, including the prospectus, students are admitted to candidacy for the combined Ph.D. degree.

Dissertation At least one faculty member affiliated with the Program in Early Modern Studies must be on the dissertation committee.

Teaching A student's teaching assignments will be determined by Music, with every effort made to assign a student to *at least one course* (or course equivalent) in early modern studies.

Near Eastern Languages and Literatures

Coursework The required number of courses and timeline for coursework follows the Department of Near Eastern Languages and Civilizations (NELC) guidelines. Students also enroll in EMST 7000 and EMST 8000/EMST 8001 and in EMST 9000. These courses do not count towards the total number of courses required for the Ph.D. in NELC.

Advising A student's academic adviser will be a member in NELC. A student may also choose to have as coadviser a faculty member affiliated with the Program in Early Modern Studies who is not affiliated with NELC.

Language Requirement The language requirement follows the NELC department requirements.

Qualifying Examination Qualifying exams follow the NELC department requirements for the Arabic humanities track, with the added requirement that one of the fields be focused on an early modern topic.

Dissertation At least one faculty member affiliated with the Program in Early Modern Studies must be on the dissertation committee.

Teaching A student's teaching assignments are determined by NELC, with every effort made to assign a student to at least one course (or course equivalent) in early modern studies.

Philosophy

Coursework The required number of courses and timeline for course work follows Department of Philosophy guidelines for students in the philosophy Ph.D. program. Out of those twelve required courses, it is expected that students in the combined program take *four* early modern courses, and at least *one* of those four courses must be taken outside the student's primary department.

Students will enroll in the following three EMST courses, none of which count towards the total number of courses required for the Ph.D. in philosophy: EMST 7000 (Workshop in Early Modern Studies), EMST 8000/EMST 8001 (Early Modern Colloquium), and EMST 9000 (Professional Skills Workshop).

Advising A student's academic adviser will be a member in the Department of Philosophy.

Qualifying Papers Students in the Department of Philosophy are required to write their "history" QP on an early modern topic.

Prospectus and Admission to Candidacy Procedures for the prospectus will follow Department of Philosophy guidelines. At least one faculty member affiliated with the

Program in Early Modern Studies must be on the committee. Upon completion of all predissertation requirements, including the prospectus, students are admitted to candidacy for the combined Ph.D. degree.

Dissertation At least one faculty member affiliated with the Program in Early Modern Studies must be on the dissertation committee.

Teaching A student's teaching assignments will be determined by the Department of Philosophy, with every effort made to assign a student to *at least one course* (or course equivalent) in early modern studies.

Spanish and Portuguese

Coursework Students must take fourteen elective seminars at the graduate level, with up to four outside the department. Of the courses taken in Spanish and Portuguese, one must be SPAN 5000, Principles of Language Teaching and Learning. Four others (electives) must fall within the early modern period, and at least one of those four electives must be a course outside the department.

Students will also enroll in the following three EMST courses, none of which count towards the total number of courses required for the Ph.D. in Spanish and Portuguese: EMST 7000 (Workshop in Early Modern Studies), EMST 8000/EMST 8001 (Early Modern Colloquium), and EMST 9000 (Professional Skills Workshop).

Language Requirement The language requirement will follow that of the Department of Spanish and Portuguese.

Qualifying Examination The qualifying exams will follow the Department of Spanish and Portuguese requirements with one added requirement that two out of the three exams fields must be on early modern topics.

Dissertation A formal prospectus is to be presented at the end of year three to the DGS by Monday of the final full week of spring semester classes. A prospectus defense is held the following week with the student's Prospectus Guidance Committee. At least one member of the dissertation committee should be affiliated with the Program in Early Modern Studies.

MASTER'S DEGREES

M.Phil. The combined M.Phil. degree may be requested after all requirements but the dissertation are met.

M.A. Students who withdraw from the Ph.D. program may be eligible for the M.A. degree if they have met the following requirements: successful completion of eight term courses, at least two of which must be in early modern studies, and with at least three grades of Honors. Candidates in combined programs will be awarded the M.A. only when the master's degree requirements for both programs have been met.

COURSES

EMST 5210a / ENGL 6721a / PLSC 6720a, Edmund Burke and the Age of Empire
David Bromwich
A partial survey of the political writings of Burke in the context of the theory of empire and of revolution. We emphasize his writings on India and France, which reveal a

common theme: innovation—sudden change in a way of life—always depends on violence, whether its agents are internal or external to the society. We touch on a wider subject: the birth of modern ideology, from the demand for systematic excuses to justify empire and revolution.

EMST 5611a / ENGL 6611a, Renaissance Material Performance Nicole Sheriko
This course surveys the wide range of early modern English performance from commercial drama (Shakespeare, Jonson, Marlowe) to court masques and street theater. Across this range, the course considers the materiality of performance, focused especially on theatrical objects, bodies, and spaces. Special attention is paid to intertheatrical ways these elements are recycled within and between performances to center theatrical matter as a physical and conceptual resource. Topics may include props, costumes, cosmetics, boy actors, puppetry, prosthesis, theater architecture, texts, animals, environment, and sensory experience. Readings offer an introduction to the practical craft of early modern theatermaking and critical frameworks for interrogating early modern materiality.

EMST 6150b / HIST 6150b / RLST 6790b, Popular Religion in Europe, 1300–1700 Carlos Eire
Readings and discussion in recent scholarship on the history of religion in the Christian West in the late medieval and early modern periods.

EMST 6900a, Taking Leave: Meditations on Art, Death, and the Afterlife from the Bible to the Twentieth Century Jane Tylus and Bruce Gordon
This seminar seeks to contextualize leave-taking within the explicitly religious and artistic contexts of Western culture. We open with readings from ancient texts from Mesopotamian, Greek, Latin, and Judaic cultures, and end with the U.S. Civil War. And in between we spend considerable time on the ways in which the advent of Christianity and, in turn, the Reformation, Counter-Reformation, and modern worlds influenced the practices and understanding of leave-taking. En route we explore how, for example, Catholicism sought to extend life into the third realm of Purgatory, why the Reformation sought to undo those imaginative excursions, and the extent to which the different faiths of figures such as Michelangelo, Shakespeare, and John Donne produced radically different kinds of finished—and unfinished—works. As we explore the transformative potential of the goodbye in literary and religious works, we also engage with more recent discussions from theologians, theorists, and therapists about grieving, transitions, and letting go. Our objectives are: to strive to understand the important role that leave-takings play in the history of Christianity and artistic expression, especially between 1300–1850; to probe the difference between religious faiths of early modernity with respect to rituals of saying goodbye and the afterlife; to sharpen our skills as readers, spectators, and listeners of works that engage with complex questions regarding the meaning of one's life and one's lifework; and to contextualize our readings within contemporary conversations about dying, grief, and letting go.

EMST 7000a, Workshop in Early Modern Studies Erika Valdivieso
This workshop provides an introduction to key questions in the field of early modern studies. Students in the course generate shared readings from their respective fields with the aim of understanding the range of what it means to conceptualize the early modern period across time, place, and discipline. The workshop also includes extensive discussion of revising writing for publication, peer review, and a series of guest

presentations from faculty affiliated with the program. Open only to students in the combined degree.

EMST 7300a / MUSI 5300a, The Castrato Jessica Peritz
This mezzanine seminar locates the intriguing, anxiety-inducing figure of the castrato at the nexus of fact and fiction, working to disentangle the historical realities of castrato lives from fantasies (both popular and scholarly) about castrato bodies, voices, and sexualities. Though the practice of castration has a long and complicated global history, the Italian term *castrato* denotes a particular group of people within that history: the many thousands of Italian boys, mostly from poor families, who were subjected to surgery between 1550 and 1850 with the express purpose of altering their voices for music-making. As the most celebrated performers of vocal music in early modern Europe, castrati were adored, worshipped, and heaped with wealth—but also mocked, shunned, and denied basic human rights. These and other contradictions characterize the castrato's fraught place within music history, while also resonating across time with twenty-first-century concerns about constructions of gender, sexuality, race, class, and (dis)ability. Each of the seminar's weekly sessions revolves around a different approach to the castrato, spanning the historical and transhistorical, factual and fantastical, music-oriented and otherwise. Through reading and analyzing an array of primary sources, musical objects, and scholarly literature, we explore how representations of the castrato in any given time and place reveal a much broader network of cultural ideologies at work under the surface. All told, the figure of the castrato helps us understand historical modes of embodiment and music-making, while also raising still-pressing questions about desire, bodily agency, and the limitations of the archive.

EMST 8160b / HIST 8942b / HSHM 7160b, Early Modern Science and Medicine Paola Bertucci
The course focuses on recent works in the history of science and medicine in the early modern world. We discuss how interdisciplinary approaches—including economic and urban history, sociology and anthropology of science, gender studies, art and colonial history—have challenged the classic historiographical category of "the Scientific Revolution." We also discuss the avenues for research that new approaches to early modern science and medicine have opened up, placing special emphasis on the circulation of knowledge, practices of collecting, and visual and material culture.

EMST 8185a / RLST 7540a / SPAN 7710a, The World(ing) of Tarot Todne Thomas and Nicholas Jones
This new course takes an interdisciplinary approach to the exploration of tarot. It joins together religious studies, social scientific, historical, and aesthetic approaches to teach about contexts of practice, genealogies of tarot phenomena, and its visuality. It establishes a foundational knowledge of tarot by exploring popular culture (mis)representations, tracing its longstanding eclectic history, and studying its archetypes. Conceptually, the course uses tarot as an avenue to discuss conceptual themes of materiality and aesthetics, esotericism, politics, gender, culture, and worlding. Through this guided study of tarot, we explore tarot's enduring yet contested appeal and relativize Western epistemologies, including that of the academy itself.

EMST 8336a / MDVL 7334a / SPAN 8595a, Law and Humanities II: Emotions Jesus Velasco
This is the second installment of a series of graduate seminars on law and humanities. The first one dealt with the question of fiction, and this one interrogates the ways in

which legal thinking and legislations are in dialogue with emotions in general, and in particular with the creation of affective spaces through specific forms of legislation and jurisprudence. During our seminar we save some time to write together and share our insights on each of the texts we read.

EMST 9600a / EALL 7530a / MDVL 9005a / NELC 5400a / RLST 9550a, Proseminar for Jobseekers in Premodern Fields Lucas Bender

This course is intended for doctoral students (particularly studying topics in the premodern humanities) in their penultimate and final years. Over the course of the semester, students work with peers as well as faculty convener to build the skills they need to present their research to others in a clear, compelling way. Topics covered include preparing application materials, interviewing, negotiating job offers, alt-ac careers, publishing, CV building, and how to succeed in postdoctoral and junior faculty positions. Weekly sessions generally include workshop time as well as presentations by the convener and visitors. This proseminar is particularly directed toward students affiliated with Archaia and medieval studies but welcomes all those with research interests in the premodern world; if space allows, students working on modern topics can also join. The broad range of primary specialties represented provides students with experience engaging with scholars outside their field, which is increasingly essential for premodernists in the modern academic world.

Earth and Planetary Sciences

Kline Geology Laboratory, 203.432.3124
http://earth.yale.edu
M.S., M.Phil., Ph.D.

Chair
Maureen Long

Director of Graduate Studies
Mary-Louise Timmermans

Professors Jay Ague, David Bercovici, Ruth Blake, Mark Brandon, Derek Briggs, David Evans, Alexey Fedorov, Jacques Gauthier, Shun-ichiro Karato, Jun Korenaga, Maureen Long, Jeffrey Park, Noah Planavsky, Peter Raymond, James Saiers, Mary-Louise Timmermans, John Wettlaufer

Associate Professors Bhart-Anjan Bhullar, Matthew Eisaman, Pincelli Hull, Alan Rooney

Assistant Professors Damanveer Grewal, Juan Lora, Lidya Tarhan, Jordan Wostbrock, Elizabeth Yankovsky

FIELDS OF STUDY

Fields include geochemistry and petrology, geophysics, ice physics, mineral physics, seismology and geodynamics, structural geology and tectonics, paleontology and paleoecology, oceanography, meteorology, cryospheric dynamics, and climatology.

Students admitted in 2020 or earlier have the option of receiving a degree in either geology and geophysics or Earth and planetary sciences. Students admitted in 2021 and subsequent years will receive a degree in Earth and planetary sciences.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

There is no formal language requirement and no required curriculum. Students plan their course of study in consultation with their adviser to meet individual interests and needs and to lay the foundations for dissertation research. At the end of the first year the faculty reviews the standing of each student. A student recommended for continuation in the Ph.D. program will be so notified. Some students may be encouraged at that time to pursue only the M.S. degree. At the end of the second year the faculty reviews each student's overall performance to determine whether the student is qualified to continue for the Ph.D. degree. In order to qualify, a student must have met the graduate school Honors requirement and maintained a better than passing record in the areas of concentration. Also, a student must have satisfied the requirements of the Qualifying Exam by having completed two Research Discourses termed (according to their degree of development) the Minor and the Major Discourses. The Major Discourse will be presented at the Qualifying Presentation, followed by an extended question period wherein the student must successfully defend both Discourses. Remaining degree requirements include a dissertation review in the third year; the preparation and defense of the dissertation; and the submission of the dissertation to the graduate school.

Teaching experience is regarded as an integral part of the graduate training program in Earth and Planetary Sciences. For this reason, all students are required to serve as teaching fellows for two terms during the course of their predoctoral training. Students who require additional support from the graduate school must teach additional terms, if needed, after they have fulfilled the academic teaching requirement.

In addition to all other requirements, students must successfully complete EPS 7100, Responsible and Ethical Conduct of Research, prior to the end of their first year of study.

MASTER'S DEGREES

M.Phil. See Degree Requirements under Policies and Regulations.

M.S. Awarded only to students who are not continuing for the Ph.D. Students are not admitted for this degree. See Degree Requirements under Policies and Regulations. Additional requirements include a research essay or thesis and M.S. defense with the approval of the DGS and the student's thesis committee.

Program materials are available at http://earth.yale.edu or upon request to the Director of Graduate Studies, Department of Earth and Planetary Sciences, Yale University, PO Box 208109, New Haven CT 06520-8109; email, dgs@eps.yale.edu.

COURSES

EPS 5100a, Introduction to Isotope Geochemistry Alan Rooney and Jordan Wostbrock
An overview of the fundamental principles of stable and radiogenic isotope geochemistry. Emphasis is placed on applications to specific geologic problems, including petrogenesis, geochronology, geothermometry, surface processes, hydrology, and biogeochemistry.

EPS 5120a, Structural Geology Mark Brandon
An introduction to the origin and structure of the lithosphere and continental and oceanic crust. Topics include what controls the solid versus fluid behavior of rocks during deformation, and what controls the character and motion of tectonic plates. Laboratory exercises and field trips.

EPS 5150b, Aqueous Geochemistry Jordan Wostbrock
This course is designed to provide the principles of aqueous geochemistry. Topics include, but are not limited to: chemical equilibria, mineral solubility, pH controls, carbonate chemistry, surface chemistry, and redox reactions. Prerequisites: Chemistry I and II.

EPS 5210b, Geophysical Fluid Dynamics Mary-Louise Timmermans
An examination of the equations governing rotating stratified flows with application to atmospheres and oceans. Mathematical models are used to illustrate the dynamical principles of geophysical fluid phenomena such as waves, boundary layers, flow stability, and large-scale circulations. Concepts are investigated through laboratory experiments in a rotating water tank. Prerequisites: Students should have had a course in fluid mechanics (MENG 361 or equivalent), or contact the instructor.

EPS 5220a, Physics of Weather and Climate Juan Lora
The climatic system; survey of atmospheric behavior on time scales from days (i.e., weather) to decades (i.e., climate); formulation of mathematical equations describing weather and climate with selected applications to small- and large-scale phenomena.

EPS 5250a, Vertebrate Paleontology Jacques Gauthier
Phylogeny and evolution of the major clades of vertebrates from Cambrian to Recent, as inferred mainly from the fossilized remains of the musculoskeletal system (cranial, axial, and appendicular skeletons). Special attention given to the evolution of vertebrate feeding, locomotor, and sensory systems.

EPS 5260a, Introduction to Earth and Planetary Physics Shun-ichiro Karato
An introduction to the structure and dynamics of Earth and other planets in the context of cosmic evolution. Review of basic physical principles and their applications to geophysics and planetary physics. Star formation and nucleosynthesis; planetary accretion and the birth of the solar system; heat flow, plate tectonics, and mantle dynamics; seismology and geodesy; core dynamics, geomagnetism, and planetary magnetism. Prerequisites for Yale College students: PHYS 1800, PHYS 2000, ENAS 1940, MATH 2470 or similar and/or permission of instructor.

EPS 5290a, Introduction to Geodynamics Jun Korenaga
This introductory course starts with the basics of continuum mechanics and covers a range of topics in geodynamics and relevant fields including the structure and dynamics of lithosphere, thermal convection and magmatism, Rayleigh-Taylor instability and plume dynamics, geoid and dynamic topography, and the thermal history of the core and geodynamo.

EPS 5320a, Cosmochemistry Damanveer Grewal
This course explores the chemical and isotopic composition of planetary materials to understand the formation and evolution of the solar system. This course covers the condensation of solids from the solar nebula, meteorites, planetary differentiation, and the geochemical processes that shaped asteroids, planets, and moons. Prerequisite: introductory chemistry, geology, or planetary science recommended.

EPS 5350a, Physical Oceanography Alexey Fedorov
An introduction to ocean dynamics and physical processes controlling the large-scale ocean circulation, ocean stratification, the Gulf Stream, wind-driven waves, tides, tsunamis, coastal upwelling, and other oceanic phenomena. Equations of motion. Modern observational, theoretical, and numerous other techniques used to study the ocean. The ocean role in climate and global climate change.

EPS 5360a, Waves, Instabilities, and Turbulence Elizabeth Yankovsky
This course explores the fundamental dynamics of geophysical fluid flows, focusing on wave phenomena, instabilities, and turbulence in the ocean and atmosphere. The course begins with a survey of wave types and their role in shaping large-scale climate dynamics, followed by an examination of fluid instabilities and their impact on energy transfer. We conclude with turbulence theory and implications for numerical modeling. Prerequisite: Students should have had a course in fluid mechanics (MENG 3610, EPS 4210, or equivalent), or contact instructor.

EPS 5370a, Optical Mineralogy Jay Ague
Introduction to the optical properties of minerals and rocks in thin section. The basic concepts of polarized light microscopy using the petrographic microscope are

examined, together with their application to the identification of minerals. Examples are drawn from metamorphic, hydrothermal, sedimentary, and igneous settings. The first class meeting each week is mostly lecture material, whereas the second is mostly laboratory in which students use the petrographic microscope to examine rock and mineral thin sections. Prerequisite: EPS 2200, Mineralogy, or equivalent.

EPS 5380a / ASTR 5200a, Computational Methods in Astrophysics and Geophysics Paolo Coppi
The analytic and numerical/computational tools necessary for effective research in astronomy, geophysics, and related disciplines. Topics include numerical solutions to differential equations, spectral methods, and Monte Carlo simulations. Applications are made to common astrophysical and geophysical problems including fluids and N-body simulations.

EPS 5400b, Advanced Topics in Geodynamics Jun Korenaga
This course provides a platform for an in-depth discussion of some fundamental as well as timely topics chosen from the field of geodynamics, broadly defined.

EPS 5500a, Introduction to Continuum Mechanics David Bercovici
Introduction to the physics of continuous media, with application to physical, natural, and biological sciences and engineering. Topics include tensor analysis; analysis of stress, motion, and strain; conservation of mass, momentum, and energy; rheology; examples in fluid dynamics, elasticity theory; and other topics at the discretion of instructor.

EPS 6200a, Essentials of Earth and Planetary Sciences Jun Korenaga
EPS faculty take turns to teach what they think everyone in the EPS department should know about their own field (geophysics, geology, geochemistry, atmospheric, ocean, climate dynamics, and paleontology).

EPS 6450a, Paleoecology Pincelli Hull
This course in paleoecology reviews basic ecological concepts in the context of classic and recent papers.

EPS 6550a, Extraordinary Glimpses of Past Life Derek Briggs
Study of exceptionally well preserved fossil deposits (*lagerstaetten*) that contain nonmineralized animal skeletons and casts of the soft parts of organisms. Examples such as the Burgess Shale and Solnhofen limestones; what they can reveal about the history and evolution of life, ancient lifestyles and environments, and preservational processes.

EPS 6590a, Data Analysis in Earth and Environmental Sciences Jeffrey Park
Introductory course in geoscience data analysis and time series methods, with emphasis on multiple-taper time series techniques. Examples drawn from seismological, paleoclimate, and historical climate data. Weekly computer assignments. Python proficiency helpful.

EPS 6710b, Tropical Oceanography and Meteorology Alexey Fedorov
This advanced mixed lecture/seminar course focuses on the dynamics of the tropical ocean and atmosphere. Topics include the Matsuno-Gill model, equatorial waves, ENSO, Pacific Decadal Oscillation, monsoons, the Madden-Julian Oscillation, the Indian Ocean Dipole, Tropical Atlantic Variability, Atlantic Multidecadal Variability, connections between different tropical basins, and the response of the tropics to climate

change. The course starts with a series of lectures on the key topics. It then proceeds to a seminar-style discussion of recent papers on the topics, with students presenting the papers. Open to graduate students, postdocs, and upper-level undergraduates (with special permission).

EPS 7030a / EEB 7930a, Seminar in Systematics Jacques Gauthier
Topics and class time are chosen by the participants, and have included reading books and/or a series of papers on particular topics (e.g., homology; morphological phylogenetics; evolution of egg colors and exposed nesting in dinosaurs/birds; origin of snake ecology; conflicts between morphology and molecules; role of fossils in phylogenetic inference).

EPS 7120a or b, Human Anatomy William Stewart
A series of courses designed to develop an understanding of normal clinical anatomy. The focus is to provide students with a comprehensive understanding of the anatomical structures and functional relationships within the entire body.

EPS 7410a, The Origin of Bilaterian Animals Bhart-Anjan Bhullar
The nature of the bilaterian ancestor—the ancestor of all animals except sponges, comb jellies, jellyfish, and acoel flatworms—is one of the enduring mysteries in evolutionary biology and paleontology. Only in the last decade has some consensus emerged on bilaterian phylogeny. Meanwhile, further insights into various bilaterian clades have been made possible using anatomical, developmental, and genetic data. However, these new sources of information have not been mustered in an attempt to revisit the question of the ancestral bilaterian's characteristics. In this seminar, we read selected papers on the biology of the major bilaterian clades, including recent evolutionary developmental and paleontological work, and attempt collaboratively to build a character dataset that permits us to reconstruct the features of the ancestral bilaterian. Prerequisite: introductory biology including phylogenetic thinking.

EPS 7440a or b, Seminar in Mantle and Core Processes Staff
The seminar covers advanced topics concerning physical and chemical processes in the mantle and core of the Earth and planets. Specific topic and hour are arranged in consultation with enrolled graduate students.

EPS 7890a or b, Current Topics in Metamorphic Processes Jay Ague
This seminar is based mostly on readings from the literature and focuses on emerging issues in metamorphic petrology, including deep element cycling, non-lithostatic pressure, and ultrahigh-temperature and ultrahigh-pressure metamorphism.

EPS 7900a, Colloquium in Earth and Planetary Sciences Staff
This course focuses on discussion of emerging research across the Earth and planetary sciences. ½ Course cr

East Asian Languages and Literatures

Humanities Quadrangle, Rm. 110, 203.432.2860
http://eall.yale.edu
M.A., M.Phil., Ph.D.

Chair
Aaron Gerow

Director of Graduate Studies
Michael Hunter

Professors Aaron Gerow, Hwansoo Kim, Tina Lu, Jing Tsu

Associate Professors Lucas Bender, Michael Hunter

Assistant Professors Kyunghee Eo, Rosa van Hensbergen, Yoshitaka Yamamoto

Senior Lecturer Pauline Lin

Senior Lectors II Angela Lee-Smith, Rongzhen Li, Ninghui Liang, Hiroyo Nishimura, Peisong Xu

Senior Lectors Hsiu-hsien Chan, Min Chen, Bookyung Jung, Hyunsung Lim, Fan Liu, Jianhua Shen, Wei Su, Chuanmei Sun, Haiwen Wang, Yu-lin Wang Saussy, Mika Yamaguchi, Yongtao Zhang, William Zhou

Lectors Jingjing Ao, Seunghee Back, Hyeseong Kim, Saori Nozaki, Mo Wu, Wen Zhang

FIELDS OF STUDY

Fields for doctoral study are Chinese literature and Japanese literature. (See also the Combined Ph.D. Program in Film and Media Studies.) Although the primary emphasis is on these East Asian subjects, the department welcomes applicants who are seeking to integrate their interests in Chinese or Japanese literature with interdisciplinary studies in such fields as history, history of art, linguistics, religious studies, comparative literature, film and media studies, theater studies, literary theory and criticism, and the social sciences.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

During the first three years of study, students are required to take at least fourteen term courses. Usually students complete twelve term courses in the first and second years, and then take two tutorials or two seminars in the third year. Students concentrating in Chinese or Japanese literature are encouraged to take at least one term course in Western literature or literary theory. If approved by the director of graduate studies (DGS), graduate courses taken for a grade of Satisfactory/Unsatisfactory in other departments or programs in which these courses are counted toward that department/program's doctoral course or certificate requirements will be counted toward the fourteen-course requirement. To maximize flexibility for students pursuing non-traditional pathways, the department will accept petitions to replace specific program requirements with alternate training. For example, a student might propose to substitute a professionalization experience for a required course. Such decisions

will be made on a case-by-case basis by the DGS in conjunction with the primary adviser. Contingent on DGS approval, students might also count up to two courses on languages beyond their primary research language toward the fourteen-course requirement.

By the end of the second year, all students must prove their proficiency in a language other than their primary language of study that is relevant to their course of study and is approved by the DGS. By the end of the third year, students specializing in premodern Japanese literature must pass a reading test in literary Chinese. By the end of the second full academic year, the student must take a written examination in the language of the student's specialization, including both its modern and premodern forms.

At the end of each academic year, until a student is admitted to candidacy, a faculty committee will review the student's progress. For the second-year review, the student must submit a revised seminar research paper, on a topic selected in consultation with the adviser, no later than April 1 of the fourth term. No later than the end of the first month of the sixth term the student will take the qualifying oral examination. The exam will cover three fields distinguished by period and/or genre in one or more East Asian national literatures or in other fields closely related to the student's developing specialization. These fields and accompanying reading lists will be selected in consultation with the examiners and the DGS in order to allow the student to demonstrate knowledge and command of a range of topics. After having successfully passed the qualifying oral examination, students will be required to submit a dissertation prospectus to the department for approval by May 15 of the sixth term in order to complete the process of admission to candidacy for the Ph.D.

Teaching experience is an integral part of the graduate program in East Asian Languages and Literatures. As such, the department requires all students to serve as teaching fellows for four terms, typically in the third and fourth years. With the permission of the DGS, students can substitute a professional development opportunity for a teaching fellowship or, in extraordinary circumstances, reduce their academic teaching requirement by one or more terms. Note that this academic requirement is distinct from the graduate school's financial requirement that students serve as teaching fellows for four terms.

COMBINED PH.D. PROGRAM

The Department of East Asian Languages and Literatures also offers, in conjunction with the Film and Media Studies Program, a combined Ph.D. in East Asian Languages and Literatures and Film and Media Studies. For further details, see Film and Media Studies. Applicants to the combined program must indicate on their application that they are applying both to Film and Media Studies and to East Asian Languages and Literatures. All documentation within the application should include this information.

MASTER'S DEGREES

M.Phil. The successful completion of all predissertation requirements, including the qualifying examination and the dissertation prospectus, will make a student eligible for an M.Phil. degree.

M.A. Students who withdraw from the Ph.D. program may be eligible to receive the M.A. degree provided they have met the requirements and have not already received the M.Phil. For the M.A., students must successfully complete twelve term courses and satisfy the language requirement. Candidates in combined programs will be awarded the M.A. only when the master's degree requirements for both programs have been met.

Additional program materials are available on the department website, http://eall.yale.edu.

COURSES

Courses in Chinese, Japanese, and Korean languages at the elementary, intermediate, and advanced levels are listed in *Yale College Programs of Study*. See also https://courses.yale.edu.

CHNS 5700a, Introduction to Literary Chinese I Pauline Lin
Reading and interpretation of texts in various styles of literary Chinese (*wenyan*), with attention to basic problems of syntax and literary style. Prerequisite: CHNS 1510 or CHNS 1530 or equivalent.

CHNS 5710b, Introduction to Literary Chinese II Pauline Lin
Continuation of CHNS 570. Reading and interpretation of texts in various styles of literary Chinese (*wenyan*), with attention to basic problems of syntax and literary style. Prerequisite: CHNS 570 or equivalent.

EALL 5050b, The Culture of Landscape in China Pauline Lin
An introduction to Chinese philosophical, poetic, and visual explorations of landscape and the changing relationship between human beings and nature. Through texts, archaeological materials, visual and material culture, and garden designs from the second century BCE to modern times, we learn about the Chinese conception of the world; relationship to and experiences in nature; and shaping of the land through agriculture, imperial parks, and garden designs. We conclude with contemporary environmental issues confronting China and how contemporary parks can help regenerate our ecosystem. None

EALL 5670a, Japan's Global Modernisms: 1880–1980 Rosa van Hensbergen
This course is an introduction to Japanese literature from the 1880s to 1980s. Our reading is guided by a different "ism" each week, from 19th-century eroticism and exoticism, through mid-century cosmopolitanism and colonialism, to second-wave feminism and existentialism in the wake of World War II. These distinct moments in the development of Japanese modernism (modanizumu) are shaped by encounters with foreign cultures and by the importing of foreign ideas and vogues. All the same, we question—along with modernist writer Yū Ryūtanji—the "critique that says modanizumu is nothing more than the latest display of imported cosmetics" (1930). We seek to develop a correspondingly nuanced picture of the specific and changing ways in which Japan understood and figured its relationship to the rest of the world through the course of a century. Creative and comparative perspectives are especially welcome, and assignments can accommodate a range of media and presentation formats to suit. There are no prerequisites for this course, beyond an enthusiasm for reading literature. All readings are in translation, however there is an opportunity to read short stories in the original language. To facilitate this, our second

class each week is structured around break-out groups that allow students to focus on one of the following: (a) comparative works of Western literature, (b) works of Japanese literary theory, and (c) original-language short stories.

EALL 5810a / FILM 8730a / FILM 873a and FILM 8730a, Japanese Cinema and Its Others Kirsten Seuffert
Critical inquiry into the myth of a homogeneous Japan through analysis of how Japanese film and media historically represent "others" of different races, ethnicities, nationalities, genders, and sexualities, including women, black residents, ethnic Koreans, Okinawans, Ainu, undocumented immigrants, LGBTQ minorities, the disabled, youth, and monstrous others such as ghosts.

EALL 6000a / EAST 6222a, Sinological Methods Pauline Lin
A research course in Chinese studies, designed for students with background in modern and literary Chinese. Students explore and evaluate the wealth of primary sources and research tools available in China and in the West. For native speakers of Chinese, introduction to the secondary literature in English and instruction in writing professionally in English on topics about China. Topics include Chinese bibliographies; bibliophiles' notes; specialized dictionaries; maps and geographical gazetteers; textual editions, variations, and reliability of texts; genealogies and biographical sources; archaeological and visual materials; and major Chinese encyclopedias, compendia, and databases.

EALL 7330a, Zhuangzi Mick Hunter
An in-depth examination of one of the great masterworks of ancient philosophy. Topics vary according to student interest but include: the interpretation of the text, its formation and history, its reception in the commentarial and scholarly literature, and its role in the modern construction of classical Chinese philosophy. This seminar is designed primarily for students who can read classical Chinese but is also open to students reading the text in translation. In that event, we hold separate sessions for students working in the original language. Proficiency in classical Chinese is preferred but not absolutely necessary.

EALL 7530a / EMST 9600a / MDVL 9005a / NELC 5400a / RLST 9550a, Proseminar for Jobseekers in Premodern Fields Lucas Bender
This course is intended for doctoral students (particularly studying topics in the premodern humanities) in their penultimate and final years. Over the course of the semester, students work with peers as well as faculty convener to build the skills they need to present their research to others in a clear, compelling way. Topics covered include preparing application materials, interviewing, negotiating job offers, alt-ac careers, publishing, CV building, and how to succeed in postdoctoral and junior faculty positions. Weekly sessions generally include workshop time as well as presentations by the convener and visitors. This proseminar is particularly directed toward students affiliated with Archaia and medieval studies but welcomes all those with research interests in the premodern world; if space allows, students working on modern topics can also join. The broad range of primary specialties represented provides students with experience engaging with scholars outside their field, which is increasingly essential for premodernists in the modern academic world.

EALL 7540b and EALL 7550b, Proseminar in East Asian Languages and Literatures
Lucas Bender and Rosa van Hensbergen
This course asks, "why do we need East Asian studies?" Through a series of core readings in the discipline, we interrogate the foundations of East Asian studies and consider the critiques that have troubled those foundations over recent decades. We also read important works of East Asian literary theory in conjunction with foundational works from the West. The aim of this course is to enable graduate students to critically articulate their relationship to the discipline of East Asian studies, to frame the relevance of their own research for the future of the discipline, and to understand their own work within broader humanities frameworks. Prerequisite: graduate standing in EALL or permission from the instructors. ½ Course cr per term

EALL 8230a / CPLT 9053a / EAST 8220a, Topics in Sinophone and Chinese Studies
Jing Tsu
This recurring graduate research seminar and symposium examines different areas, periods, genres, and conceptual frameworks in Chinese and Sinophone studies. The topic this year is 1950s–2020. Prerequisite: reading fluency in modern and semi-classical Chinese. Enrollment is restricted; no auditors.

EALL 8920a / FILM 8740a, Japanese New Wave Cinema Kirsten Seuffert
This course explores the "New Wave" in Japanese cinema in the context of the rise of "new wave" across cinemas in the American sphere in the period roughly between 1955 and 1975. It focuses on both local contexts and global flows in the turn to experimental filmmaking in Japan, paying particular attention to how films sought to make social and political interventions in both content and form. We analyze New Wave films and critical writing by asking what they can tell us about Japan's postwar, high-speed economic growth, student and counterculture movements, and place in the Cold War order. We also consider what the Japanese New Wave tells us about the possibilities of cinema: its global simultaneity, transcultural movement, and historical trajectory. Topics include the legacy of World War II in Japan and cinema as a mode for narrating history; the rise of global youth culture in the context of postwar economic growth; cinema and protest against the U.S.-Japan Security Treaty; the aesthetic use of sex, violence, and politics to shock mainstream culture; documentary as a site for radical experimentation; the studio system, independent filmmaking, and transformations of the Japanese film industry; and what is meant by "modernist" and "avant-garde" in New Wave cinema.

EALL 9000a or b, Directed Readings Mick Hunter
Offered by permission of instructor and DGS to meet special needs not met by regular courses.

EALL 9900a or b, Directed Research Mick Hunter
Offered as needed with permission of instructor and DGS for student preparation of dissertation prospectus.

JAPN 5700a, Introduction to Literary Japanese Yoshitaka Yamamoto
Introduction to the grammar and style of the premodern literary language (*bungotai*). We read *Taketori monogatari* (The Tale of the Bamboo Cutter, ca. 909), the oldest surviving work of prose fiction in Japanese, with a view toward understanding how literary texts were created, preserved, and disseminated in premodern Japan and East Asia. Prerequisite: JAPN 1510 or equivalent.

JAPN 5710b, Readings in Literary Japanese Yoshitaka Yamamoto
Close analytical reading of a selection of texts from the Nara through Tokugawa period: prose, poetry, and various genres. Introduction of *kanbun*. Prerequisite: JAPN 570 or equivalent.

East Asian Studies

The MacMillan Center
320 Luce Hall, 203.432.3426
https://macmillan.yale.edu/eastasia
M.A.

Professors Daniel Botsman (*History*), Fabian Drixler (*History*), Aaron Gerow (*East Asian Languages and Literatures*; *Film and Media Studies*), Valerie Hansen (*History*), Hwansoo Kim (*Religious Studies*), Tina Lu (*East Asian Languages and Literatures*), Helen Siu (*Anthropology*), Chloë Starr (*Divinity School*), Jing Tsu (*East Asian Languages and Literatures*; *Comparative Literature*), Anne Underhill (*Anthropology*), Arne Westad (*Global Affairs*; *History*), Mimi Yiengpruksawan (*History of Art*)

Associate Professors Lucas Bender (*East Asian Languages and Literatures*), Eric Greene (*Religious Studies*), William Honeychurch (*Anthropology*), Michael Hunter (*East Asian Languages and Literatures*), Yukiko Koga (*Anthropology*), Daniel Mattingly (*Political Science*)

Assistant Professors Jinyi Chu (*Slavic Languages and Literatures*), Maura Dykstra (*History*), Kyunghee Eo (*East Asian Languages and Literatures*), Bo kyung Blenda Im (*Sacred Music*; *Divinity*), Charles McClean (*Political Science*), Quincy Ngan (*History of Art*), Marta Sanvido (*Religious Studies*), Hannah Shepherd (*History*), Rosa van Hensbergen (*East Asian Languages and Literatures*), Yoshitaka Yamamoto (*East Asian Languages and Literatures*), Emma Zang (*Sociology*)

Senior Lecturer Pauline Lin (*East Asian Languages and Literatures*)

Lecturers Usmon Boron, Ugyan Choedup, Hyemin Lee, Wonseok Lee, Sheng Long, J. Scott Lyons, Maddalena Poli, Luciana Sanga, Tulku Ngawang Sonam, Catherine Tsai, Yingxue Wang

Senior Lectors II Angela Lee-Smith, Rongzhen Li, Ninghui Liang, Hiroyo Nishimura, Peisong Xu

Senior Lectors Hsiu-hsien Chan, Min Chen, Boo Kyung Jung, Fan Liu, Jianhua Shen, Wei Su, Chuanmei Sun, Haiwen Wang, Yu-lin Wang Saussy, Mika Yamaguchi, Yongtao Zhang, William Zhou

Lectors Jingjing Ao, Seunghee Back, Hye Seong Kim, Hyun Sung Lim, Saori Nozaki, Yuki Sakomura

FIELDS OF STUDY

The Master of Arts (M.A.) program in East Asian studies is a multidisciplinary program offering a concentrated course of study designed to provide a broad understanding of the people, history, culture, contemporary society, politics, and economy of China, Japan, Korea, or a transnational region within East Asia. This program is designed for students preparing to go on to the doctorate in one of the disciplines of East Asian studies (e.g., anthropology; history; history of art; languages and literatures, including comparative literature and film studies; political science; religious studies; sociology;

etc.), as well as for those students seeking a terminal M.A. degree before entering the business world, the media, government service, or a professional school.

COURSE OF STUDY FOR THE M.A. DEGREE

The East Asian studies graduate program is designed to be completed in either a one-year or a two-year track. The two-year track requires the preparation of a master's thesis and is therefore ideal for students who are keen to pursue focused, independent research under the guidance of a faculty member. It also provides students with an opportunity to pursue additional disciplinary and language training. Students who enter the two-year track with a strong command of one East Asian language will be encouraged to consider beginning a second (or third) language.

In general, students focus their course work on the study of China, Japan, Korea, or transnational East Asia. Some students may prefer to focus their course work on one or two disciplines, in addition to language study and courses focused on East Asia. Others may create a highly interdisciplinary program, taking courses in traditional disciplines such as history, literature, political science, religious studies, art history, or anthropology, as well as in Yale's professional schools.

Applicants to the East Asian studies graduate program must indicate on their application whether they are applying to the one-year or the two-year track.

REQUIREMENTS FOR THE M.A. DEGREE: ONE-YEAR TRACK

Language Proficiency Students must demonstrate proficiency in one's primary East Asian research language equivalent to Yale's third-year level, demonstrated by:

1. native fluency;
2. completion of the language placement and proficiency exam (https://eall.yale.edu/academics/language-programs) offered by the Department of East Asian Languages and Literatures; or
3. completion of two terms of language courses at the third-year level at Yale.

Eight Courses With the exception of East Asian language classes, all classes must be at the graduate level (either a code 5000 or above class, or an undergraduate class approved for graduate credit). If approved by the DGS, one graduate course taken for a grade of Satisfactory/Unsatisfactory in other departments or programs in which these courses are counted toward that department/program's requirements will be counted toward the eight-course requirement.

A maximum of four East Asian language classes can be counted toward degree requirements. Four of the eight courses must be East Asian studies classes. These four classes may include:

- a maximum of one independent study class on an East Asian studies topic
- graduate-level courses that appear on the East Asian studies course list (https://ceas.yale.edu/academics/courses)
- with DGS approval, one non-East Asian studies class for which a final paper or project is written on an East Asian studies topic. The final paper must be submitted to the DGS at the end of the term. In exceptional cases the DGS may approve, in

consultation with the academic mentor, additional non-EA classes (with a final EA paper/project).

The course of study must be approved by the DGS.

Special Requirements

Students must earn two Honors grades ("H") over the course of their two terms at Yale. Honors grades earned in any language course cannot be counted toward satisfying this requirement, except with the permission of the DGS.

REQUIREMENTS FOR THE M.A. DEGREE: TWO-YEAR TRACK

Language Proficiency Students must demonstrate proficiency in one's primary East Asian research language equivalent to Yale's fourth-year level, demonstrated by:

1. native fluency;
2. completion of the language placement and proficiency exam (https://eall.yale.edu/academics/language-programs) offered by the Department of East Asian Languages and Literatures; or
3. completion of two terms of language courses at the fourth-year level at Yale.

Sixteen Courses With the exception of East Asian language classes, all classes must be at the graduate level (either a code 500 or above class, or an undergraduate class approved for graduate credit). If approved by the director of graduate studies (DGS), up to two graduate courses taken for a grade of Satisfactory/Unsatisfactory in other departments or programs in which these courses are counted toward that department/program's requirements will be counted toward the sixteen-course requirement.

A maximum of eight East Asian language classes can be counted toward degree requirements. One of the sixteen courses is EAST 9900, Master's Thesis. Eight of the sixteen courses must be East Asian studies classes. These eight classes may include:

- a maximum of two independent study class on an East Asian studies topic
- graduate-level courses that appear on the East Asian studies course list (https://ceas.yale.edu/academics/courses)
- with DGS approval, two non-East Asian studies classes for which a final paper or project is written on an East Asian studies topic. The final paper must be submitted to the DGS at the end of the semester. In exceptional cases the DGS may approve, in consultation with the academic mentor, additional non-EA classes (with a final EA paper/project).

The course of study must be approved by the DGS.

Special Requirements

Students must earn four Honors grades ("H") over the course of their four terms at Yale. Honors grades earned in any language course cannot be counted toward satisfying this requirement, except with the permission of the DGS. A master's thesis is also required.

Master's Thesis

A master's thesis is required of students enrolled in the two-year degree program. The master's thesis is based on research in a topic approved by the DGS and advised by a faculty member with specialized competence in the chosen topic. M.A. students must register for EAST 9900, which may count toward the sixteen required courses. EAST 9900 may not be taken for audit. Students may register for an additional independent study to prepare topics and begin research. The master's thesis must be prepared according to CEAS guidelines and is due in the student's second year on a mid-December date (if completed in the fall term) or an early-May date (if completed in the spring term) as specified by CEAS.

JOINT-DEGREE PROGRAMS

The Council on East Asian Studies (CEAS) collaborates with three of Yale's professional schools—Environment, Law, and Public Health—and has developed joint-degree programs that offer a strong connection between two demanding courses of study while also fulfilling the requirements of each separate school. Only students enrolled in the two-year track of the East Asian studies M.A. degree program are eligible for a joint degree.

Each joint program leads to the simultaneous award of two graduate professional degrees: the M.A. in East Asian studies from the Graduate School of Arts and Sciences, and an M.F., M.E.M., M.E.Sc., M.F.S., J.D., or M.P.H. from the relevant professional school. Students can earn the two degrees simultaneously in less time than if they were pursued sequentially.

With the exception of the joint M.A./J.D. program, which requires four years, completion of all requirements takes three years. Typically candidates spend the first year in one program and the second year in the partner program. During the third and final year of study, students register in one program each term. Joint-degree students are guided in this process by a committee composed of the DGS and a faculty member of the relevant professional school.

Candidates must submit formal applications to both the graduate school and the relevant professional school and be admitted separately to each school, i.e., each school makes its decision independently. It is highly recommended that students apply to and enter a joint-degree program from the outset, although it is possible to apply to the second program once matriculated at Yale.

Program materials are available upon request to the Council on East Asian Studies, Yale University, PO Box 208206, New Haven CT 06520-8206; e-mail, eastasian.studies@yale.edu; Applications are available online at http://gsas.yale.edu/admission; email, graduate.admissions@yale.edu.

COURSES

Please consult the course information available online at http://ceas.yale.edu/academics/courses and https://courses.yale.edu for a complete list of East Asian-related courses offered at Yale University.

EAST 5301a, Advanced Readings in Tokugawa Documents Masato Takenouchi
The holdings of the Yale University Library include numerous collections of invaluable pre-modern Japanese documents, including many, such as the "Kyoto Komonjo" collection, which make it possible to delve deep into the history of Tokugawa period (1600–1868) Japan. In the last two years, moreover, the Council on East Asian Studies has been able to acquire a variety of fascinating new collections of Tokugawa period documents to augment the library's existing holdings. As a result, students at Yale now have the opportunity to use unpublished primary sources to study various aspects of Tokugawa period history in a way that is rarely possible outside of Japan. This course is intended to help graduate students and properly qualified undergraduates build the advanced skills, knowledge, and confidence needed to engage these kinds of materials independently and use them to pursue a variety of historical research topics. Students participating in this course should have a high level of competency in Japanese. Prerequisite: HIST 304J, Japanese Historical Documents, or instructor's permission.

EAST 5520b / PLSC 6850b, Chinese Thinking on International Relations Feng Zhang
How have the Chinese thought about international relations and their country's role in the world? How has such thinking influenced China's foreign relations past and present? This advanced seminar canvasses Chinese thinking on international relations from the imperial epoch to the present, focusing on the post-1949 era of the People's Republic of China. It is structured around three core engagements: the historical background of Chinese thinking; policy thinking of the successive PRC leaderships; and new strands of thinking at present. It examines both the evolutionary process of thinking and a body of prominent ideas and doctrines. Throughout the course, students have the opportunity to place China's foreign policy in a broader and deeper intellectual context than is often the case.

EAST 5521a / PLSC 6840a, China's International Relations Feng Zhang
This course examines China's international relations with a focus on both historical context and contemporary developments. Beginning with imperial China's traditional foreign relations and the "century of humiliation," the course traces the evolution of Chinese foreign policy through the Cold War period to the present day. Students analyze China's relationships with major powers and regions, including the United States, Russia, Northeast Asia, Southeast Asia, and India, while exploring critical issues such as the Taiwan question, territorial disputes in the South China Sea, and China's growing role in global governance. Special attention is paid to understanding the drivers of China's recent assertive turn in foreign policy under Xi Jinping, theories of international relations as applied to China's rise, and the implications of China's increasing power for the international order. Through engagement with scholarly works and contemporary policy debates, the course provides students with a comprehensive understanding of China's foreign relations and its emergence as a global power.

EAST 6222a / EALL 6000a, Sinological Methods Pauline Lin
A research course in Chinese studies, designed for students with background in modern and literary Chinese. Students explore and evaluate the wealth of primary sources and research tools available in China and in the West. For native speakers of Chinese, introduction to the secondary literature in English and instruction in writing

professionally in English on topics about China. Topics include Chinese bibliographies; bibliophiles' notes; specialized dictionaries; maps and geographical gazetteers; textual editions, variations, and reliability of texts; genealogies and biographical sources; archaeological and visual materials; and major Chinese encyclopedias, compendia, and databases.

EAST 6423a / HSAR 6594a, Chinese Paintings at the YUAG Quincy Ngan
This seminar explores the issue of authenticity in thirteenth through twentieth century Chinese paintings at the Yale University Art Gallery. Students become familiar with the different schools of connoisseurship and the major debates surrounding authenticity in the field of Chinese painting. Students learn about the methods for authenticating an attribution, as well as the rationale behind the dating provided by the gallery. Calligraphical inscriptions and seals on the works, as well as their physical condition, related conservation reports, and provenance are consulted as well. This class makes frequent visits to the gallery. Reading ability of Chinese is not required.

EAST 8220a / CPLT 9053a / EALL 8230a, Topics in Sinophone and Chinese Studies Jing Tsu
This recurring graduate research seminar and symposium examines different areas, periods, genres, and conceptual frameworks in Chinese and Sinophone studies. The topic this year is 1950s–2020. Prerequisite: reading fluency in modern and semi-classical Chinese. Enrollment is restricted; no auditors.

EAST 9100a or b, Independent Study Staff
By arrangement with faculty and with approval of the DGS.

EAST 9900a or b, Master's Thesis Mimi Yiengpruksawan
Directed reading and research on a topic approved by the DGS and advised by a faculty member (by arrangement) with expertise or specialized competence in the chosen field. Readings and research are done in preparation for the required master's thesis.

Ecology and Evolutionary Biology

Osborn Memorial Laboratories, 203.432.3837
http://eeb.yale.edu
M.S., Ph.D.

Chair
David Vasseur

Professors Casey Dunn, Erika Edwards, Vanessa Ezenwa, Walter Jetz, Martha Muñoz, Thomas Near, C. Brandon Ogbunu, David Post, Jeffrey Powell, Richard Prum, Alison Sweeney, Paul Turner, David Vasseur

Affiliated Professors Richard Bribiescas (*Anthropology*), Craig Brodersen (*School of the Environment*), Nicholas Christakis (*Sociology*), Liza Comita (*School of the Environment*), Forrest Crawford (*Public Health*), Nathan Grubaugh (*Epidemiology*), Vivian Irish (*Molecular, Cellular, and Developmental Biology*), James Noonan (*Genetics*), Eric Sargis (*Anthropology*), Oswald Schmitz (*School of the Environment*), David Skelly (*School of the Environment*), Jeffrey Townsend (*Public Health*), Serena Tucci (*Anthropology*)

Assistant Professors Jennifer Coughlan, Martina Dal Bello, Eric Slessarev, Michelle Wong

Lecturers Adalgisa Caccone, Gordon Geballe, Joshua Moyer, Linda Puth

Research Scientists Mary Beth Decker, Annise Dobson

FIELDS OF STUDY

The Department of Ecology and Evolutionary Biology (E&EB) offers training programs in organismal biology, ecology, and evolutionary biology.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Each entering student, in consultation with the faculty Entry Committee, develops a specific program of courses, seminars, laboratory research, and independent reading tailored to the student's interests, background, and goals. There are normally no foreign language requirements. The course requirements to advance to candidacy in E&EB are:

1. EEB 6500* and EEB 6501,* Advanced Topics in Ecology and Evolutionary Biology;
2. EEB 6545,* a course on the responsible conduct of research;
3. weekly E&EB seminars;
4. symposia of faculty and graduate student research;
5. two research rotations (EEB 6901,* Research Rotation I, and EEB 6902,* Research Rotation II) in the first two years; and
6. a minimum of three additional graduate-level courses (numbered 5500 and above) with a grade of Honors in at least two of these.

Teaching experience is regarded as an integral part of the graduate training program. All students are required to teach three courses, typically during their first three years of study. Students who require additional support from the graduate school may be required to teach additional terms after they have fulfilled the academic teaching requirement.

By the middle of the fourth term of study, each student organizes a formal pre-prospectus consultative meeting with the student's advisory committee to discuss the planned dissertation research. Before the beginning of the fifth term, students present and defend their planned dissertation research at a prospectus meeting, at which the department determines the viability and appropriateness of the student's Ph.D. proposal. A successful prospectus meeting and completion of course requirements results in admission to candidacy for the Ph.D. The prospectus is held by the end of the fourth semester. Following admission to candidacy, the student must hold committee meetings at least once a year and remain in good academic standing by showing significant progress on their thesis project. The final requirements for a Ph.D. include completion, presentation, and successful defense of the dissertation, and submission of copies of the dissertation to the graduate school and to the Marx Science and Social Science Library.

In some cases, such as when there is extensive field work, the prospectus meeting can be delayed by one term. A request for a delay must come from the dissertation committee adviser and must be approved by the DGS. In these exceptional cases, admission to candidacy may not be required for registration for the third year of graduate study.

* This course is graded on a Satisfactiory/Unsatisfactory basis.

HONORS REQUIREMENT

Students must meet the graduate school's requirement of Honors in two courses by the end of the fourth term of study. The E&EB department also requires an average grade of at least High Pass in coursework during the first two years of study.

MASTER'S DEGREE

M.S. (en route to the Ph.D.) The course requirements for the M.S. are the same those as for advancing to candidacy in the Ph.D. program except that an M.S. does not require successful completion of a prospectus meeting.

Additional information on the department, faculty, courses, and facilities is available from Kelly Pyers, Registrar, Department of Ecology and Evolutionary Biology, Yale University, PO Box 208106, New Haven CT 06520-8106; kelly.pyers@yale.edu; 203.432.3837; http://eeb.yale.edu.

COURSES

EEB 5220a, General Ecology David Post and Eric Slessarev
A broad consideration of the theory and practice of ecology, including the ecology of individuals, population dynamics and regulation, community structure, ecosystem function, and ecological interactions on broad spatial and temporal scales. Topics such as climate change, fisheries management, and infectious disease are placed in an ecological context.

EEB 5223Lb, Laboratory for Evolution, Functional Traits, and the Tree of Life Linda Puth
Experimental approaches to organismal and population biology, including study of the diversity of life.

EEB 5225b, Evolutionary Biology Jenn Coughlan and Brandon Ogbunu
An overview of evolutionary biology as the discipline uniting all of the life sciences. Evolution explains the origin of life and Earth's biodiversity, and how organisms acquire adaptations that improve survival and reproduction. This course uses reading and discussion of scientific papers to emphasize that evolutionary biology is a dynamic science, involving active research to better understand the mysteries of life. We discuss principles of population genetics, paleontology, and systematics; and application of evolutionary thinking in disciplines such as developmental biology, ecology, microbiology, molecular biology, and human medicine.

EEB 5228b, Ecology and Evolution of Infectious Disease Vanessa Ezenwa and Paul Turner
Overview of the ecology and evolution of pathogens (bacteria, viruses, protozoa) and their impact on host populations. Topics include theoretical concepts, ecological and evolutionary dynamics, molecular biology, and epidemiology of ancient and emerging diseases.

EEB 5255a, Invertebrates Casey Dunn
An overview of animal diversity that explores themes including animal phylogenetics (evolutionary relationships), comparative studies of evolutionary patterns across species, organism structure and function, and the interaction of organisms with their environments. Most animal lineages are marine invertebrates, so marine invertebrates are the focus of most of the course. Concurrent enrollment in E&EB 5556L is not required.

EEB 5256La, Laboratory for Invertebrates Casey Dunn
The study of invertebrate anatomy and diversity in a laboratory and field setting. Activities include examination of live animals and museum specimens, as well as local field trips. Some field trips fall on weekends. Must be taken concurrently with E&EB 555. ½ Course cr

EEB 5264b, Ichthyology Thomas Near
A survey of fish diversity, including jawless vertebrates, chimaeras and sharks, lungfishes, and ray-finned fishes. Topics include the evolutionary origin of vertebrates, the fossil record of fishes, evolutionary diversification of major extant fish lineages, biogeography, ecology, and reproductive strategies of fishes.

EEB 5265Lb, Laboratory for Ichthyology Thomas Near

EEB 5340a, Microbial Ecology Martina Dal Bello
When thinking about microbes what comes to mind are usually diseases and unpleasant smells from the fridge or the basement. Nevertheless, microbes and the communities they form are key contributors to our wellbeing and the functioning of the planet. This course provides an introduction to microbial ecology, with an emphasis on how microbial systems differ from their macroscopic counterparts, including defining a microbial species; sampling/experimenting with microbes; principles of microbial growth, metabolism, and death; species interactions and community assembly in different environments; microbial community functions; and elements of microbial evolution.

EEB 6500a and EEB 6501b, Advanced Topics in Ecology and Evolutionary Biology Vanessa Ezenwa
Topics to be announced. Graded Satisfactory/Unsatisfactory.

EEB 6545a, Responsible Conduct of Research Vanessa Ezenwa
This five-week discussion seminar considers issues related to the responsible conduct of research. Topics addressed include research misconduct, plagiarism, data acquisition and management, mentoring and collaboration, authorship and peer review, the use of animals and humans in scientific research, sexual harassment, diversity, and balancing professional and personal life. Graded Satisfactory/Unsatisfactory. o Course cr

EEB 6901a or b, Research Rotation I Vanessa Ezenwa
Research Rotation I

EEB 6902a or b, Research Rotation II Vanessa Ezenwa
Research Rotation II

EEB 7712b, Foundations of Ecology Martina Dal Bello
This seminar course familiarizes students with foundational concepts and themes in ecology and how they have changed over time. Each week we read and discuss two papers: one classic paper selected from the recently published volume *Foundations of Ecology II: Classic Papers with Commentaries* (Eds. Miller and Travis, 2022) covering the period 1970–1995, and one related contemporary paper published after 2010. We discuss how the concepts and themes introduced in classic papers have influenced the field of ecology and consider how new tools, data, and insights have advanced, diminished, or changed their impact. The *Foundations* book covers many topics, arranged into six core areas. Readings cover all six areas, but the included content varies depending on the interests of the class. Students are responsible for choosing one classic paper from *Foundations*, pairing it with one contemporary paper and leading the discussion during the class meeting. Students also submit short weekly "reflections" in response to a prompt.

EEB 7713a, New Technologies for Biodiversity Monitoring and Conservation Walter Jetz
With ever-growing threats to species worldwide, decision-relevant information is needed to empower local communities, businesses, governments, and conservation practitioners to deliver biodiversity outcomes. Rapidly advancing technologies such as visual and acoustic sensors, eDNA, UAV-based survey approaches, community science, GPS-tracking, computer vision, and AI-informed organismal detections and identifications are hailed as central to this goal and as avenue to accelerate our understanding of biodiversity across scales. In this course we survey and critically assess novel technological avenues for local wildlife monitoring and species assessment. We explore their potential to support global biodiversity monitoring at large and to advance ecological concepts. Each week, we evaluate a different technology arena and discuss its scalability and potential impact in applied and basic ecological contexts. We focus specifically on the use of these methods in currently understudied regions, such as the tropics, and assess the emerging opportunities, as well as limitations and risks, around overcoming existing information and knowledge biases and inequities. Finally, we identify the opportunities for integrating different technologies combined with remote sensing to support a more robust monitoring of planetary biodiversity change. The course consists of faculty, guest, and participant presentations addressing

specific themes, followed by group discussions. Course participants are expected to read literature around both the application and potential broader scientific relevance of new technologies. The course draws on some of our own engagement in the recent XPrize Rainforest Final and the upcoming CBD COP 16 and includes select guest presentations from these arenas. The course is held in weekly intervals and is based on readings from the literature, in-class presentations and discussions, and engagements with guests. This is a seminar course that requires synchronous attendance.

EEB 7820a, Darwinian Thought and Society Brandon Ogbunu
In this seminar, we discuss the work of Charles Darwin and others, focusing on the intersection between their ideas and their social relevance. We examine the fundamental importance of Darwinian thinking, along with more specific concepts such as adaptationism, biological determinism, and discrimination (among others). The course includes substantial reading, writing, and other projects that facilitate a deeper understanding of how Darwin's legacy manifests in contemporary discourses of social significance.

EEB 7870a, Ecological Genomics Jenn Coughlan
In this seminar-style course, we discuss current research on the use of genomics in the study of adaptation. The course covers fundamental concepts in biology, including those in evolutionary ecology and evolutionary genomics, as well as important applied aspects of ecological genomics, such as conservation biology.

EEB 7930a / EPS 7030a, Seminar in Systematics Jacques Gauthier
Topics and class time are chosen by the participants, and have included reading books and/or a series of papers on particular topics (e.g., homology; morphological phylogenetics; evolution of egg colors and exposed nesting in dinosaurs/birds; origin of snake ecology; conflicts between morphology and molecules; role of fossils in phylogenetic inference).

Economics

28 Hillhouse Avenue, 203.432.3575
http://economics.yale.edu
M.A., M.Phil., Ph.D.

Chair
Samuel Kortum

Director of Graduate Studies
Yuichi Kitamura (30 Hillhouse Ave., 203.432.3699, yuichi.kitamura@yale.edu)

Professors Joseph Altonji, Donald Andrews, Konstantinos Arkolakis, Orazio Attanasio, Dirk Bergemann, Steven Berry, Leah Boustan, Xiaohong Chen, Timothy Christensen, Janet Currie, Ray Fair, Howard Forman (*Public Health*), John Geanakoplos, Pinelopi Goldberg, Philip Haile, Marina Halac, Gerald Jaynes, Amit Khandelwal, Yuichi Kitamura, Samuel Kortum, Giovanni Maggi, Costas Meghir, Robert Mendelsohn (*School of the Environment*), A. Mushfiq Mobarak (*Management*), Giuseppe Moscarini, Kaivan Munshi, Christopher A. Neilson, William Nordhaus, Gerard Padró i Miquel, Rohini Pande, Benjamin Polak, Mark Rosenzweig, Larry Samuelson, Katja Seim (*Management*), Tony Smith, Philipp Strack, Aleh Tsyvinski, Edward Vytlacil, Fabrizio Zilibotti

Associate Professors José-Antonio Espín-Sánchez, Zhen Huo, Ilse Lindenlaub, Elliot Lipnowski, Michael Peters, Pascual Restrepo, Nicholas Ryan

Assistant Professors Lauren Bergquist, Cody Cook, Max Cytrynbaum, Eduardo Davila, Mayara Felix, Joel Flynn, Charles Hodgson, John Eric Humphries, Victoria Marone, Yusuke Narita, Cormac O'Dea, Winnie van Dijk

FIELDS OF STUDY

Fields include microeconomics, macroeconomics, econometrics, labor, public finance, industrial organization, international trade and finance, financial economics, environmental economics, economic development, economic history, political economy, and behavioral economics.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Exceptions to the requirements described below may be obtained only by vote of the Economics faculty and will be granted only in recognition of extenuating circumstances.

Prior to Registration for the Second Year

(1.1) Students must have taken for credit and passed at least six economics graduate courses. With the permission of the director of graduate studies (DGS), courses in related fields can be used to fulfill this requirement. (Courses in the International and Development Economics master's program do not satisfy this requirement.) (1.2) Students who earn a grade of HP- or better in each of the four first-year courses in microeconomics and macroeconomics may proceed directly to the second year. In June and August of each year, the department will give waiver exams in micro and macro, written and graded to the extent possible by a committee of faculty who have taught the first-year courses in the previous year. First-year students who do not earn a grade

of HP- or better in each of the first-year micro or macro courses must either take and pass the corresponding exam in June or take the exam in June and then (in the event of failure) take and pass the exam in August in order to continue in the program. A student who obtains an HP- or better in one term of a sequence, but not the other, must take (and retake, if necessary) only the waiver exam corresponding to the term in which they failed to obtain an HP- or better. Students who have not passed all the required examinations prior to the second year of study may register as master's candidates for the following fall term for the purpose of completing enough courses to be eligible for the Master of Arts degree.

Exceptionally well prepared incoming students may petition the DGS and the faculty in the field to take the waiver exam before their first year, with an eye toward placing out of either one or both terms of either of the first-year micro or macro courses. Incoming students taking the waiver exam will be exempt from the corresponding course only if their performance is an exemplary (rather than marginal) pass.

Prior to Registration for the Third Year

(2.1) Students must have met the graduate school's requirement of Honors in two courses. (2.2) Students must have taken at least fourteen term courses in economics and have received a grade of at least a P- in each of them. With the permission of the DGS, courses in related fields and independent reading courses can be used to fulfill this requirement. Workshops may not be used to satisfy it. (2.3) Students must have received an average of at least HP in the courses they have taken. The admissibility of courses for this requirement is the same as for the fourteen-course requirement, (2.2). Grades within the Economics department include pluses and minuses. The grade average is computed as follows. A failure counts as a zero, a P- as a 1, a P as a 2, a P+ as a 3, an HP- as a 4, and so on up to a 9 for an H+. The arithmetic average of these numbers must be at least 4.5. (2.4) All students must have submitted a draft of their empirical paper, discussed in (3.3) below. (2.5) All students must make their first attempt at each of two qualifying examinations by June 30 of their second year in the program. The examinations test a student's general analytic ability in economics and knowledge of two fields chosen by the student. Fields are typically drawn from microeconomics, macroeconomics, econometrics, labor, public finance, industrial organization, international trade and finance, financial economics, environmental economics, economic development, economic history, political economy, and behavioral economics. Students may request examination in a special field designed in consultation with Economics department faculty. The choice of fields must be approved by the DGS. Students may list two preferred examiners in each field. The DGS's office strives to satisfy these preferences subject to faculty availability and the number of students making similar requests. The nature and content of the field qualifying exams will be determined by the faculty in the field (i.e. these exams might require written work, depending on the field). If a student fails a field qualifying exam in the spring of the second year, the student must either retake the exam in that field or may take an exam in a different field. In either case, the student must pass this second attempt, whether in the same field or not, in the fall of the third year to remain in the program.

Admission to Candidacy

The Economics department adheres strictly to the graduate school requirement that students be admitted to candidacy prior to registration for the fourth year of study. Students are recommended to the graduate school for admission to candidacy by vote of the Department of Economics faculty after having completed requirements (2.1), (2.2), and (2.3) above, the graduate school's prospectus requirement, and the following additional requirements. (3.1) Students must have completed two one-term prospectus workshops, one in each term of the third year. All prospectus workshops have the word "prospectus" in their title. If students can find no prospectus workshop corresponding to their interests, they may substitute other workshops to meet this requirement. In order for two workshops to count toward the prospectus requirement, students must make a presentation in each workshop and present original work in one of them. This stipulation applies even if a workshop is not labeled as a prospectus workshop. If students can find no workshop whatsoever in their area of interest, they may substitute an independent study course guided by a faculty member, provided the independent study leads to a dissertation prospectus that is accepted. (3.2) Students must receive a grade of HP- or better in ECON 5551 (Econometrics II) or ECON 5552 (Econometrics III). More advanced courses may be substituted for these with permission of the DGS. (3.3) Students must receive a grade of Satisfactory on an empirical paper, which is evaluated by a faculty adviser or an instructor of ECON 5556. In the paper, the student should (a) specify an economic model useful for the investigation of an interesting economic problem, (b) select data and econometric methods appropriate to the question, (c) conduct proper statistical analysis, and (d) interpret the results in an intelligent way. The paper may be written in the course ECON 5556 or independently with the help of a faculty adviser, the standards for a satisfactory paper being the same in both cases. The paper is not expected to be of publishable or nearly publishable quality but should demonstrate facility in the application of econometric methods to an economic question. *Note:* Jointly authored papers will not be accepted. (3.4) Students must complete with a grade of at least HP- a term of economic history, drawn from a list of courses approved by the DGS and the economic history instructors. (3.5) Students must pass two field qualifying examinations given by committees of faculty members. These exams are discussed in (2.5) above.

Additional Requirements

1. All students must give a dissertation prospectus to their advisory committee by the second Friday in May of their third year.
2. Students must provide, via email, the names of their advisory committee consisting of two members to the DGS's office by February 1 of the third year. The student should indicate which faculty member is the main advisor for the purpose of reviewing their annual DPR (Dissertation Progress Report).
3. In each academic year after the second, all students must regularly attend at least two workshops. At least one of them must be an "informal" prospectus workshop lunch or reading group, and at least one must be a "formal" research workshop. Each student must present at least once a year in one or other of the workshops that they regularly attend in the third and fourth years.

4. Third-year students who have not yet satisfied the empirical paper requirement must submit an empirical paper by February 1.

The Dissertation

The dissertation should make an original contribution to economics that demonstrates the student's mastery of relevant resources and methods. Although the dissertation may cover several related topics, it should have a unifying theme. The dissertation may consist of one or more than one essay. The dissertation is guided by a committee of two advisers, at least one of whom must be a member of the Economics department. The second adviser need not be from the Economics department or even from Yale University. Second advisers from outside the Yale Economics department must be approved by the DGS. The two advisers serve as readers. After the student has completed a first draft of the dissertation, the DGS appoints a third reader. The student and the committee may recommend third readers, but the choice remains with the DGS, since the third reader serves as an independent referee.

Collaborative Work in the Dissertation

The Economics department's objective regarding collaboration is to achieve a reasonable compromise between two goals. While the department wishes to encourage collaborative research among students and between students and faculty, a dissertation should demonstrate the student's ability to do independent research. The dissertation committee and the DGS must approve the inclusion of collaborative work in the dissertation, and students must acknowledge and describe any collaboration in the preface to the dissertation.

Expiration of Admission to Candidacy

Advancement to candidacy expires ten years after the date it is granted, if no dissertation has been submitted and approved in the intervening period.

Normal Sequence of Studies

What follows in the next three paragraphs are recommendations, *not* requirements.

During the fall term of the first year, students usually take ECON 5500 (General Economic Theory: Microeconomics), ECON 5510 (General Economic Theory: Macroeconomics), ECON 5550 (Econometrics I). In the following spring, they usually take ECON 5501 (General Economic Theory: Microeconomics), ECON 5511 (General Economic Theory: Macroeconomics), ECON 5551 (Econometrics II). Students who are well prepared in econometrics may take an advanced econometrics course instead of ECON 5500 in the fall of the first year after consulting the DGS and an appropriate econometrics faculty member.

Students typically also take a course in economic history in either the fall or spring term, that would satisfy the economic history requirement, (3.4) above, if a grade of at least HP- were obtained. Taking the history course in the spring may be more appropriate for students concerned about making the transition to graduate school in the fall.

During the second year, students normally take ECON 5556 and satisfy the empirical paper requirement. Students also take economics courses in specialized fields, such

as economic theory, macroeconomics, econometrics, labor, public finance, industrial organization, international trade and finance, financial economics, environmental economics, economic development, economic history, political economy, and behavioral economics. These courses serve as preparation for the qualifying examinations and allow students to identify potential areas of study for dissertation research. As they identify an area, students should locate a faculty adviser to advise them about their studies. Students may also take courses related to economics from other departments.

The third year is normally devoted to finding a dissertation topic and to beginning research on it. In this year, students are expected to make the transition from being a taker of classes to a participant in research. Important elements in achieving this transition are thinking critically about material learned, reading widely, choosing research topics that are feasible and of interest to the student, and gaining contact with faculty. Students should expect to take the initiative in making such contact.

COMBINED PH.D. DEGREES

A combined degree results in the award of one Ph.D. with two departments named. It is not two separate degrees, and the student is not expected to fulfill all the requirements of both departments.

Purpose Combined degrees are intended to provide a sufficiently broad training program for a student wishing to complete an interdisciplinary dissertation.

Program Design Combined-degree programs are designed on an ad hoc basis by the student, the DGSs of the two departments, and the appropriate associate dean of the graduate school.

Timing Most combined degrees are proposed by students during the summer after the first year of study. Students are not given extra time or funding to complete combined degrees. In particular, students must advance to candidacy by the end of their third year of study.

Degree of Integration A combined program should synthesize the knowledge and methods of the two departments into a single study. Ideally the dissertation should be equally strong in both fields. For example, a dissertation with the first half focused on economics and the second half focused on political science would not be acceptable.

Administrative Requirements An ad hoc combined degree program is established in the following steps.

1. A program is initiated by writing of a pre-prospectus by the student. This document describes how and why the two fields are to be integrated.
2. The student recruits a faculty dissertation adviser from each department and obtains their approval of the pre-prospectus, perhaps modified in response to their advice.
3. The student recruits two other faculty members to serve on the dissertation committee, one from each department.
4. The student discusses the requirements for a combined degree with both departmental DGSs.
5. The student prepares a comprehensive study plan that contains a list of courses and examinations agreed on by both DGSs and approved by both departments. The

goals of the course selection are to give some breadth of knowledge of both fields and prepare the student to complete the dissertation. A key to success in combined programs is not to require too many courses and to focus on preparation for dissertation research. Requirements include successful completion of ECON 5500, ECON 5501, ECON 5510, and ECON 5511 with grades of at least HP-; please see (1.2) for a complete description of the requirement. Normally the two departments administer qualifying examinations. This procedure may require the production of examinations that both departments evaluate simultaneously. The plan of study should contain the following: (a) a cover sheet for approvals by both dissertation advisers, both DGSs, and the appropriate associate dean of the graduate school, (b) an introduction where the student explains the rational for proposing the ad hoc combined degree, and (c) a term-by-term timeline listing all classes, teaching, and required examinations.

6. Both departments must accept the dissertation prospectus.
7. The plan of study is a contract, and the student must receive written permission in advance from both DGSs and the appropriate associate dean of the graduate school for any changes to the plan.
8. Once everyone agrees and the plan of study is approved, the combined program is recorded in Banner.

Funding and Teaching The department that first admitted the student is the "primary department." The student's funding is from the primary department, as is the teaching expectation. Ideally students should obtain teaching experience from both departments.

MASTER'S DEGREES

M.Phil. The M.Phil. degree is awarded to students in the Ph.D. program upon completion of all the requirements for advancement to candidacy for a doctorate in economics except the prospectus and prospectus workshop requirements.

M.A. Students who withdraw from the Ph.D. program may be eligible to receive the M.A. degree if they have met the requirements and have not already received the M.Phil. degree. For the M.A., students must successfully complete at least eight term graduate courses in the Department of Economics. At least six of these courses must be Ph.D. courses in the Department of Economics (not courses from the International and Development Economics master's program). The average grade of all the graduate courses taken that are listed or cross-listed by the Department of Economics must be at least a High Pass, and at least two of these grades must be Honors. Students must complete at least two of the three first-year two-course sequences in microeconomics, macroeconomics, or econometrics. In computing the grade average, the relevant grades are those reported to the registrar and so do not include pluses or minuses. A Fail counts as a zero, a Pass counts as a 1, a High Pass counts as a 2, and an Honors counts as a 3. To say that the average grade must be High Pass means that the arithmetic average of these numbers must be at least 2. Candidates in combined programs will be awarded the M.A. only when the master's degree requirements for both programs have been met.

J.D./M.A. Degree Program Students working toward a J.D. in the Law School may earn an M.A. degree in Economics. The degree requirements that apply to these students are the same as those described above. Students wishing to join this J.D./M.A.

joint-degree program must apply for separate admission to the Economics graduate program; applicants should submit scores from the GRE General Test. Students admitted to this program pay three years of tuition to the Law School and one year of tuition to the graduate school. The graduate school does not offer fellowship support to J.D./M.A. candidates.

The M.A. in International and Development Economics is described under International and Development Economics.

COURSES

ECON 5500a and ECON 5501b, General Economic Theory: Microeconomics Staff
Introduction to optimization methods and partial equilibrium. Introduction to decision making under uncertainty. Theories of utility and consumer behavior production and firm behavior. General equilibrium and welfare economics. Allocations involving time and uncertainty and incomplete markets.

ECON 5510a and ECON 5511b, General Economic Theory: Macroeconomics Staff
Analysis of short-run determination of aggregate employment, income, prices, and interest rates in closed and open economies. Stabilization policies.

ECON 5520a, Advanced Microeconomic Theory I Philipp Strack
A formal introduction to game theory and information economics. Alternative non-cooperative solution concepts are studied and applied to problems in oligopoly, bargaining, auctions, strategic social choice, and repeated games.

ECON 5521b, Advanced Microeconomic Theory II Juuso Valimaki
Contracts and the economics of organization. Topics may include dynamic contracts (both explicit and implicit), career concerns, hierarchies, Bayesian mechanism design, renegotiation, and corporate control.

ECON 5522a, Microeconomic Theory Lunch Staff
A forum for advanced students to critically examine recent papers in the literature and present their own work.

ECON 5525a, Advanced Macroeconomics I Pascual Restrepo
Heterogeneous agent economics, investment, scrapping and firing, nonquadratic adjustment costs, financial constraints, financial intermediation, psychology of decision making under risk, optimal risk management, financial markets, consumption behavior, monetary policy, term structure of interest rates.

ECON 5526b, Advanced Macroeconomics II Ilse Lindenlaub and Joel Flynn
Macroeconomic equilibrium in the presence of uninsurable labor income risk. Implications for savings, asset prices, unemployment.

ECON 5530a, General Equilibrium Foundations of Finance and Macroeconomics John Geanakoplos
The course gives a careful mathematical description of the general equilibrium underpinnings of the main models of finance and the new macroeconomics of collateral and default. Part I is a review of Walrasian general equilibrium, including the mathematical techniques of fixed points and genericity, both taught from an elementary point of view. Part II covers general equilibrium with incomplete markets (GEI). Part III focuses on the special case of the capital asset pricing model (CAPM), including extensions to multi-commodity CAPM and multifactor CAPM. Part IV focuses on

the Modigliani-Miller theorem and generic constrained inefficiency. Part V describes collateral equilibrium and the leverage cycle. Part VI covers default and punishment and adverse selection and moral hazard in general equilibrium. Part VII describes monetary equilibrium.

ECON 5531b, Mathematical Economics II Herakles Polemarchakis
This course examines the foundations of money and finance from the perspective of general equilibrium with incomplete markets. The relevant mathematical tools from elementary stochastic processes to differential topology are developed in the course. Topics include asset pricing, variations of the capital asset pricing model, the "Hahn paradox" on the value of flat money, default and bankruptcy, collateral equilibrium, market crashes, adverse selection and moral hazard with perfect competition, credit card equilibrium, and general equilibrium with asymmetric information.

ECON 5538a, Microeconomic Theory Workshop Staff
Presentations by research scholars and participating students.

ECON 5540a, Student Workshop in Macroeconomics Staff
A course that gives third- and fourth-year students doing research in macroeconomics an opportunity to prepare their prospectuses and to present their dissertation work. Each student is required to make at least two presentations per term. For third-year students and beyond, at least one of the presentations in the first term should be a mock job talk.

ECON 5542a, Macroeconomics Workshop Staff
A forum for presentation and discussion of state-of-the-art research in macroeconomics. Presentations by research scholars and participating students of papers in closed economy and open economy macroeconomics and monetary economics.

ECON 5545a, Microeconomics Michael Boozer
A survey of the main features of current economic analysis and of the application of the theory to a number of important economic questions, covering microeconomics and demand theory, the theory of the firm, and market structures. For IDE students.

ECON 5546a, Growth and Macroeconomics Ana Fieler
This course presents a basic framework to understand macroeconomic behavior and the effects of macroeconomic policies. Topics include consumption and investment, labor market, short-run income determinations, unemployment, inflation, growth, and the effects of monetary and fiscal policies. The emphasis is on the relation between the underlying assumptions of macroeconomic framework and policy implications derived from it.

ECON 5547b, Social Networks and Economic Development Kaivan Munshi
The objective of this course is to study the emerging literature on social networks and economic development. Both theoretical and empirical research papers are covered, at a level that is suitable for the advanced undergraduate or graduate student. The course is divided into three sections: (1) Labor Markets and Migration: how community networks support their members in the labor market and how they support their spatial and occupational mobility during the process of development; (2) Commitment: how communities use social ties to solve commitment problems in developing economics, both in theory and in practice; (3) Inter-Group Interactions: community networks do not operate independently, and a nascent literature is starting to investigate the nature

of these group interactions. Time permitting, we examine the role played by networks in the diffusion of information at the end of the course. Prerequisites: intermediate microeconomics, introductory econometrics, and data analysis. Students are expected to be familiar with calculus, basic microeconomics, and basic econometrics.

ECON 5548b / PLSC 7210b, Political Economy of Development Rohini Pande and Gerard Padro

This course analyzes empirically and theoretically the political, institutional, and social underpinnings of economic development. We cover an array of topics ranging from power structures to corruption, state capacity, social capital, conflict, democratization, and democratic backsliding. We focus on recent advances to identify open areas for further research.

ECON 5550a, Econometrics I Staff

Probability: concepts and axiomatic development. Data: tools of descriptive statistics and data reduction. Random variables and probability distributions; univariate distributions (continuous and discrete); multivariate distributions; functions of random variables and transformations; the notion of statistical inference; sampling concepts and distributions; asymptotic theory; point and interval estimation; hypothesis testing.

ECON 5551b, Econometrics II Ed Vytlacil

Provides a basic knowledge of econometric theory, and an ability to carry out empirical work in economics. Topics include linear regression and extensions, including regression diagnostics, generalized least squares, statistical inference, dynamic models, instrumental variables and maximum likelihood procedures, simultaneous equations, nonlinear and qualitative-choice models. Examples from cross-section, time series, and panel data applications.

ECON 5552a, Econometrics III Yuichi Kitamura

The treatment of the subject is rigorous, attentive to modern developments, and proceeds to research level in several areas. Linear models from core curriculum. Topics include linear estimation theory, multiple and multivariate regressions, Kruskal's theorem and its applications, classical statistical testing by likelihood ratio, Lagrange multiplier and Wald procedures, bootstrap methods, specification tests, Stein-like estimation, instrumental variables, and an introduction to inferential methods in simultaneous stochastic equations.

ECON 5553b, Econometrics IV: Econometrics of Dependent Data Timothy Christensen

A sequel to ECON 551 or ECON 552, this research-level course explores the econometrics of dependent data. It introduces frontier theory and methods for a variety of data structures. Topics range from time-series and panel data through to data with spatial, cluster, or network dependence, but the specific focus may vary each year at the instructor's discretion. Applications span many fields of empirical economics, such as macro, trade, and industrial organization.

ECON 5554b, Econometrics V Xiaohong Chen

The first half of this course is about nonlinear parametric models. Specification, estimation, and testing within the Likelihood and Generalized Method of Moments frameworks. First-order asymptotics for both smooth and non-smooth objective functions. Efficiency and robustness. A short account of high-order asymptotics

for smooth problems. The second part is on nonparametric and semiparametric methods. Nonparametric estimation by kernels, series, splines, and other methods. Bias reduction and bandwidth selection. The course of dimensionality and additive models. Specification and estimation of semiparametric models. U-statistics and asymptotic properties. Efficiency and adaptation.

ECON 5556a, Topics in Empirical Economics and Public Policy Philip Haile, Charles Hodgson, and Joseph Altonji
Methods and approaches to empirical economic analysis are reviewed, illustrated, and discussed with reference to specific empirical studies. The emphasis is on learning to use methods and on understanding how specific empirical questions determine the empirical approach to be used. We review a broad range of approaches including program evaluation methods and structural modeling, including estimation approaches, computational issues, and problems with inference. Open only to doctoral students in the Department of Economics. Exceptionally, doctoral students from other departments may take the course for credit if a faculty member, normally from their department, can supervise and grade their term paper.

ECON 5558a, Econometrics Michael Boozer
Application of statistical analysis to economic data. Basic probability theory, linear regression, specification and estimation of economic models, time series analysis, and forecasting. The computer is used. For IDE students.

ECON 5559b, Development Econometrics (IDE) Michael Boozer
Development Econometrics (IDE)

ECON 5565b / CPSC 5630b, Algorithms via Convex Optimization Nisheeth Vishnoi
Convex optimization has played a major role in the recent development of fast algorithms for problems arising in areas such as theoretical computer science, discrete optimization, and machine learning. The approach is to first formulate the problem as a continuous (convex) optimization problem, even if the problem may be over a discrete domain, adapt or develop deterministic or randomized continuous-time dynamical systems to solve it, and then design algorithms for the problem via appropriate discretizations. The goal of this course is to design state-of-the-art algorithms for various classical discrete problems through the use of continuous optimization/sampling. The algorithmic applications include maximum flow in graphs, maximum matching in bipartite graphs, linear programming, submodular function minimization, and counting problems involving discrete objects such as matroids. We present approaches gradient descent, mirror descent, interior-point methods, and cutting plane methods. A solid background in calculus, linear algebra, and probability is recommended. It is intended for students who are comfortable with proofs.

ECON 5568a, Econometrics Workshop Staff
A forum for state-of-the-art research in econometrics. Its primary purpose is to disseminate the results and the technical machinery of ongoing research in theoretical and applied fields.

ECON 5570a, Prospectus Workshop in Econometrics Staff
A course for third- and fourth-year students doing research in econometrics to prepare their prospectus and present dissertation work.

ECON 5580a, General Economic History: Western Europe Jose-Antonio Espin-Sanchez
This course examines the economic development of Western Europe from the medieval period to modern times, with particular emphasis on institutional changes, technological progress, and structural transformation. The course explores major historical periods including the Commercial Revolution, the Black Death, and the Industrial Revolution while analyzing their causes and consequences. Students will engage with comparative perspectives that place Western European development in global context, particularly in relation to China, India, and Japan. The course covers key themes including demographic transitions, the evolution of markets and trade, state formation, financial innovations, labor institutions, human capital development, and historical patterns of inequality. Each week introduces a different empirical methodology commonly used in economic history research, showing how these approaches can be applied to historical questions using original data and case studies. Through analysis of these diverse topics and methods, students will develop a comprehensive understanding of how historical processes shaped modern economic growth and contemporary economic structures. Prerequisites: simultaneous enrollment in or successful completion of ECON 5500 and ECON 5510; permission of the instructor.

ECON 5581b, American Economic History Staff
This course examines both the long-term factors (such as industrialization and the development of markets) and the epochal events (such as the Revolution, Civil War, and Great Depression) that have shaped the development of the American economy. The objectives of this course are to familiarize students with the major topics and debates in American economic history. Prerequisites: concurrent enrollment in or successful completion of ECON 501 and ECON 510.

ECON 5588a, Economic History Lunch Staff
A forum for discussion and criticism of research in progress. Presenters include graduate students, Yale faculty, and visitors. Topics concerned with long-run trends in economic organization are suitable for the seminar. Special emphasis given to the use of statistics and of economic theory in historical research.

ECON 5589a, Economic History Workshop Staff
A forum for discussion and criticism of research in progress. Presenters include graduate students, Yale faculty, and visitors. Topics concerned with long-run trends in economic organization are suitable for the seminar. Special emphasis given to the use of statistics and of economic theory in historical research.

ECON 6600a, Industrial Organization I Philip Haile and Charles Hodgson
Begins by locating the study of industrial organization within the broader research traditions of economics and related social sciences. Alternative theories of decision making, of organizational behavior, and of market evolution are sketched and contrasted with standard neoclassical theories. Detailed examination of the determinants and consequences of industrial market structure.

ECON 6601b, Industrial Organization II Steven Berry and Katja Seim
Examination of alternative modes of public control of economic sectors with primary emphasis on antitrust and public utility regulation in the U.S. economy. Public policy issues in sectors of major detailed governmental involvement.

ECON 6606a, Prospectus Workshop in Industrial Organization Staff
For third-year students in microeconomics, intended to guide students in the early stages of theoretical and empirical dissertation research. Emphasis on regular writing assignments and oral presentations.

ECON 6608a, Industrial Organization Seminar Staff
For advanced graduate students in applied microeconomics, serving as a forum for presentation and discussion of work in progress of students, Yale faculty members, and invited speakers.

ECON 6630a and ECON 6631b, Labor Economics Staff
Topics include static and dynamic approaches to demand, human capital and wage determination, wage income inequality, unemployment and minimum wages, matching and job turnover, immigration and international trade, unions, implicit contract theory, and efficiency wage hypothesis.

ECON 6638a, Labor and Population Workshop Staff
A forum primarily for graduate students to present their research plans and findings. Discussions encompass empirical microeconomic research relating to both high- and low-income countries.

ECON 6640a, Prospectus Workshop in Labor Economics and Public Finance Staff
Workshop for students doing research in labor economics and public finance.

ECON 6642a, Topics in Public Economics Winnie van Dijk
This course discusses a selection of topics related to the design and evaluation of government policy, with a focus on government expenditures, education, health, housing, and anti-poverty policies in high-income countries. We emphasize recent empirical research, and we discuss how the availability of new types of data, such as administrative datasets and customized survey and experimental data, have enabled researchers to use new empirical methods and to open up new areas of study. The course has two objectives. The first objective is to familiarize Ph.D. students with some of the theoretical frameworks, data, and empirical methods that are used in public economics research at the frontier. The second objective is to guide students in developing a proposal for an empirical research project. This course is intended for Ph.D. students in applied fields who are planning to do empirical research as part of their dissertation. The first-year Ph.D. sequence in economics (or equivalent) is a prerequisite.

ECON 6670a / MGMT 7204a, Financial Economics I Stefano Giglio
Current issues in theoretical financial economics are addressed through the study of current papers. Focuses on the development of the problem-solving skills essential for research in this area.

ECON 6677a / MGMT 7206a, Financial Econometrics and Machine Learning Bryan Kelly
This course, taught in the first half of the term, provides a theoretical treatment of major topics in corporate finance and banking, including: capital structure; incomplete contract and ownership; agency theory, information, and financial contracting; corporate finance and financial market; banking and intermediaries; and recent topics relating to financial crises. Economics Ph.D. students need to take both this course and

Empirical Corporate Finance (ECON 676/MGMT 748) to obtain credit; then, together, they will be counted as one credit. ½ Course cr

ECON 6679a, Financial Economics Student Lunch Staff
This workshop is for third-year and other advanced students in financial economics. It is intended to guide students in the early stages of dissertation research. The emphasis is on presentation and discussion of materials presented by students that will eventually lead to dissertation topics. Open to third-year and advanced Ph.D. students only.

ECON 6680a, Public Finance I Orazio Attanasio and Felix Bierbrauer
Major topics in public finance including externalities, public goods, benefit/cost analysis, fiscal federalism, social insurance, retirement savings, poverty and inequality, taxation, and others. Applications are provided to crime, education, environment and energy, health and health insurance, housing, and other markets and domains. The course covers a variety of applied methods including sufficient statistics, randomized control trials, hedonic models, regression discontinuity, discrete choice, spatial equilibrium, dynamic growth models, differences-in-differences, integrated assessment models, applied general equilibrium, event studies, firm production functions, learning models, general method of moments, and propensity-score reweighting estimators.

ECON 6681b, Public Finance II Christopher Neilson and Cody Cook
Major topics in public finance including externalities, public goods, benefit/cost analysis, fiscal federalism, social insurance, retirement savings, poverty and inequality, taxation, and others. Applications are provided to crime, education, environment and energy, health and health insurance, housing, and other markets and domains. The course covers a variety of applied methods including sufficient statistics, randomized control trials, hedonic models, regression discontinuity, discrete choice, spatial equilibrium, dynamic growth models, differences-in-differences, integrated assessment models, applied general equilibrium event studies, firm production functions, learning models, general method of moments, and propensity-score reweighting estimators.

ECON 7706a, Prospectus Workshop in International and Spatial Economics Staff
This workshop is for third-year and other advanced students in international economic fields. It is intended to guide students in the early stages of dissertation research. The emphasis is on students' presentation and discussion of material that will eventually lead to the prospectus.

ECON 7720a, International Trade I Costas Arkolakis and Amit Khandelwal
The first part of this course covers the basic theory of international trade, from neoclassical theory where trade is the result of comparative advantage (Ricardo, Heckscher-Ohlin) to the "New Trade Theory" where trade is generated by imperfect competition and increasing returns to scale. Particular emphasis is placed on the implications of the different theories concerning the aggregate gains or losses from trade and the distributional implications of trade liberalization. The second part of the course explores new advances in the field. It covers the Eaton-Kortum (2002) and Melitz (2003) models; extensions of these models with many countries, multiproduct firms, and sectors; methods of quantitative trade analysis to revisit classic questions (gains from trade, distributional effects of trade, trade policy); and new advances in dynamic trade theory.

ECON 7721b, International Trade II Staff
The course covers empirical topics in international trade with particular emphasis on current research areas. Topics include tests of international trade theories; studies of the relationship between international trade, labor markets, and income distribution; recent trade liberalization episodes in developing countries; empirical assessment of various trade policies, such as VERs and Anti-Dumping; productivity (and its relation to international trade liberalization); and exchange rates, market integration, and international trade. Methodologically, the course draws heavily on empirical models used in the fields of industrial organization and to a lesser degree labor economics; taking these courses is thus recommended though not required.

ECON 7724a, International Finance Ana Fieler
A study of how consumers and firms are affected by the globalization of the world economy. Topics include trade costs, the current account, exchange rate pass-through, international macroeconomic co-movement, multinational production, and gains from globalization. Prerequisite: intermediate macroeconomics or equivalent.

ECON 7728a / MGMT 521a, Workshop: International Trade Staff
Workshop/seminar for presentations and discussion on topics in the field of international trade.

ECON 7730a, Economic Development I Mushfiq Mobarak and Mark Rosenzweig
Development theory at both aggregate and sectoral levels; analysis of growth, employment, poverty, and distribution of income in both closed and open developing economy contexts.

ECON 7731b, Economic Development II Lauren Bergquist and Nicholas Ryan
Analysis of development experiences since World War II. Planning and policy making across countries and time. Models of development, growth, foreign trade, and investment. Trade, capital, and technology flows and increasing interdependence. The political economy of policy making and policy reform.

ECON 7732b, Advanced Economic Development Michael Boozer
Examines the models of classical and modern economists to explain the transition of developing economies into modern economic growth, as well as their relevance to income distribution, poverty alleviation, and human development.

ECON 7750a, Trade and Development Workshop Staff
A forum for graduate students and faculty with an interest in the economic problems of developing countries. Faculty, students, and a limited number of outside speakers discuss research in progress.

ECON 7756a, Prospectus Workshop in Development Staff
Workshop for students doing research in development to present and discuss work.

ECON 7794b, International Trade Policy Giovanni Maggi
Theoretical and empirical research in international trade policy. The course focuses on welfare analysis of trade policies under perfect completion and under oligopoly; the political economy of trade policy; and the economics and political economy of international trade agreements. Prerequisites: ECON 500 and 501.

ECON 8899a or b, Individual Reading and Research Staff
By arrangement with faculty.

Electrical and Computer Engineering

17 Hillhouse Avenue, 203.432.4220
M.S., M.Phil., Ph.D.

Chair
Jung Han

Director of Graduate Studies
Hong Tang (hong.tang@yale.edu)

Professors Hui Cao,* Ronald Coifman,† James Duncan,* Anna Gilbert,† Jung Han, Liangbing Hu, Roman Kuc, Rajit Manohar, A. Stephen Morse, Kumpati Narendra (*Emeritus*), Daniel Prober,* Lawrence Staib,* Hemant Tagare,* Hong Tang, Leandros Tassiulas, J. Rimas Vaisnys (*Emeritus*), Fengnian Xia, Y. Richard Yang*

Associate Professors Amin Karbasi, Robert Soule,* Sekhar Tatikonda*

Assistant Professors Tara Boroushaki, Claudia Cea, Dionysis Kalogerias, Boris Landa, Mengxia Liu, Owen Miller,* Priyadarshini Panda, Shreya Saxena,* Linghao Song

* A secondary appointment with primary affiliation in another department or school

† A joint appointment with another department

FIELDS OF STUDY

Fields include biomedical sensory systems, communications and signal processing, neural networks, control systems, wireless networks, sensor networks, microelectromechanical and nanomechanical systems, nanoelectronic science and technology, optoelectronic materials and devices, semiconductor materials and devices, quantum and nonlinear photonics, quantum materials and engineering, computer engineering, computer architecture, hardware security, neuromorphic computing, and VLSI design.

For degree requirements and courses, see Engineering & Applied Science.

Engineering & Applied Science

7 Hillhouse Avenue, 203.432.4220
http://seas.yale.edu
M.S., M.Phil., Ph.D.

Dean
Jeffrey Brock

Deputy Dean
Vincent Wilczynski

Chief of Staff and Associate Dean for Strategic Initiatives
Sarah M. Miller

Associate Dean for Faculty Affairs
Kristin Flower

Deputy Dean for Faculty Development
Julie Dorsey

Deputy Dean for Innovation and Entrepreneurship
Rajit Manohar

Deputy Dean for Research
Vidvuds Ozolins

Deputy Dean for Academic Affairs
W. Mark Saltzman

APPLIED PHYSICS

Chair
Vidvuds Ozolins

Director of Graduate Studies
Daniel Prober (BCT 417; 203.432.4280; daniel.prober@yale.edu)

Professors Charles Ahn, Sean Barrett (*Physics*), Hui Cao, Michel Devoret, Paul Fleury (*Emeritus*), Steven Girvin (*Physics*), Leonid Glazman (*Physics*), Jack Harris (*Physics*), Victor Henrich (*Emeritus*), Sohrab Ismail-Beigi, Marshall Long (*Mechanical Engineering & Materials Science*), Simon Mochrie, Corey O'Hern (*Mechanical Engineering & Materials Science*), Vidvuds Ozolins, Daniel Prober, Nicholas Read, Peter Schiffer, Robert Schoelkopf, Ramamurti Shankar (*Physics*), Mitchell Smooke (*Mechanical Engineering & Materials Science*), A. Douglas Stone, Hong Tang (*Electrical Engineering*), Robert Wheeler (*Emeritus*), Werner Wolf (*Emeritus*)

Associate Professors Michael Choma (*Biomedical Engineering*), Peter Rakich

Assistant Professors Yu He, Owen Miller, Shruti Puri

BIOMEDICAL ENGINEERING

Chair
James Duncan

Director of Graduate Studies
Kathryn Miller-Jensen (kathryn.miller-jensen@yale.edu)

Professors Helene Benveniste,* Joerg Bewersdorf,* Stuart Campbell, Richard Carson,† Nicholas Christakis,* Todd Constable,* Robin de Graaf,* James Duncan,† Rong Fan, Anjelica Gonzalez, Michelle Hampson,* Michael Higley,* Henry Hsia,* Jay Humphrey, Fahmeed Hyder,† Farren Isaacs,* Themis Kyriakides,† Francis Lee,* Andre Levchenko, Chi Liu, Graeme Mason,* Kathryn Miller-Jensen, Evan Morris,* Xenophon Papademetris,* Dana Peters,* Douglas Rothman,† W. Mark Saltzman, Martin Schwartz,* Fred Sigworth,* Albert Sinusas,* Brian Smith,* Lawrence Staib,† Hemant Tagare,* John Tsang,* Paul Van Tassel,* Jiangbing Zhou,* Steven Zucker†

Associate Professors Fadi Akar,* Julius Chapiro, Tarek Fahmy, Gigi Galiana,* Chenxiang Lin,* Michael Murrell, Yibing Qyang*

Assistant Professors Sanjay Aneja,* Daniel Coman,* Purushottam Dixit,* Nicha Dvornek,* Paul Han,* Aaron Kuan,* Evelyn Lake, Xiaofeng Liu,* Chao Ma,* John Onofrey, Cristina Rodriguez, Shreya Saxena, Dustin Scheinost*

CHEMICAL AND ENVIRONMENTAL ENGINEERING

Chair
John Fortner

Director of Graduate Studies
Mingjiang Zhong (mingjiang.zhong@yale.edu)

Professors Eric Altman, Paul Anastas,* Michelle Bell,* John Fortner, Gary Haller (*Emeritus*), Edward Kaplan, Jaehong Kim, Michael Loewenberg, Jordan Peccia, Lisa Pfefferle, W. Mark Saltzman,* Udo Schwarz,* T. Kyle Vanderlick, Paul Van Tassel, Julie Zimmerman†

Associate Professor Nicole Deziel,* Drew Gentner, Krystal Pollitt*

Assistant Professors Peijun Guo, Amir Haji-Akbari, Shu Hu, David Kwabi, Lea Winter, Yuan Yao,* Mingjiang Zhong

Lecturer Colby Buehler, Yehia Khalil

COMPUTER SCIENCE

Chair
Zhong Shao

Directors of Graduate Studies
Lin Zhong (lin.zhong@yale.edu)
Vladimir Rokhlin

Professors Dana Angluin (*Emerita*), James Aspnes, Dirk Bergemann,* Abhishek Bhattacharjee, Ronald Coifman,* Aaron Dollar,* Julie Dorsey, Joan Feigenbaum, Michael Fischer, Robert Frank,* David Gelernter, Mark Gerstein,* John Lafferty,* Rajit Manohar,* Vladimir Rokhlin,† Holly Rushmeier, Brian Scassellati, Martin Schultz (*Emeritus*), Zhong Shao, Avi Silberschatz, Daniel Spielman, Phillipp Strack,* Leandros Tassiulas,* Nisheeth Vishnoi, Y. Richard Yang, Lin Zhong, Steven Zucker†

Associate Professors Yang Cai, Theodore Kim, Smita Krishnaswamy,* Sahand Negahban,* Charalampos Papamanthou, Ruzica Piskac, Robert Soule, Jakub Szefer*

Assistant Professors Ian Abraham,* Kim Blenman,* Arman Cohan, Yongshan Ding, Benjamin Fisch, Tesca Fitzgerald, Julian Jara-Ettinger,* Anurag Khandelwal, Quanquan Liu, Tom McCoy,* Daniel Rakita, Katerina Sotiraki, David van Dijk,* Marynel Vázquez, Andre Wibisono, Alex Wong, Zhitao Ying, Manolis Zampetakis

Senior Lecturers James Glenn, Stephen Slade

Lecturers Timos Antonopoulos, Timothy Barron, Ozan Erat, Kyle Jensen,* Janet Kayfetz, Jay Lim, Dylan McKay, Cody Murphey, Sohee Park, Scott Petersen, Brad Rosen, Alan Weide, Cecillia Xie

ELECTRICAL AND COMPUTER ENGINEERING

Chair
Jung Han

Director of Graduate Studies
Hong Tang (hong.tang@yale.edu)

Professors Hui Cao,* Ronald Coifman,† James Duncan,* Anna Gilbert,† Jung Han, Liangbing Hu, Roman Kuc, Rajit Manohar, A. Stephen Morse, Kumpati Narendra (*Emeritus*), Daniel Prober,* Lawrence Staib,* Hemant Tagare,* Hong Tang, Leandros Tassiulas, J. Rimas Vaisnys (*Emeritus*), Fengnian Xia, Y. Richard Yang*

Associate Professors Amin Karbasi, Robert Soule,* Sekhar Tatikonda*

Assistant Professors Tara Boroushaki, Claudia Cea, Dionysis Kalogerias, Boris Landa, Mengxia Liu, Owen Miller,* Priyadarshini Panda, Shreya Saxena,* Linghao Song

MATERIALS SCIENCE

Chair
Charles Ahn

Director of Graduate Studies
Liangbing Hu (liangbing.hu@yale.edu)

Professors Charles Ahn,† Gary Brudvig,* Liangbing Hu,† Sohrab Ismail-Beigi,† Corey O'Hern,* Vidvuds Ozolins,† W. Mark Saltzman,* Jan Schroers,† Udo Schwarz,* Hailiang Wang,* Fengnian Xia*

Associate Professors Rebecca Kramer-Bottiglio,* Madhusudhan Venkadesan,* Mingjiang Zhong*

Assistant Professors Amir Pahlavan,* Diana Qiu, Cong Su

MECHANICAL ENGINEERING

Chair
Udo Schwarz

Director of Graduate Studies
Jan Schroers (jan.schroers@yale.edu)

Professors Charles Ahn,† Ira Bernstein (*Emeritus*), Juan Fernández de la Mora, Aaron Dollar, Alessandro Gomez, Sohrab Ismail-Beigi,* Shun-Ichiro Karato,* Marshall Long (*Emeritus*), Corey O'Hern, Vidvuds Ozolins,* Brian Scassellati,* Jan Schroers, Udo Schwarz, Mitchell Smooke

Associate Professors Rebecca Kramer-Bottiglio, Madhusudhan Venkadesan

Assistant Professors Ian Abraham, Yimin Luo, Amir Pahlavan, Bauyrzhan Primkulov, Daniel Wiznia*

Senior Lecturer Beth Anne Bennett

Lecturers Lawrence Wilen, Joseph Zinter

* A secondary appointment with primary affiliation in another department or school.

† A joint appointment with another department.

Programs of study are offered in the areas of applied physics, biomedical engineering, chemical and environmental engineering, computer science, electrical engineering and computer engineering, materials science, and mechanical engineering. All programs are under the School of Engineering & Applied Science.

APPLIED PHYSICS

Fields of Study

Fields include areas of theoretical and experimental condensed-matter and materials physics, optical and laser physics, quantum engineering, and nanoscale science. Specific programs include surface and interface science, first principles electronic structure methods, photonic materials and devices, complex oxides, magnetic and superconducting artificially engineered systems, quantum computing and superconducting device research, quantum transport and nanotube physics, quantum optics, and random lasers.

BIOMEDICAL ENGINEERING

Fields of Study

The department spans the fields of biomechanics and mechanobiology, biomolecular engineering and biomaterials, systems biology, bioimaging and biosensing, drug delivery, and computational modeling and analysis.

CHEMICAL AND ENVIRONMENTAL ENGINEERING

Fields of Study

Fields include nanomaterials, polymers, interfacial phenomena, energy, water and air quality, environmental microbiology, carbon capture, and sustainability.

COMPUTER SCIENCE

Fields of Study

Algorithms and computational complexity, artificial intelligence, data networking, databases, graphics, machine learning, programming languages, robotics, scientific computing, security and privacy, and systems.

ELECTRICAL AND COMPUTER ENGINEERING

Fields of Study

Fields include biomedical sensory systems, communications and signal processing, neural networks, control systems, wireless networks, sensor networks, microelectromechanical and nanomechanical systems, nanoelectronic science and technology, optoelectronic materials and devices, semiconductor materials and devices, quantum and nonlinear photonics, quantum materials and engineering, computer engineering, computer architecture, hardware security, neuromorphic computing, and VLSI design.

MATERIALS SCIENCE

Fields of Study

Quantum and low dimensional materials; energy materials; soft, polymer, and bio materials; electronic and optical materials; metals, ceramics, and structural materials; and computational materials science.

MECHANICAL ENGINEERING

Fields of Study

Fluids and thermal sciences Electrospray theory and characterization; electrical propulsion applications; aerodynamic instrumentation for separation of clusters and aerosol particles; heterogeneous nucleation in the gas phase; combustion and flames; computational methods for fluid dynamics and reacting flows; interfacial flows and instabilities and transport phenomena in disordered media.

Soft matter/complex fluids Jamming and slow dynamics in gels, glasses, and granular materials; mechanical properties of soft and biological materials; rheology and statistical mechanics of muscle; structure and dynamics of proteins and other macromolecules and wetting of soft solids, elastocapillarity, poroelasticity, microrheology and scattering.

Robotics/mechatronics Machine and mechanism design; dynamics and control; robotic grasping and manipulation; legged locomotion; multi-agent search and exploration; optimal control for learning; model-predictive control; reinforcement learning; human-machine interface; rehabilitation robotics; haptics; soft robotics; flexible and stretchable electronics; soft material manufacturing; responsive material actuators; artificial muscle; soft-bodied control; electromechanical energy conversion; biomechanics of human movement and human-powered vehicles.

Bioengineering Engineering sciences of living systems; biomolecular structure; biomechanics; motor control; animal locomotion; cell and tissue mechanics;

biomaterials and therapeutics; human health and orthopaedics; bio-inspired computation and design; biomaterials and cell-material interaction.

INTEGRATED GRADUATE PROGRAM IN PHYSICAL AND ENGINEERING BIOLOGY (PEB)

Students applying to the Ph.D. program in Applied Physics, Biomedical Engineering, Chemical and Environmental Engineering, and Materials Science may also apply to be part of the PEB program. See the description under Non-Degree-Granting Programs, Councils, and Research Institutes for course requirements, and http://peb.yale.edu for more information about the benefits of this program and application instructions.

QUANTUM MATERIALS SCIENCE AND ENGINEERING (QMSE)

Students applying to the Ph.D. program in Applied Physics or Materials Science may also apply to be part of the QMSE program. See the description under Non-Degree-Granting Programs, Councils, and Research Institutes for course requirements.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

The online publication *Qualification Procedure for the Ph.D. Degree* describes in detail all requirements in Biomedical Engineering, Chemical and Environmental Engineering, Electrical and Computer Engineering, Mechanical Engineering, and Materials Science. The student is strongly encouraged to read it carefully; key requirements are briefly summarized below. See Computer Science's departmental entry in this bulletin for special requirements for the Ph.D. in Computer Science and the Applied Physics departmental entry for special requirements for the Ph.D. in Applied Physics.

Students plan their course of study in consultation with faculty advisers (the student's advisory committee). A minimum of ten term courses is required, to be completed in the first two years. Well-prepared students may petition for course waivers based on courses taken in a previous graduate degree program. Similarly, students may place out of certain ENAS courses via an examination prepared by the course instructor. Placing out of the course will not reduce the total number of required courses. Core courses, as identified by each department, should be taken in the first year unless otherwise noted by the department. With the permission of the departmental director of graduate studies (DGS), students may substitute more advanced courses that cover the same topics. During the first year, students are required to register for two Special Investigations; any additional terms of Special Investigations will not count toward the degree. At least two elective courses must be outside the area of the dissertation. All students must complete a one-term course, Responsible Conduct of Research, in the first year of study.

Each term, the faculty review the overall performance of the student and report their findings to the DGS who, in consultation with the deputy dean, determines whether the student may continue toward the Ph.D. degree. By the end of the second term, it is expected that a faculty member has agreed to accept the student as a research assistant, and it is required that by the beginning of the third term, the faculty adviser provides the financial support indicated in the admissions offer letter, barring the award of external funding to the student. The acceptance of the student into a faculty member's laboratory, along with the associated financial support, on this time schedule

is required for the student to remain in good standing. By December 5 of the third year, an area examination must be passed and a written prospectus submitted before dissertation research is begun. These events result in the student's admission to candidacy. Subsequently, the student will report orally each year to the full advisory committee on progress. When the research is nearing completion, but before the thesis writing has commenced, the full advisory committee will advise the student on the thesis plan. A final oral presentation of the dissertation research is required to be given during term time. There is no foreign language requirement.

Teaching experience is regarded as an integral part of the graduate training program at Yale University, and all engineering graduate students are required to serve as teaching fellows for two terms, typically during year two. Teaching duties normally involve assisting in laboratories or discussion sections and grading papers and are not expected to require more than ten hours per week. Students are not permitted to teach during their first year of study.

If a student was admitted to the program having earned a score of less than 26 on the Speaking section of the Internet-based TOEFL, the student will be required to take an English as a Second Language (ESL) course each term at Yale until the graduate school's Oral English Proficiency standard has been met. This must be achieved by the end of the third year for the student to remain in good standing.

CORE COURSE REQUIREMENTS FOR THE PH.D. DEGREE

Applied Physics See the departmental entry for Applied Physics in this bulletin.

Biomedical Engineering Of the ten-course minimum requirement, five are required courses and five are electives. Two terms of BENG 5990 are required in the first year. The three additional required courses (one of which may be taken in the second year) are BENG 5410, BENG 5200, and a math requirement that must be met by taking ENAS 5000, CENG 5050, or BENG 5849. Students enrolled in PEB may also meet the math requirement by taking ENAS 5410 or ENAS 5620.

Chemical and Environmental Engineering (Chemical track) ENAS 5000, and two of the following three courses: CENG 5210, CENG 6020, CENG 6030.

Chemical and Environmental Engineering (Environmental track)
ENVE 6400, ENVE 6410, ENVE 6420. In addition, there is a math requirement that must be met by taking one of the following courses in the first year: ENAS 5000, MENG 5041, ENV 758, or S&DS 5300. Any other mathematics or statistics class can be taken as an elective in addition to one of these core classes.

Computer Science See the departmental entry for Computer Science in this bulletin.

Electrical and Computer Engineering Courses will be assigned by the adviser in coordination with the research committee, and are subject to approval by the DGS.

Materials Science Courses will be selected in consultation with the adviser and are subject to approval by the DGS.

Mechanical Engineering and Materials Science Students must demonstrate competence in one of five areas: Fluid and Thermal Sciences, Soft Matter/Complex Fluids, Materials Science, Robotics/Mechatronics, or Bioengineering. As a minimum

requirement, students must take at least two of the following courses in the first year of study:

APHY 5480	Solid State Physics I	1
APHY 5490	Solid State Physics II	1
CENG 5210	Classical and Statistical Thermodynamics	1
CENG 6060	Polymer Chemistry and Physics	1
CENG 6150	Synthesis of Nanomaterials	1
CPSC 5590	Building Interactive Machines	1
CPSC 5700	Artificial Intelligence	1
CPSC 5720	Intelligent Robotics	1
CPSC 5730	Intelligent Robotics Laboratory	1
CPSC 5850	Applied Planning and Optimization	1
ECE 9020	Linear Systems (if not used to satisfy the math requirement)	1
ENAS 5410	Biological Physics	1
MENG 5020	Mechatronics Laboratory	1
MENG 5050	Computer-Aided Engineering	1
MENG 5359	Neuromuscular Biomechanics	1
MENG 6263	Fundamentals of Robot Modeling and Control	1
MENG 6265	Introduction to Embedded Robotic Systems	1
MENG 6273	Introduction to Soft Robotics	1
MENG 6277	Introduction to Robot Analysis	1
MENG 6278	Advanced Robotic Mechanisms	1
MENG 7463	Theoretical Fluid Dynamics	1
MENG 7468	Fundamentals of Combustion	1
MENG 8652	Solidification and Phase Transformations	1
MENG 8664	Forces on the Nanoscale	1
MENG 8672	Electronic and Optical Properties of Energy Materials	1
MENG 8673	Introduction to Nanomaterials and Nanotechnology	1
MENG 8675	Thermodynamics, Kinetics, and Structure of Materials	1
PHYS 6120	Statistical Physics II	1

There is a math requirement that must be met by taking CPSC 5530, ENAS 5000, ECE 9020, or PHYS 5060, depending on the research area. In addition, students must take two terms of MENG 9000 during the first two years of study; this course does not count toward the ten-course requirement.

HONORS REQUIREMENT

Students must meet the Honors requirement in at least two term courses (excluding Special Investigations) by the end of the second term of full-time study to remain in good standing. An extension of one term may be granted at the discretion of the DGS. An average grade of at least High Pass must be maintained through all courses that count toward the Ph.D. to remain in good standing.

M.D.-PH.D. STUDENTS

M.D.-Ph.D. students affiliate with the Department of Biomedical Engineering via the School of Medicine. Affiliation occurs after selecting a thesis adviser and consulting with the DGS of Biomedical Engineering.

M.D.-Ph.D. students entering Biomedical Engineering are subject to the same requirements as the Ph.D. students in the department except for the modifications described below.

Courses BENG 5200 is waived for M.D.-Ph.D. students and only three elective courses are required (for a total of seven courses rather than ten). One Yale graduate-level course taken for a grade during medical school may be counted toward this requirement at the discretion of the DGS. One elective must be in engineering or a closely related field.

Prospectus and qualifying exam M.D.-Ph.D. students must complete and submit their thesis prospectus by the end of the fifth term as an affiliated Biomedical Engineering graduate student.

MASTER'S DEGREES

M.Phil. See Degree Requirements under Policies and Regulations.

M.S. (en route to the Ph.D.) To qualify for the M.S., the student must pass eight term courses; no more than two may be Special Investigations. An average grade of at least High Pass is required, with at least one grade of Honors.

Terminal Master's Degree Program Students may also be admitted directly to a terminal master's degree program in Biomedical Engineering, Chemical & Environmental Engineering, Electrical and Computer Engineering, or Mechanical Engineering. The requirements are the same as for the M.S. en route to the Ph.D., although there are no core course requirements for students in this program. This program is normally completed in one year, but a part-time program may be spread over as many as four years. Some courses are available in the evening, to suit the needs of students from local industry.

The Master of Science in Personalized Medicine and Applied Engineering Directed and taught jointly by faculty in the School of Engineering & Applied Science and the School of Medicine, this program prepares biomedical, mechanical, and electrical engineers, computer science majors, pre-med students, medical students and residents with the tools to develop innovative 3D solutions for personalized medicine. The program trains graduate students to develop and apply 3D technology to address surgical and medical conditions, with the goal of personalizing healthcare treatments to improve patient clinical outcomes. Additional societal benefits include lower healthcare costs and improved patient quality of life. Prospective students should apply through the Graduate School of Arts and Sciences (https://gsas.yale.edu/admissions/degree-program-application-process).

The program is one full year: summer through spring. Students are required to participate in an eight-week, summer clinical immersion session prior to registration in fall term sequence courses.

Students have flexibility in selecting the focus of their master's thesis special investigation projects or industry collaboration project ("internal internship") and elective classes tailored to their specific academic backgrounds and interests. For example, students with a strong engineering background may want to focus on medical school-focused classes, while medical students may want to focus on engineering-related courses. Students must take a total of nine courses, of which seven courses are required of all students in the program: PMAE 6526, PMAE 6527, PMAE 6528, PMAE 6529, PMAE 5533, and two terms of PMAE 9532. With the approval of the program's DGS, the final two courses may be chosen from Yale-wide graduate-level technical electives, which must be approved by the program's DGS. An average grade of at least High Pass is required, with at least one grade of Honors.

Joint Master's Degree Program (School of Engineering & Applied Science and School of the Environment) The joint master's degree program offered by the School of the Environment (YSE) and the School of Engineering & Applied Science (SEAS) provides environmental engineers and environmental managers with the opportunity to develop knowledge and tools to address the complex relationship between technology and the environment. This joint-degree program will train graduate students to design and manage engineered and natural systems that address critical societal challenges, while considering the complex technical, economic, and sociopolitical systems relationships. Each joint program leads to the simultaneous award of two graduate professional degrees: either the Master of Environmental Management (M.E.M.) or the Master of Environmental Science (M.E.Sc.) from YSE, and a Master of Science (M.S.) from SEAS. Students can earn the two degrees concurrently in 2.5 years, less time than if they were pursued sequentially. Candidates spend the first year at YSE, the second year at SEAS, and their final term at YSE. Joint-degree students are guided in this process by advisers in both YSE and SEAS. Candidates must submit formal applications to both YSE and SEAS and be admitted separately to each School, i.e., each School makes its decision independently. It is highly recommended that students apply to and enter a joint-degree program from the outset, although it is possible to apply to the second program once matriculated at Yale. Prospective students to the joint-degree program apply to the YSE master's degree through YSE (https://apply.environment.yale.edu/apply) and to the SEAS master's degree in Chemical and Environmental Engineering through the Graduate School of Arts and Sciences (https://gsas.yale.edu/admissions/degree-program-application-process).

The following six courses are required of all joint-degree YSE/SEAS master's students completing their M.S. in Environmental Engineering: ENVE 6410, ENVE 6420, ENVE 6600, ENV 773, ENV 838, and either ENV 712 or ENV 724. Two additional Yale-wide technical electives approved by the DGS (or faculty in an equivalent role in Environmental Engineering) are required. These courses may be cross-listed with or administered by YSE with prior approval from the DGS. For the joint-degree requirements for completion of the M.E.M. or M.E.Sc. in YSE, see the bulletin of the Yale School of the Environment at https://bulletin.yale.edu.

Joint Master's Degree Program (School of Engineering & Applied Science and School of Management) The joint M.S./M.B.A. degree program offered by the School of Engineering & Applied Science (SEAS) and the School of Management (SOM) offers a unique opportunity to earn a Master's of Science in engineering, computer science or applied physics while getting your M.B.A. This joint degree program is

designed for students aspiring to integrate advanced technical expertise with strategic management and leadership skills, preparing them for dynamic and impactful careers at the intersection of technology and business. Students must complete the first year the of M.B.A. program, including the M.B.A. core curriculum, and then complete the M.S. requirements during the second year. Both degrees will be awarded at the end of the two-year period, less time than if they were pursued sequentially. Candidates spend the first year at SOM and the second year at SEAS. Students are guided through this process by advisors from both SEAS and SOM. Joint degree applicants must apply to and be admitted to both programs independently, but may indicate in the application that they are applying to the M.S./M.B.A. program. Applicants may apply to both programs simultaneously, or apply to the M.S. program during the first year of the M.B.A. program. Per the requirements of the School of Engineering & Applied Science, applicants must submit a GRE score in their M.S. application and satisfy all prerequisites for their selected engineering program. Joint M.S. degrees for this program are possible in the following disciplines: Applied Physics, Biomedical Engineering, Chemical and Environmental Engineering, Computer Science, Electrical and Computer Engineering, and Mechanical Engineering & Materials Science. Prospective students to the joint degree program apply to a SEAS master's program through the Graduate School of Arts and Sciences (https://gsas.yale.edu/admissions/degree-program-application-process) and to the M.B.A. program through the School of Management (https://som.yale.edu/programs/mba/admissions).

The joint M.S./M.B.A. degree program requires completion of 18 credits as well as a summer internship. Eight credits are required for the SEAS M.S. degree. The M.B.A. requires a total of 18 credits and the 8 M.S. credits count toward that total. For completion of the M.S., the Director of Graduate Studies (DGS) in each SEAS department will guide the selection of the 8 SEAS courses and the progress of each student. All of the courses will be SEAS graduate level courses, with exceptions made by the DGS for courses in other departments. A sequence of 2 design and product development courses will be common for all participants in the program. Engineering majors will take ENAS 6000 and ENAS 6010, while Computer Science majors will take a sequence to be determined by their DGS.

Program information is available via email to engineering@yale.edu or at our website, http://seas.yale.edu.

COURSES

The list of courses may be slightly modified by the time term begins. Please visit https://courses.yale.edu for the most updated course listing.

APHY 5060a, Basic Quantum Mechanics John Sous
Basic concepts and techniques of quantum mechanics essential for solid state physics and quantum electronics. Topics include the Schrödinger treatment of the harmonic oscillator, atoms and molecules and tunneling, matrix methods, and perturbation theory.

APHY 5220b, Theory of Electromagnetic Waves, Radiation, and Scattering A Douglas Stone
This is a graduate-level course on electromagnetic theory, focusing on electromagnetic wave phenomena in a variety of contexts. Electrostatics and magnetostatics are

reviewed briefly and then the full time-dependent Maxwell equations are studied to derive the fundamentals of wave propagation, the wave equation, plane waves, polarization, energy and momentum flow in EM waves, conservation laws, gauge transformation, and Green functions for the wave equations. Dielectric media and Fresnel reflection and refraction, total internal reflection, group velocity, wave packets and dispersion. Beam propagation and gaussian optics, optical birefringence. Waves in confined structures, waveguides, optical fibers, resonant cavities. Radiating sources, electric and magnetic dipolar radiation, multipolar radiation, near and far-field solutions, radiating antennas. Scattering theory, scalar and vector diffraction, Rayleigh scattering, scattering matrix and temporal coupled mode theory, scattering resonances, multiple scattering, systems with gain and lasing. Time permitting: relativistic kinematics, covariance of Maxwell's equations, Lorentz transformation of electric and magnetic fields, relativistic mechanics of charged particles. Prerequisites: an undergraduate course on electricity and magnetism and graduate-level vector calculus and differential equations.

APHY 5260a, Explorations in Physics and Computation Logan Wright
Computation has taken on an important, often central, role in both the practice and conception of physical science and engineering physics. This relationship is intricate and multifaceted, including computation for physics, computation with physics, and computation as a lens through which to understand physical processes. This course takes a more or less random walk within this space, surveying ideas and technologies that either apply computation to physics, that understand physical phenomena through the lens of computation, or that use physics to perform computation. Given the extent to which machine learning methods are currently revolutionizing this space of ideas, we focus somewhat more on topics related to modern machine learning, as opposed to other sorts of algorithms and computation. Since it is covered more deeply in other courses, we do not extensively cover error-corrected/fault tolerant quantum information processing, but we do frequently consider quantum physics. The course does not provide a systematic overview of any one topic, but rather a sampling of ideas and concepts relevant to modern research challenges. It is therefore intended for graduate students in early years of their program or research-inclined senior undergraduate students contemplating a research career. As a result, in addition to the scientific topics at hand, key learning goals include the basics of literature review, presentation, collegial criticism (peer review), and synthesizing new research ideas. Evaluation is primarily through two projects, one a lecture reviewing a topic area of interest and one a tutorial notebook providing worked numerical examples/code meant to develop or introduce a concept. Prior experience with Python is ideal, but can be learned as part of the coursework. Students should ideally be familiar with quantum mechanics, including density matrices and some phase-space methods, but this applies to only small fraction of the course. The course is primarily a survey-level overview of many topics, not a deep dive into any one topic. As a result, students who have extensive background on many of the topics described in the syllabus are welcome to participate but should speak with the instructor beforehand so we can determine if their learning goals can be met.

APHY 5480a / PHYS 5480a, Solid State Physics I Yu He
A two-term sequence (with APHY 549) covering the principles underlying the electrical, thermal, magnetic, and optical properties of solids, including crystal

structures, phonons, energy bands, semiconductors, Fermi surfaces, magnetic resonance, phase transitions, and superconductivity.

APHY 5490b / ENAS 851 / PHYS 5490b, Solid State Physics II Vidvuds Ozolins
A two-term sequence (with APHY 548) covering the principles underlying the electrical, thermal, magnetic, and optical properties of solids, including crystal structures, phonons, energy bands, semiconductors, Fermi surfaces, magnetic resonance, phase transitions, and superconductivity.

APHY 5750b, Physics of AI John Sous
A introduction to current research in AI from a physics perspective, i.e. one that emphasizes the mechanisms through which various AI architectures learn. Topics include, linear regression, neural nets, transformers, diffusion, etc. Prerequisites: linear algebra, calculus.

APHY 5760a, Topics in Applied Physics Research Peter Rakich
The course introduces the fundamentals of applied physics research to graduate students in the Department of Applied Physics in order to introduce them to resources and opportunities for research activities. The content of the class includes overview presentations from faculty and other senior members of the department and related departments about their research and their career trajectories. The class also includes presentations from campus experts who offer important services that support Applied Physics graduate students in their successful degree completion.

APHY 5900b / PHYS 5900b, Responsible Conduct in Research for Physical Scientists Staff
A review and discussion of best practices of conduct in research including scientific integrity and misconduct; mentorship; data management; and diversity, equity, and inclusion in science.

APHY 6070b, Modern Topics in Optics and Quantum Electronics Peter Rakich
This course provides a survey of modern topics involving integrated photonics, optomechanics, nonlinear optics, and laser physics for students interested in contemporary experimental optics research. Subjects include nonlinear wave phenomena, optomechanical interactions, phonon physics, light scattering, light emission and detection, cavities, systems of cavities, traveling-wave devices and interactions, perturbation theory, reciprocal and nonreciprocal systems, parametric interactions, laser oscillators and related technologies. Students are encouraged to explore these and related research topics through independent study and classroom presentations.

APHY 6100a / PHYS 6100a, Quantum Many-Body Theory Yoram Alhassid
Identical particles and second quantization. Electron tunneling and spectral function. General linear response theory. Approximate methods of quantum many-body theory. Dielectric response, screening of long-range interactions, electric conductance, collective modes, and photon absorption spectra. Fermi liquid; Cooper and Stoner instabilities; notions of superconductivity and magnetism. BCS theory, Josephson effect, and Majorana fermions in condensed matter; superconducting qubits. Bose-Einstein condensation; Bogoliubov quasiparticles and solitons.

APHY 6280a / PHYS 6120a, Statistical Physics II Nicholas Read
An advanced course in statistical mechanics. Topics may include mean field theory of and fluctuations at continuous phase transitions; critical phenomena, scaling, and

introduction to the renormalization group ideas; topological phase transitions; dynamic correlation functions and linear response theory; quantum phase transitions; superfluid and superconducting phase transitions; cooperative phenomena in low-dimensional systems.

APHY 6330b / PHYS 6330b, Introduction to Superconductivity Yu He
The fundamentals of superconductivity, including both theoretical understandings of basic mechanism and description of major applications. Topics include historical overview, Ginzburg-Landau (mean field) theory, critical currents and fields of type II superconductors, BCS theory, Josephson junctions and microelectronic and quantum-bit devices, and high-Tc oxide superconductors.

APHY 6600a / PHYS 6010a, Quantum Information and Computation Shruti Puri
This course focuses on the theory of quantum information and computation. We cover the following tentative list of topics: overview of postulates of quantum mechanics and measurements, quantum circuits, physical implementation of quantum operations, introduction to computational complexity, quantum algorithms (DJ, Shor's, Grover's, and others as time permits), decoherence and noisy quantum channels, quantum error-correction and fault-tolerance, stabilizer formalism, error-correcting codes (Shor, Steane, surface-code, and others as time permits), quantum key distribution, quantum Shannon theory, entropy, and data compression.

APHY 6610b, Fault Tolerance and Quantum Error Correction Aleksander Kubica
This course focuses on the theory of fault tolerance and quantum error correction. We cover the following tentative list of topics: criteria for quantum error correction, classical linear codes and quantum CSS codes, stabilizer codes, existence of good codes, concatenated codes, threshold theorems, topological codes, decoding algorithms, statistical-mechanical mappings, logical gates and fault-tolerant quantum computing, resource overheads, limitations and no-go theorems, quantum LDPC codes, approximate quantum error correction, experimental realizations of quantum error correction, and open research problems. Prerequisite: APHY 660 or CPSC 547 (or equivalent).

APHY 6700a, Statistical Methods with Applications in Science and Finance Sohrab Ismail-Beigi
Introduction to key methods in statistical physics with examples drawn principally from the sciences (physics, chemistry, astronomy, statistics, biology) as well as added examples from finance. Students learn the fundamentals of Monte Carlo, stochastic random walks, and analysis of covariance analytically as well as via numerical exercises. Prerequisites: ENAS 1940, MATH 2220, ENAS 1300 or equivalents.

APHY 6750a / PHYS 6750a, Principles of Optics with Applications Hui Cao
Introduction to the principles of optics and electromagnetic wave phenomena with applications to microscopy, optical fibers, laser spectroscopy, nanophotonics, plasmonics, and metamaterials. Topics include propagation of light, reflection and refraction, guiding light, polarization, interference, diffraction, scattering, Fourier optics, and optical coherence.

APHY 6760a / PHYS 6760a, Introduction to Light-Matter Interactions Peter Rakich
Optical properties of materials and a variety of coherent light-matter interactions are explored through the classical and quantum treatments. The role of electronic, phononic, and plasmonic interactions in shaping the optical properties of materials

is examined using generalized quantum and classical coupled-mode theories. The dynamic response of media to strain, magnetic, and electric fields is also treated. Modern topics are explored, including optical forces, photonic crystals, and metamaterials; multi-photon absorption; and parametric processes resulting from electronic, optomechanical, and Raman interactions.

APHY 6790b / PHYS 6790b, Nonlinear Optics and Lasers Logan Wright
Properties and origins of the nonlinear susceptibility; Sum-freq, diff-freq and 2nd-harmonic generation; Intensity-dependent refractive index; Optical phase conjugation; Self-focusing, self-phase modulation, solitons; Stimulated light scattering; Fixed points, bifurcations; Amplification; Rate equations; Relaxation oscillations, frequency pulling; Hole burning; Q-switching; Semiconductor and DFB lasers; Mode-locking; Injection-locking; Intense-field NLO and QM laser theory (time permitting)

APHY 7260a, Advanced Thin Film Synthesis and Characterization Charles Ahn
This course covers principles of thin film growth and characterization for advanced electronic and quantum materials applications. Topics include physical vapor deposition and related techniques for achieving state-of-the-art thin films and heterostructures, along with atomic-scale and spectroscopic characterization of thin film structures, including scanning probe microscopies, electron microscopies, diffraction techniques, and photon-based spectroscopies.

APHY 7270b, Circuit Quantum Electrodynamics Michael Hatridge and Robert Schoelkopf
Circuit quantum electrodynamics, or circuit QED, is the field of quantum optics with microwave photons, and is the basis of most solid-state quantum computing technologies. In the microwave domain, we can engineer the properties of "artificial atoms" constructed from circuits containing Josephson junctions and couple them strongly to stationary photons trapped in a cavity or resonant circuit and to traveling photons in a waveguide or transmission line. With this approach, one can access regions of strong coupling between "light" and "matter" that are not accessible in atomic physics. This course is an introduction to the concepts and techniques of circuit QED, aimed for the beginning graduate student or advanced undergraduate with a solid background in classical electricity and magnetism and also basic quantum mechanics. The course is intended to provide an important base of knowledge that can prepare the student for research in quantum information processing with superconducting circuits. Topics to be covered include the basics of superconducting qubits, the Jaynes-Cummings model and the strong dispersive regime, and the use of light-matter interactions for measurement, control, and quantum computing with quantum circuits. Extra work for graduate students: The last homework set is optional for undergrads and required for grads. Prerequisites: one semester QM and one semester E&M at advanced undergrad or higher.

BENG 5200a / C&MP 5500a / MCDB 5500a / PHAR 5500 / PTB 5500, Physiological Systems W. Mark Saltzman and Stuart Campbell
The course develops a foundation in human physiology by examining the homeostasis of vital parameters within the body, and the biophysical properties of cells, tissues, and organs. Basic concepts in cell and membrane physiology are synthesized through exploring the function of skeletal, smooth, and cardiac muscle. The physical basis of blood flow, mechanisms of vascular exchange, cardiac performance, and regulation of overall circulatory function are discussed. Respiratory physiology explores the

mechanics of ventilation, gas diffusion, and acid-base balance. Renal physiology examines the formation and composition of urine and the regulation of electrolyte, fluid, and acid-base balance. Organs of the digestive system are discussed from the perspective of substrate metabolism and energy balance. Hormonal regulation is applied to metabolic control and to calcium, water, and electrolyte balance. The biology of nerve cells is addressed with emphasis on synaptic transmission and simple neuronal circuits within the central nervous system. The special senses are considered in the framework of sensory transduction. Weekly discussion sections provide a forum for in-depth exploration of topics. Graduate students evaluate research findings through literature review and weekly meetings with the instructor.

BENG 5270b / C&MP 5560 / MCDB 5600b / PHAR 5600, Cellular and Molecular Physiology: Molecular Machines in Human Disease Emile Boulpaep

The course focuses on understanding the processes that transfer molecules across membranes at the cellular, molecular, biophysical, and physiological levels. Students learn about the different classes of molecular machines that mediate membrane transport, generate electrical currents, or perform mechanical displacement. Emphasis is placed on the relationship between the molecular structures of membrane proteins and their individual functions. The interactions among transport proteins in determining the physiological behaviors of cells and tissues are also stressed. Molecular motors are introduced and their mechanical relationship to cell function is explored. Students read papers from the scientific literature that establish the connections between mutations in genes encoding membrane proteins and a wide variety of human genetic diseases.

BENG 5350b / PATH 5630, Biomaterial-Tissue Interactions Themis Kyriakides

Study of the interactions between tissues and biomaterials, with an emphasis on the importance of molecular- and cellular-level events in dictating the performance and longevity of clinically relevant devices. Attention to specific areas such as biomaterials for tissue engineering and the importance of stem/progenitor cells, as well as biomaterial-mediated gene and drug delivery.

BENG 5410a, Physical and Chemical Basis of Bioimaging and Biosensing Douglas Rothman and Daniel Coman

Basic principles and technologies for imaging and sensing the chemical, electrical, and structural properties of living tissues and biological macromolecules. Topics include magnetic resonance spectroscopy, MRI, positron emission tomography, and molecular imaging with MRI and fluorescent probes.

BENG 5415a, Practical Applications of Bioimaging and Biosensing Daniel Coman and Evelyn Lake

Detecting, measuring, and quantifying the structural and functional properties of tissue is of critical importance in both biomedical research and medicine. This course focuses on the practicalities of generating quantitative results from raw bioimaging and biosensing data to complement other courses focus on the theoretical foundations which enable the collection of these data. Participants in the course work with real, cutting-edge data collected here at Yale. They become familiar with an array of current software tools, denoising and processing techniques, and quantitative analysis methods that are used in the pursuit of extracting meaningful information from imaging data. The subject matter of this course ranges from bioenergetics, metabolic pathways, molecular processes, brain receptor kinetics, protein expression and interactions to

wide spread functional networks, long-range connectivity, and organ-level brain organization. The course provides a unique hands-on experience with processing and analyzing *in vitro* and *in vivo* bioimaging and biosensing data that is relevant to current research topics. The specific imaging modes which are covered include *in vivo* magnetic resonance spectroscopy (MRS) and spectroscopic imaging (MRSI), functional, structural, and molecular imaging (MRI), wide-field fluorescent optical imaging, and positron emission tomography (PET). The course provides the necessary background in biochemistry, bioenergetics, and biophysics for students to motivate the image manipulations which they learn to perform. Prerequisites: Math through first order differential equations, PHYS 180/181, CHEM 161, BIOL 101/102, BENG 249 or other experience with scientific software like MATLAB, BENG 350 and BENG 410 (both of which can be taken at the same time as this course) o Course cr

BENG 5420a, Biophotonics Cristina Rodriguez
This course provides an introduction to biophotonics, with a strong emphasis on optical microscopy and the fundamental principles governing how light interacts with biological matter. Students learn key optical concepts, including diffraction, interference, Fourier optics, and fluorescence, as well as advanced techniques such as multiphoton microscopy and harmonic generation imaging. The course covers the physics underlying imaging systems, the design and function of modern optical microscopes, and their applications in biomedical research. This course is designed for students in biomedical engineering, physics, biology, and related fields who seek to understand the optical foundations of modern imaging technologies.

BENG 5440a, Fundamentals of Medical Imaging Chi Liu, Dana Peters, and Gigi Galiana
Review of basic engineering and physical principles of common medical imaging modalities including X-ray, CT, PET, SPECT, MRI, and echo modalities (ultrasound and optical coherence tomography). Additional focus on clinical applications and cutting-edge technology development.

BENG 5450a, Biomedical Image Processing and Analysis Lawrence Staib and James Duncan
This course is an introduction to biomedical image processing and analysis, covering image processing basics and techniques for image enhancement, feature extraction, compression, segmentation, registration, and motion analysis including traditional and machine-learning techniques. Students learn the fundamentals behind image processing and analysis methods and algorithms with an emphasis on biomedical applications.

BENG 5482a, Physics of Magnetic Resonance Spectroscopy in Vivo Graeme Mason
The physics of chemical measurements performed with nuclear magnetic resonance spectroscopy, with special emphasis on applications to measurement studies in living tissue. Concepts that are common to magnetic resonance imaging are introduced. Topics include safety, equipment design, techniques of spectroscopic data analysis, and metabolic modeling of dynamic spectroscopic measurements.

BENG 5485b / INP 9585b, Fundamentals of Neuroimaging Fahmeed Hyder, Elizabeth Goldfarb, and Douglas Rothman
The neuroenergetic and neurochemical basis of several dominant neuroimaging methods, including fMRI. Topics range from technical aspects of different methods

to interpretation of the neuroimaging results. Controversies and/or challenges for application of fMRI and related methods in medicine are identified.

BENG 5550b, Vascular Mechanics Jay Humphrey
This course is designed to enable students to apply methods of continuum biomechanics to study diverse vascular conditions and treatments, including aging, atherosclerosis, aneurysms, effects of hypertension, design of tissue-engineered constructs, and vein grafts from an engineering perspective. Emphasis is placed on ensuring that the mechanics is driven by advances in the vascular mechanobiology.

BENG 5560b, Molecular and Cellular Biomechanics Michael Murrell
The basic mechanical principles at the molecular and cellular level that underlie the major physical behaviors of the cell, from cell division to cell migration. Basic cellular physiology, methodology for studying cell mechanical behaviors, models for understanding the cellular response under mechanical stimulation, and the mechanical impact on cell differentiation and proliferation.

BENG 5570b, Computational Mechanics Martin Pfaller
This course integrates fundamental concepts from nonlinear continuum mechanics and finite element methods applied to solid and fluid mechanics, focusing on theoretical understanding and numerical techniques. Topics covered are fundamentals of tensor calculus, kinematics, balance equations, constitutive relationships, geometric and material nonlinearities, nonlinear solution strategies, stability, nonlinear dynamics, errors, convergence, and adaptivity. Applications in biomedical engineering are stressed throughout the course. Prerequisites: fundamentals in calculus, differential equations, and linear algebra.

BENG 5611b, BioMEMS & Biomedical Microdevices Rong Fan
Principles and applications of micro- and nanotechnologies for biomedicine. Approaches to fabricating micro- and nanostructures. Fluid mechanics, electrokinetics, and molecular transport in microfluidic systems. Integrated biosensors and microTAS for laboratory medicine and point-of-care uses. High-content technologies including DNA, protein microarrays, and cell-based assays for differential diagnosis and disease stratification. Emerging nanobiotechnology for systems medicine. Prerequisites: CHEM 112a, 114a, or 118a, and ENAS 194a or b.

BENG 5630a, Immunoengineering Tarek Fahmy
An advanced class that introduces immunology principles and methods to engineering students. The course focuses on biophysical principles and biomaterial applications in understanding and engineering immunity. The course is divided into three parts. The first part introduces the immune system: organs, cells, and molecules. The second part introduces biophysical characterization and quantitative modeling in understanding immune system interactions. The third part focuses on intervention, modulation, and techniques for studying the immune system with emphasis on applications of biomaterials for intervention and diagnostics.

BENG 5680b, Topics in Immunoengineering Tarek Fahmy
This course addresses the intersection of immunobiology with engineering and biophysics. It invokes engineering tools, such as biomaterials, solid-state devices, nanotechnology, biophysical chemistry, and chemical engineering, toward developing newer and effective solutions to cancer immunotherapy, autoimmune therapy, vaccine design, transplantation, allergy, asthma, and infections. The central theme is that

dysfunctional immunity is responsible for a wide range of disease states and that engineering tools and methods can forge a link between the basic science and clinically translatable solutions that will potentially be "modern cures" to disease. This course is a follow-up to ENAS 553 and focuses more on the clinical translation aspect as well as new understandings in immunology and how they can be translated to the clinic and eventually to the market. Prerequisites: ENAS 553, differential equations, and advanced calculus.

BENG 5690a, Single-Cell Biology, Technologies, and Analysis Rong Fan
This course teaches the principles of single-cell heterogeneity in human health and disease as well as the cutting-edge wet-lab and computational techniques for single-cell analysis, with a particular focus on omics-level profiling and data analysis. Topics covered include single-cell-level morphometric analysis, genomic alteration analysis, epigenomic analysis, mRNA transcriptome sequencing, small RNA profiling, surface epitope, intracellular signaling protein and secreted protein analysis, metabolomics, multi-omics, and spatially resolved single-cell omics mapping. We also teach computational methods for quantification of cell types, states, and differentiation trajectories using single-cell high-dimensional data. Finally, case studies are provided to show the power of single-cell analysis in therapeutic target discovery, biomarker research, clinical diagnostics, and personalized medicine. Prerequisite: physiological systems, molecular biology, or biochemistry.

BENG 5724b, Topics in Computational and Systems Biology Purushottam Dixit
This course covers topics related to modeling biological networks across time and length scales. Specifically, the course covers models of intracellular signaling networks, transcriptional regulation networks, cellular metabolic networks, and ecological networks in microbial consortia. For each type of network, we cover the biological basics, standard mathematical treatments including deterministic and stochastic modeling, methods to infer model parameters from data, and new machine-learning based inference approaches. The required mathematical methods are briefly covered. The course assignments involve coding in MATLAB.

BENG 5767b, Systems Biology of Cell Signaling Andre Levchenko
This course designed for graduate and advanced undergraduate students is focused on systems biology approaches to the fundamental processes underlying the sensory capability of individual cells and cell-cell communication in health and disease. The course is designed to provide deep treatment of both the biological underpinnings and mathematical modeling of the complex events involved in signal transduction. As such, it can be attractive to students of biology, bioengineering, biophysics, computational biology, and applied math. The class is part of the planned larger track in systems biology, being one of its final, more specialized courses. In spite of this, each lecture has friendly introduction to the specific topic of interest, aiming to provide sufficient refreshment of the necessary knowledge. The topics have been selected to represent both cutting-edge directions in systems analysis of signaling processes and exciting settings to explore, making learning complex notions more enjoyable. Prerequisites: basic knowledge of biochemistry and cell biology, as well as programming experience and basic notions from probability theory and differential equations.

BENG 5823b, Data and Clinical Decision-Making John Onofrey and Michael Choma
Data and computation are reshaping medicine and clinical decision-making. Examples include acute states of physiological failure such as shock and sepsis as well as failure

modes associated with aging (e.g., delirium/acute brain failure, falls). This seminar provides (1) a modern, clinically facing view of physiological failure and (2) a survey of how data and computation are reshaping clinical concepts and practice, including decision-making. Key topics and concepts include medical data types (e.g., imaging, lab values, oximetry); nonlinearity and complexity in physiological resilience and failure; clinically relevant AI/ML methods; data-driven definitions of medical disease; predictive modeling as a distinct field in AI/ML; and clinical decision-making using modern data and computational tools. The course is led by two instructors with complementary backgrounds that include AI/ML, statistics/data science, medical physiology, clinical medicine, and digital health. Guest lecturers from both clinical practice and industry provide additional context. Course work includes scientific literature review, written reports, oral presentations, and a final project. Students interested in AI/ML in medicine in both academic and industry settings with an engineering/medical background would benefit from this course. The course provide the requisite background for physiology and assumes a basic understanding of AI/ML but has no strict prerequisites.

BENG 5849b, Biomedical Data Analysis Cristina Rodriguez and Richard Carson
The course focuses on the analysis of biological and medical data associated with applications of biomedical engineering. It provides basics of probability and statistics, and analytical approaches for determination of quantitative biological parameters from noisy, experimental data. Programming in MATLAB to achieve these goals is a major portion of the course. Applications include Michaelis-Menten enzyme kinetics, Hodgkin-Huxley, neuroreceptor assays, receptor occupancy, MR spectroscopy, PET neuroimaging, brain image segmentation and reconstruction, and molecular diffusion.

BENG 5910b, Effective Fellowship Grant Writing: From Concept to Submission Fadi Akar
This course is designed to equip participants with the essential skills and strategies needed to prepare successful fellowship grant applications. It covers the entire grant writing process, from understanding funding opportunities and requirements to developing a compelling proposal. Participants learn how to clearly define research goals, align their projects with funding criteria, and craft persuasive narratives that effectively communicate their ideas. The course also emphasizes the importance of strong supporting documents, including CVs, budgets, and letters of recommendation. Through practical exercises, peer reviews, and expert feedback, participants refine their writing techniques, enhance proposal clarity, and increase their chances of securing funding. The course is intended for seniors and graduate students in Biomedical Engineering or a related Biomedical Sciences department. o Course cr

BENG 5990a or b, Special Investigations Kathryn Miller-Jensen
Faculty-supervised individual projects with emphasis on research, laboratory, or theory. Students must define the scope of the proposed project with the faculty member who has agreed to act as supervisor, and submit a brief abstract to the director of graduate studies for approval.

CENG 5210b, Classical and Statistical Thermodynamics Peijun Guo
A unified approach to bulk-phase equilibrium thermodynamics, bulk-phase irreversible thermodynamics, and interfacial thermodynamics in the framework of classical thermodynamics, and an introduction to statistical thermodynamics. Both the activity coefficient and the equations of state are used in the description of bulk phases.

Emphasis on classical thermodynamics of multicomponents, including concepts of stability and criticality, curvature effect, and gravity effect. The choice of Gibbs free energy function covers applications to a broad range of problems in chemical, environmental, biomedical, and petroleum engineering. The introduction includes theory of Gibbs canonical ensembles and the partition functions, fluctuations; Boltzmann statistics; Fermi-Dirac and Bose-Einstein statistics. Application to ideal monatomic and diatomic gases is covered.

CENG 6020a, Chemical Reaction Engineering Eric Altman
Applications of physical-chemical and chemical-engineering principles to the design of chemical process reactors. Ideal reactors treated in detail in the first half of the course, practical homogeneous and catalytic reactors in the second.

CENG 6030b, Energy, Mass, and Momentum Processes Amir Haji-Akbari
Application of continuum mechanics approach to the understanding and prediction of fluid flow systems that may be chemically reactive, turbulent, or multiphase.

CENG 6050a, Colloid Science and Engineering Paul Van Tassel
A graduate-level introduction is given to modern colloid science as practiced by engineers. Topics include thermodynamics of surfaces, transport in colloidal systems, the electric double layer, colloidal forces, self-assembly in solution and at interfaces, and adsorption. Applications to problems frequently encountered by chemical, biomedical, and environmental engineers are stressed throughout.

CENG 6090a, Principles and Design of Energy Devices Shu Hu
This is a comprehensive course with content at the intersection of nanoscale science, engineering, and technology, including application areas and nanofabrication technique. Topics include nanoscaled photovoltaic cells, hydrogen storage, fuel cells, and nanoelectronics; layer-by-layer assembly; organic-inorganic mesostructures; colloidal crystals, organic monolayers, proteins, DNA and abalone shells; synthesis of carbon nanotubes, nanowire, and nanocrystals; microelectromechanical systems (MEMs) devices; photolithography, electron beam lithography, and scanning probe lithography; lithium-based batteries; and nanomanufacturing (roll to roll, nanoimprint lithography, inkjet printing).

CENG 6140b, Surface and Thin Film Characterization Eric Altman
Fundamental and practical aspects of spectroscopy, diffraction, and microscopy related to the structural and chemical characterization of surfaces and thin films. Emphasis on identification of adsorbed species by vibrational spectroscopy, determination of the chemical state of the surface by photoelectron spectroscopy, quantitative methods in surface analysis, determination of surface structure by scanning probe microscopy techniques and diffraction methods, and recent advances in surface characterization.

CENG 6150a, Synthesis of Nanomaterials Lisa Pfefferle
This course focuses on the synthesis and engineering of nanomaterials. We also introduce different types of nanomaterials, unique properties at the nanoscale, measurement, and important applications of nanomaterials (including biomedical, electronic, and energy applications). Synthesis methods covered include gas phase and high vacuum techniques (CVD, MOCVD) as well as wet chemistry techniques such as reduction of metal salts, sonochemistry, and sol gel methods. Taking sample applications, we discuss the properties necessary for each, and how to control these properties through synthesis control, such as by using templating methods.

CENG 6200a, Fundamentals of Molecular Modeling Amir Haji-Akbari
This is an elective course for graduate students in engineering and sciences that familiarizes them with basics of molecular modeling. The course commences with a brief overview of classical thermodynamics and statistical mechanics. Subsequently, the theoretical foundations and the algorithmic implementation aspects of the following techniques are covered: Monte Carlo simulations, molecular dynamics simulations, thermostats and barostats, estimation of static and dynamic properties, long-ranged interactions and Ewald-based methods, free energy calculations, constrained MD, biased simulations (Landau free energies, umbrella sampling, metadynamics), and rare events and rate calculations. Students are expected to be proficient in calculus, probability theory, thermodynamics and statistical mechanics. They should also have basic familiarity with computer programming (preferably in C or C++).

CPSC 5130b, Computer System Security Timothy Barron
Overview of the principles and practice behind analyzing, designing, and implementing secure computer systems. The course covers problems that have continued to plague computer systems for years as well as recent events and research in this rapidly evolving field. Students learn to think from the perspective of an adversary, to understand systems well enough to see how their flaws could be exploited, and to consequently defend against such exploitation. The course offers opportunities for hands-on exploration of attacks and defenses in the contexts of web applications, networks, and system-level software. It also addresses ethical considerations and responsibilities associated with security research and practice.

CPSC 5150b, Law and Large Language Models Ruzica Piskac and Scott Shapiro
This course is intended for computer science and law students interested in how artificial intelligence can be applied to legal reasoning. It combines basic AI theory with practical project work, focusing on using tools like large language models (LLMs) and other AI technologies for tasks common in legal practice. Students learn how to automate case summarization, draft legal memos and briefs, simulate oral arguments for better argumentation skills, and assist in the preparation of pro-se motions for self-represented litigants. The course emphasizes hands-on experience, helping students build real-world skills in applying AI in legal settings. Our goal is to bring together students from computer science and from law and match them together in the teams. Each team works on a project that automates a specific aspect of the legal process or legal reasoning, focusing on practical, real-world applications. In addition to all standard course requirements, graduate students need to present a recent, relevant research paper in class. Prerequisites: basic coding skills, including knowledge of Python; interest in Large Language Models (LLMs); basic understanding of linear algebra and calculus; familiarity with basic probability (e.g., likelihood, averages) and simple statistical concepts (like mean and variance).

CPSC 5160a, Lattices and Post-Quantum Cryptography Katerina Sotiraki
This course explores the role of lattices in modern cryptography. In the last decades, novel computational problems, whose hardness is related to lattices, have been instrumental in cryptography by offering: (a) a basis for "post-quantum" cryptography, (b) cryptographic constructions based on worst-case hard problems, and (c) numerous celebrated cryptographic protocols unattainable from other cryptographic assumptions. This course covers the foundations of lattice-based cryptography from fundamental definitions to advanced cryptographic constructions. More precisely, we introduce

the Learning with Error (LWE) and the Short Integer Solutions (SIS) problems and study their unique properties, such as the fact that their average-case hardness is based on the worst-case hardness of lattice problems. Next, we cover lattice constructions of advanced cryptographic primitives, such as fully homomorphic encryption and signature schemes. Finally, we introduce some notions of quantum cryptography and explore the role of lattices in this area. Overall, this course offers insights on the foundations and recent advancements in lattice-based cryptography. Prerequisites: CPSC 467/567 or equivalent and linear algebra.

CPSC 5190a or b, Full Stack Web Programming Alan Weide
This course introduces students to a variety of advanced software engineering and programming techniques in the context of full-stack web programming. The focus of the course includes both client- and server-side programming (and database programming), client/server communication, user interface programming, and parallel programming.

CPSC 5200b, Computer Architecture Abhishek Bhattacharjee
This course offers a treatment of computer architectures for high-performance and power/energy-efficient computer systems. Topics include the foundations of general-purpose computing, including instruction set architectures, pipelines, superscalar and out-of-order execution, speculation, support for precise exceptions, and simultaneous multi-threading. We also cover domain-specific hardware (e.g., graphics processing units), and ongoing industry efforts to elevate them to the status of first-class computing units. In tandem, we cover topics relevant to both general-purpose and domain-specific computing, including memory hierarchies, address translation and virtual memory, on-chip networks, machine learning techniques for resource management, and coherence techniques. If time permits, we study the basics of emerging non-classical computing paradigms like neuromorphic computing. Overall, this course offers insights on how the computing industry is combating the waning of traditional technology scaling via acceleration and heterogeneity. Prerequisites: Courses similar to CPSC 323, 223, and 202. This is a programming-intensive course, so comfort with large programming projects is essential.

CPSC 5210a, Compilers and Interpreters Zhong Shao
Compiler organization and implementation: lexical analysis, formal syntax specification, parsing techniques, execution environment, storage management, code generation and optimization, procedure linkage, and address binding. The effect of language-design decisions on compiler construction.

CPSC 5230b, Operating Systems Anurag Khandelwal
The design and implementation of operating systems. Topics include synchronization, deadlocks, process management, storage management, file systems, security, protection, and networking.

CPSC 5240b, Parallel Programming Techniques Quanquan Liu
Practical introduction to parallel programming, emphasizing techniques and algorithms suitable for scientific and engineering computations. Aspects of processor and machine architecture. Techniques such as multithreading, message passing, and data parallel computing using graphics processing units. Performance measurement, tuning, and debugging of parallel programs. Parallel file systems and I/O.

CPSC 5261a, Building AI Infra Systems Y. Richard Yang
This course covers the design, deployment, operations, and optimization of infrastructure systems that power large-scale modern AI systems such as large-language models (LLMs). It takes an all-resources view, considering AI infrastructure components spanning compute, memory, storage, network, data, and energy resources. Focusing on core AI infrastructure design goals including efficiency, scalability, and stability, the course studies not only the basic mechanisms but also the complete systems to realize the goals. Labs and a capstone project form the core of the course. Prerequisite: CPSC 323, or an equivalent course in systems programming. A background in AI is highly recommended.

CPSC 5270a, C++ Programming for Stability, Security, and Speed Michael Fischer
Computer programming involves both abstraction and practice. Lower-level programming courses focus on learning how to correctly implement algorithms for carrying out a task. This course treats a computer program as an artifact with additional attributes of practical importance including execution efficiency, clarity and readability, redundancy, safety in the face of unexpected or malicious environments, and longevity—the ability to evolve over time as bugs are discovered and requirements change. This course is taught using modern C++.

CPSC 5310a, Computer Music: Algorithmic and Heuristic Composition Scott Petersen
Study of the theoretical and practical fundamentals of computer-generated music. Music and sound representations, acoustics and sound synthesis, scales and tuning systems, algorithmic and heuristic composition, and programming languages for computer music. Theoretical concepts are supplemented with pragmatic issues expressed in a high-level programming language.

CPSC 5320b, Computer Music: Sound Representation and Synthesis Scott Petersen
Study of the theoretical and practical fundamentals of computer-generated music, with a focus on low-level sound representation, acoustics and sound synthesis, scales and tuning systems, and programming languages for computer music generation. Theoretical concepts are supplemented with pragmatic issues expressed in a high-level programming language. Prerequisite: ability to read music.

CPSC 5330b, Computer Networks Y. Richard Yang
An introduction to the design, implementation, analysis, and evaluation of computer networks and their protocols. Topics include layered network architectures, applications, transport, congestion, routing, data link protocols, local area networks, performance analysis, multimedia networking, network security, and network management. Emphasis on protocols used in the Internet.

CPSC 5350b, Building an Internet Router Robert Soule
Over the course of the term, students build a fully functioning Internet router. Students design the control plane in Python on a Linux host and design the data plane in the new P4 language on the bmv2 software switch. To provide context and background for the design of their router, students read a selection of papers to get both a historical perspective and exposure to current research in networking. Prerequisite: CPSC 533.

CPSC 5370a, Database Systems Avi Silberschatz
An introduction to database systems. Data modeling. The relational model and the SQL query language. Relational database design, integrity constraints, functional

dependencies, and natural forms. Object-oriented databases. Implementation of databases: file structures, indexing, query processing, transactions, concurrency control, recovery systems, and security.

CPSC 5380a, Big Data Systems: Trends and Challenges Anurag Khandelwal
Today's Internet-scale applications and cloud services generate massive amounts of data. At the same time, the availability of inexpensive storage has made it possible for these services and applications to collect and store every piece of data they generate, in the hopes of improving their services by analyzing the collected data. This introduces interesting new opportunities and challenges designing systems for collecting, analyzing, and serving the so-called big data. This course looks at technology trends that have paved the way for big data applications, surveys state-of-the-art systems for storage and processing of big data, and considers future research directions driven by open research problems. Our discussions span topics such as cluster architecture, big data analytics stacks, scheduling and resource management, batch and stream analytics, graph processing, ML/AI frameworks, and serverless platforms and disaggregated architectures.

CPSC 5390a, Software Engineering Timos Antonopoulos
Introduction to building a large software system in a team. Learning how to collect requirements and write a specification. Project planning and system design. Increasing software reliability: debugging, automatic test generation. Introduction to type systems, static analysis, and model checking.

CPSC 5391b, Advanced Software Engineering Timos Antonopoulos
This course builds on CPSC 439/539, Software Engineering, with a focus on (a) building systems that scale well and (b) the technical infrastructure and approaches that would guide or inform entrepreneurship/business decisions. During the whole semester, teams work on a term-length software project of students' design, most often a continuation of the project they worked on during CPSC 439/539. There is an extra seminar for the graduate students, where they are assigned topics based on relevant recent research papers published at the top conferences. The topics closely correspond to the lectures covered in the course. The graduate students prepare twenty-minute presentations of those papers and present them in the class. Grading also reflects an expectation of additional sophistication. Prerequiste: After CPSC 539 or similar. Students have to have a working product they built during CPSC 539 or similar course to further develop during this course.

CPSC 5410a, Verifiable, Private, Decentralized Computing in the Age of AI Ben Fisch
You type your question into ChatGPT and get back a response. How do you trust its accuracy? Perhaps you have reviewed the latest published benchmark results for GPT-4, or trust that others have. But how do you know the response you are getting from OpenAI's servers is the true output of GPT-4? Perhaps due to a bug or system overload your question was handled by a weaker AI model. Or worse, perhaps the servers were hacked by someone maliciously giving you incorrect results. And, how do you trust that the sensitive questions you are sending to ChatGPT will not be leaked or used against you? This is a course in cryptographic proof systems. In the digital world today, we trust services to perform many kinds of computations on our data, from managing financial ledgers and databases to complex analytics, such as large-language model (LLM) inference. We trust these services not only to operate correctly, but also to keep our information private. Cryptographic systems allow us

to remove this trust. A "succinct" cryptographic proof enables a service to attach a small certificate on the correctness of its computation which can be verified easily on a low-power device, even if the original computation was extremely complex. The proof of some ML computation that was run for hours on a GPU farm can fit in an email and take just milliseconds to verify on a mobile device! Beyond correctness, a "zero-knowledge" proof system enables us to prove knowledge of secret information, including hidden inputs to a computation that achieves a certain output. For instance, OpenAI could prove that the response is the true output of GPT-4 (a proprietary model) without revealing sensitive details about the model itself. In industry, the market for cryptographic proofs is currently around $75 million and projected to reach $10 billion by 2030, according to some estimates. Cryptographic proofs have become the leading technology for scaling blockchains and achieving privacy in cryptocurrencies. Verifiable and zero-knowledge computing also create an important foundation for decentralizing AI services. Training and serving large models currently require vast resources, leading to centralization. Decentralized ML networks offer a compelling alternative—letting many independent operators contribute incremental work to the overall task using their own resources big or small, from a single GPU to a server cluster, and earn a share of the payments clients make to use the service. In such a setting it is critical to verify that operators contribute incremental work correctly. Or, they may use private data to jointly train an ML model. Succinct zero-knowledge proofs would enable these operators to prove correctness of their work without revealing sensitive data. We cover some of the other challenges and directions in decentralized model training and inference, such as reducing the amount of data that needs to be communicated between physically distributed islands of hardware and the potential role of reinforcement learning.

CPSC 5420a, Theory of Computation Dylan McKay
This course first introduces core, traditional ideas from the theory of computation with more modern ideas used in the process, including basic ideas of languages and automata. Building on the core ideas, the course then covers a breadth of topics in modular units, where each unit examines a new model and potentially a new perspective on computation. Topics may include: basic notions of Complexity Theory, provability and logic, circuits and non-uniform computation, randomized computation, quantum computation, query-based computation, notions of machine learning, compression, and algebraic models of computation. Additional topics might be introduced in lectures or student projects, according to student interests, including mechanism design, voting schemes, cryptography, biological computation, distributed computation, and pseudorandomness. Prerequisite: One of CPSC 365, 366, or 368 is required. This course is a proof-based theory course and mathematical maturity is expected.

CPSC 5440b, Real-World Cryptography Fan Zhang
Cryptography provides strong security and privacy guarantees in well-defined mathematical models, but applying it to real-world systems is an art—one that must account for performance, cost, evolving adversarial threats, and even user behavior. This course aims to impart the art of designing and applying cryptography in the real world, by examining select advanced cryptographic tools used in practice. Topics include secure channels, identity and credentials, anonymity, end-to-end encrypted messaging, and Trusted Execution Environments (TEEs). Graduate

students undertake a semester-long research project and present at the end of the semester. Students are expected to be familiar with concepts in computer security and cryptography (e.g., from CPSC 4130, CPSC 4670, or similar courses). To set the stage, we go over the content of Katz and Lindell (https://www.cs.umd.edu/~jkatz/imc.html) in the first few lectures at a quick pace.

CPSC 5460a, Data and Information Visualization Holly Rushmeier
Visualization is a powerful tool for understanding data and concepts. This course provides an introduction to the concepts needed to build new visualization systems, rather than to use existing visualization software. Major topics are abstracting visualization tasks, using visual channels, spatial arrangements of data, navigation in visualization systems, using multiple views, and filtering and aggregating data. Case studies to be considered include a wide range of visualization types and applications in humanities, engineering, science, and social science. Prerequisite: CPSC 223.

CPSC 5470a, Introduction to Quantum Computing Yongshan Ding
This course introduces the fundamental concepts in the theory and practice of quantum computing. Topics covered include information processing, quantum programming, quantum compilation, quantum algorithms, and error correction. The objective of the course is to engage students in applying fresh thinking to what computers can do. We establish an understanding of how quantum computers store and process data, and we discover how they differ from conventional digital computers. We anticipate this course will be of interest to students working in computer science, electrical engineering, physics, or mathematics. Students must be comfortable with programming, discrete probability, and linear algebra. Prior experience in quantum computing is useful but not required.

CPSC 5490b, Quantum Information Systems Yongshan Ding
Quantum information systems encompass the hardware, software, and networking systems that are designed to encode, store, process, and distribute quantum information. In this course, students get a complete view of such information systems and explore the current advancement associated with building practical quantum computers and networks. This course is structured as four modules: quantum information theory, quantum processor, quantum memory, and quantum network. Students are asked to read and discuss selected research papers. Prerequisite: CPSC 547, PHYS 345 or equivalent. This course is intended for advanced undergraduates who are familiar with basic quantum computation and information. We anticipate this course will be of interest to students working in computer science, electrical engineering, or physics.

CPSC 5510b, The User Interface David Gelernter
The user interface (UI) in the context of modern design, where tech has been a strong and consistent influence from the Bauhaus and U.S. industrial design of the 1920s and 1930s through the IBM-Eames design project of the 1950s to 1970s. The UI in the context of the windows-menus-mouse desktop, as developed by Alan Kay and Xerox in the 1970s and refined by Apple in the early 1980s. Students develop a detailed design and simple implementation for a UI.

CPSC 5520b / AMTH 5520b / CB&B 6663b / GENE 6630b, Deep Learning Theory and Applications Smita Krishnaswamy
Deep neural networks have gained immense popularity within the past decade due to their success in many important machine-learning tasks such as image recognition, speech recognition, and natural language processing. This course provides a principled and hands-on approach to deep learning with neural networks. Students master the principles and practices underlying neural networks, including modern methods of deep learning, and apply deep learning methods to real-world problems including image recognition, natural language processing, and biomedical applications. Course work includes homework, a final exam, and a final project—either group or individual, depending on enrollment—with both a written and oral (i.e., presentation) component. The course assumes basic prior knowledge in linear algebra and probability. Prerequisites: CPSC 202 and knowledge of Python programming.

CPSC 5540a, Software Analysis and Verification Ruzica Piskac
Introduction to concepts, tools, and techniques used in the formal verification of software. State-of-the-art tools used for program verification; detailed insights into algorithms and paradigms on which those tools are based, including model checking, abstract interpretation, decision procedures, and SMT solvers.

CPSC 5550a, Algorithmic Game Theory Manolis Zampetakis
A mathematically rigorous investigation of the interplay of economic theory and computer science, with an emphasis on the relationship of incentive-compatibility and algorithmic efficiency. Particular attention to the formulation and solution of mechanism-design problems that are relevant to data networking and Internet-based commerce.

CPSC 5580b, Automated Decision Systems Stephen Slade
People make dozens of decisions every day in their personal and professional lives. What would it mean for you to trust a computer to make those decisions for you? It is likely that many of those decisions are already informed, mediated, or even made by computer systems. Explicit examples include dating sites like match.com or recommendation systems such as Amazon or Netflix. Most Internet ads on sites like Google or Facebook are run by real-time-bidding (RTB) systems that conduct split-second auctions in the hopes of getting your attention. Driverless cars offer the promise of safer highways. Corporations and other enterprises invest in decision support systems to improve the quality of their products and services. This course considers the spectrum of automated decision models and tools, examining their costs and effectiveness. Examples come from a variety of fields including finance, risk management, credit-card fraud, robotics, medicine, and politics.

CPSC 5590a, Building Interactive Machines Marynel Vazquez
This advanced course brings together methods from machine learning, computer vision, robotics, and human-computer interaction to enable interactive machines to perceive and act in a variety of environments. Part of the course examines approaches for perception with different sensing devices and algorithms; the other part focuses on methods for decision-making and applied machine learning for control. The course is a combination of lectures, state-of-the-art reading, presentations and discussions, programming assignments, and a final team project. Prerequisites: CPSC 570 and understanding of probability, differential calculus, linear algebra, and planning (in Artificial Intelligence). Programming assignments require proficiency in Python and

high-level familiarity with C++. Students who do not fit this profile may be allowed to enroll with the permission of the instructor.

CPSC 5626a, Scalable and Private Graph Algorithms Quanquan Liu
What techniques can we use to deal with modern real-world data with billions of data points? How do we account for strong adversaries that violate the privacy of users providing this data? This course provides students with the knowledge to tackle research questions in these domains. We propose answers and techniques to these broad questions from an algorithmic standpoint, presenting foundational topics such as: (1) the parallel, distributed, and streaming models and algorithmic techniques commonly used within these models; (2) differential privacy and mechanisms for private data analysis; and (3) implementation techniques, tools, and examples that demonstrate the practicality of these algorithms in real-world systems. This course focuses on advanced topics in practical graph algorithms with provable guarantees beyond the sequential model used in most introductory algorithms classes. Specific topics include local graph techniques for problems such as maximal matching, independent set, k-core decomposition, densest subgraphs, and coloring as well as global techniques for problems like connectivity, shortest paths, and spanners. Introductory lectures also feature techniques used beyond graph algorithms. Students are asked to read and present influential recent research papers on these topics. Papers come from prominent CS theory conferences such as STOC, FOCS, SODA as well as database and data mining conferences like VLDB, PODS, and WWW. In addition to these presentations, students also work on a final project which may be theoretical or implementation-based. The course also features voluntary open problem sections where we discuss (known) practice problems and open-ended research questions related to the topics in this course in a collaborative group setting.

CPSC 5630b / ECON 5565b, Algorithms via Convex Optimization Nisheeth Vishnoi
Convex optimization has played a major role in the recent development of fast algorithms for problems arising in areas such as theoretical computer science, discrete optimization, and machine learning. The approach is to first formulate the problem as a continuous (convex) optimization problem, even if the problem may be over a discrete domain, adapt or develop deterministic or randomized continuous-time dynamical systems to solve it, and then design algorithms for the problem via appropriate discretizations. The goal of this course is to design state-of-the-art algorithms for various classical discrete problems through the use of continuous optimization/sampling. The algorithmic applications include maximum flow in graphs, maximum matching in bipartite graphs, linear programming, submodular function minimization, and counting problems involving discrete objects such as matroids. We present approaches gradient descent, mirror descent, interior-point methods, and cutting plane methods. A solid background in calculus, linear algebra, and probability is recommended. It is intended for students who are comfortable with proofs.

CPSC 5640a, Algorithms and their Societal Implications Nisheeth Vishnoi
Today's society comprises humans living in an interconnected world that is intertwined with a variety of sensing, communicating, and computing devices. Human-generated data is being recorded at unprecedented rates and scales, and powerful AI and ML algorithms, which are capable of learning from such data, are increasingly controlling various aspects of modern society: from social interactions. These data-driven decision-making algorithms have a tremendous potential to change our lives for the better,

but, via the ability to mimic and nudge human behavior, they also have the potential to be discriminatory, reinforce societal prejudices, violate privacy, polarize opinions, and influence democratic processes. Thus, designing effective tools to govern modern society which reinforce its cherished values such as equity, justice, democracy, health, privacy, etc. has become paramount and requires a foundational understanding of how humans, data, and algorithms interact. This course is for students who would like to understand and address some of the key challenges and emerging topics at the aforementioned interplay between computation and society. On the one hand, we study human decision-making processes and view them through the lens of computation, and on the other hand we study and address the limitations of artificial decision-making algorithms when deployed in various societal contexts. The focus is on developing solutions through a combination of foundational work such as coming up with the right definitions, modeling, algorithms, and empirical evaluation. The current focus is on bias and privacy, with additional topics including robustness, polarization, and democratic representation. The grade will be based on class participation and a project. The project grade will be determined by a midterm and endterm report/presentation. The course has four primary modules: (1) Data: human-generated data; data collection and aggregation; (2) Decision-Making Algorithms: human decision-making algorithms; traditional algorithmic decision-making models and methods; machine learning-based decision-making models and methods; (3) Bias: socio-technical contexts and underlying computational problems; definitions of fairness; interventions for ensuring fairness; human biases through the lens of computation; privacy; need for definitions of privacy; differential privacy; beyond differential privacy; (4) Other topics: robustness; polarization; elections and social choice. Solid mathematical and programming background is necessary to enroll in this course. CPSC 365 and S&DS 251 are recommended.

CPSC 5650b, Theory of Distributed Systems James Aspnes
Models of asynchronous distributed computing systems. Fundamental concepts of concurrency and synchronization, communication, reliability, topological and geometric constraints, time and space complexity, and distributed algorithms.

CPSC 5660b, Web3, Blockchains, and Cryptocurrencies Ben Fisch
This course is an introduction to blockchain systems, such as Bitcoin and Ethereum. We begin with a brief history of blockchains and an overview of how they are being used today before launching into foundational topics, including distributed consensus, smart contracts, cryptographic building blocks from signatures to authenticated datastructures, and the economics of blockchains. We then cover advanced topics including the scalability and interoperability of blockchain systems and applications such as "decentralized finance" (DeFi). The lectures and assignments engage students in both theoretical and applied aspects of blockchain systems. The course assumes background in various fundamental areas of CS, including discrete math, probability, algorithms, data structures, cryptography, and networks.

CPSC 5670a, Introduction to Cryptography Charalampos Papamanthou
This course introduces modern symmetric and public-key cryptography as well as their broad applications, both from a theoretical and practical perspective. There is an initial emphasis on fundamental cryptographic primitives (e.g., block ciphers, pseudorandom functions, pseudorandom generators, one-way functions), their concrete efficiency and implementation, as well as their security definitions and proofs. Ways of combining

such primitives that lead to more complex objects used to secure today's internet (e.g., via TLS), such as key exchange, randomized encryption, message authentication codes, and digital signatures are also studied. The last part of the course is devoted to modern and more advanced applications of cryptography (some of which are deployed at scale today), such as authenticated data structures, zero-knowledge proofs, oblivious RAM, private information retrieval, secret sharing, distributed consensus, and cryptocurrencies. (e.g, Bitcoin).

CPSC 5671b, Advanced Topics in Cryptography: Cryptography and Computation
Charalampos Papamanthou
Traditional cryptography is mostly concerned with studying the foundations of securing communication via, for example, encryption and message authentication codes. This class studies the applications of cryptography in securing *computation*. Topics include, but not limited to, fundamental results and most recent progress in oblivious computation and private information retrieval (PIR), zero-knowledge proofs, secure computation, consensus algorithms, searchable encryption, and lattice-based cryptography. The class focuses both on theory and applications. This is an advanced course, which requires mathematical maturity as well as comfort with programming. The course also assumes prior knowledge of fundamental notions in cryptography. Prerequisite: CPSC 4670 or equivalent.

CPSC 5680b, Computational Complexity Dylan McKay
Introduction to the theory of computational complexity. Basic complexity classes, including polynomial time, nondeterministic polynomial time, probabilistic polynomial time, polynomial space, logarithmic space, and nondeterministic logarithmic space. The roles of reductions, completeness, randomness, and interaction in the formal study of computation.

CPSC 5690a, Randomized Algorithms James Aspnes
Beginning with an introduction to tools from probability theory including some inequalities like Chernoff bounds, the course covers randomized algorithms from several areas: graph algorithms, algorithms in algebra, approximate counting, probabilistically checkable proofs, and matrix algorithms.

CPSC 5700a, Artificial Intelligence Tesca Fitzgerald
Introduction to artificial intelligence research, focusing on reasoning and perception. Topics include knowledge representation, predicate calculus, temporal reasoning, vision, robotics, planning, and learning.

CPSC 5710a, Trustworthy Deep Learning Rex Ying
In recent years, deep learning has seen applications in many fields, from science and technology, to finance, humanity, and businesses. However, real-world, high-impact machine learning applications demand more than just model performance. In particular, deep learning models are often required to be "trustworthy," so that domain experts can trust that the models consistently behave in a way that corresponds to their domain knowledge. For example, medical experts would expect a deep learning diagnosis model to be able to explicitly utilize medical domain knowledge in its prediction; an insurance company would expect a decision on insurance price to be explainable in terms of risk factors; a financial company would expect its fraud detection model to be robust to adversarial attacks; a physicist would expect models to provide consistency with the underlying laws. This course introduces various fields

of trustworthy deep learning, including model robustness, defenses for adversarial attacks, interpretability, explainability, fairness, privacy, domain adaptation, rules, and constraints. The course covers some of these aspects in the context of graph neural networks but also covers many other ML models in general deep learning, natural language processing, and computer vision. Prerequisites: a course in linear algebra and multi-variable calculus and familiarity with PyTorch and other common Python libraries such as Numpy, Sklearn. Deep learning courses such as CPSC 452 or 453 are recommended.

CPSC 5740a, Computational Intelligence for Games James Glenn
A seminar on current topics in computational intelligence for games, including developing agents for playing games, procedural content generation, and player modeling. Students read, present, and discuss recent papers and competitions, and complete a term-long project that applies some of the techniques discussed during the term to a game of their choice.

CPSC 5750a / ECE 5750a / INP 7575a, Computational Vision and Biological Perception Steven Zucker
An overview of computational vision with a biological emphasis. Suitable as an introduction to biological perception for computer science and engineering students, as well as an introduction to computational vision for mathematics, psychology, and physiology students.

CPSC 5770b, Natural Language Processing Arman Cohan
This course provides a deep dive into modern Natural Language Processing (NLP), with a strong focus on Language Modeling. The curriculum spans both foundational concepts and cutting-edge developments in the field. The course begins with core neural network concepts in NLP, covering word embeddings, sequence modeling, and attention mechanisms. Building on these foundations, we explore transformer architectures and their evolution, including early transformer language models like BERT, GPT and T5. The course examines how these models enable sophisticated language understanding and generation through pre-training and transfer learning. The latter portion covers contemporary advances: Large Language Models (LLMs), multi-modal integration, parameter-efficient fine-tuning, evaluation, multi-agent systems, reasoning, and model compression. We'll analyze the capabilities and limitations of current systems while discussing emerging research directions.

CPSC 5780b, Computer Graphics Theodore Kim
Introduction to the basic concepts of two- and three-dimensional computer graphics. Topics include affine and projective transformations, clipping and windowing, visual perception, scene modeling and animation, algorithms for visible surface determination, reflection models, illumination algorithms, and color theory.

CPSC 5790b, Advanced Topics in Computer Graphics Julie Dorsey
An in-depth study of advanced algorithms and systems for rendering, modeling, and animation in computer graphics. Topics vary and may include reflectance modeling, global illumination, subdivision surfaces, NURBS, physically based fluids systems, and character animation.

CPSC 5791a, Building Game Engines Michael Shah
This course teaches the fundamentals of building a reusable software architecture by building games. This is a programming-intensive course where the end product

of this course is a data-driven game engine that students work in small teams to implement in a systems programming language (e.g. C, C++, D, etc.). Students apply data structures, algorithms, and systems programming skills in the domain of games. Discussion and implementation of the components of a game engine may include: resource management (allocators, resource managers, serialization), abstraction (design patterns, game objects, scripting, graphics layers), graphics management algorithms (scene graphs, level of detail), physics (linear algebra, collision detection and resolution algorithms), artificial intelligence (e.g. pathfinding,decision making), and performance (concurrency, parallelism, math). Students work on a final course project for their portfolio. Prerequisite: previous experience with data structures and systems programming comparable to CPSC 223 and CPSC 323.

CPSC 5792b, Real-Time 3D Computer Graphics Programming Michael Shah
This course teaches the fundamentals of real-time 3D computer graphics programming using a systems programming language (e.g. C, C++, D, etc.). Students interested in making 3D games, virtual reality applications, simulations, medical visualizations, and other interactive applications are the target audience. Throughout the course students also learn about co-processors (e.g. GPUs) for hardware accelerated graphics, and program in a graphics API enabling hardware accelerated graphics. Students apply a sampling of mathematics in the domain of geometry, trigonometry, linear algebra, and calculus in order to generate photo and non-photorealistic images in real-time. Additional topics may include: geometry processing, scene organization, texturing techniques, advanced lighting techniques, compute shaders, and topics in performance.

CPSC 5800a, Introduction to Computer Vision Alex Wong
This course focuses on fundamental topics in computer vision. We begin with the image formation process and discuss the role of camera models and intrinsic calibration in perspective projection. Basic image processing techniques (i.e. filtering) is introduced. After which, we discuss techniques to describe an image, from edges to feature descriptors and methods to establish correspondences between different images of the same scene. The course additionally covers topics in recognition (i.e. image classification, segmentation, detection, etc.) and reconstruction (i.e. stereo, structure-from-motion, optical flow). Machine learning and deep learning based methods in a subset of the topics covered are also introduced. Students get hands-on experience in implementing the techniques covered in the class and applying them to real world datasets and applications. Students taking this course must have successfully passed courses in data structures and object-oriented programming (e.g. CPSC 223a or equivalent courses) and foundational mathematical tools such as discrete math and linear algebra (e.g. CPSC 202 or equivalent courses). It is recommended that students have taken or successfully passed calculus (e.g. MATH 112, MATH 115, MATH 120, or equivalent courses) and linear algebra (e.g. MATH 225, or equivalent courses). A background in statistics, machine learning and deep learning is useful but not required. Experience in programming with Python is preferable, as we use it for assignments and projects. Familiarity with Google Colab and numerical and image processing packages (i.e. NumPy, SciPy, and Sci-kit Image) is helpful throughout the course.

CPSC 5810b, Introduction to Machine Learning Alex Wong
This course focuses on fundamental topics in machine learning. We begin with an overview of different components of machine learning and types of learning paradigms. We introduce a linear function, discuss how one can train a linear function on a

given dataset, and utilize it to tackle classification and regression problems. We then consider kernel methods to enable us to solve nonlinear problems. Additionally, we introduce the concept of generalization error and overfitting. We discuss the role of regularization and extend linear regression to ridge regression. We also cover topics in optimization, beginning from gradient descent and extending it to stochastic gradient descent and its momentum variant. We also cover the concept of alternating optimization and topics within it. We introduce the curse of dimensionality and discuss topics on dimensionality reduction. Finally, we conclude the course with neural networks: how to build them using the topics discussed, how to optimize them, and how to apply them to solve a range of machine learning tasks. Prerequisites: Courses in data structures and object-oriented programming (e.g. CPSC 223a or equivalent courses), foundational mathematical tools such as discrete math and linear algebra (e.g. CPSC 202 or equivalent courses), calculus (e.g. MATH 112, MATH 115, MATH 120, or equivalent courses), linear algebra (e.g. MATH 225, or equivalent courses), and artificial intelligence (e.g. CPSC 370/570). A background in statistics is useful but not required. Experience in programming with Python and familiarity with Google Colab and numerical and image processing packages (i.e. NumPy, SciPy) is helpful.

CPSC 583ob, Deep Learning on Graph-Structured Data Rex Ying
Graph structure emerges in many important domain applications, including but not limited to computer vision, natural sciences, social networks, languages, and knowledge graphs. This course offers an introduction to deep learning algorithms applied to such graph-structured data. The first part of the course is an introduction to representation learning for graphs and covers common techniques in the field, including distributed node embeddings, graph neural networks, deep graph generative models, and non-Euclidean embeddings. The first part also touches upon topics of real-world significance, including auto-ML and explainability for graph learning. The second part of the course covers important applications of graph machine learning. We learn ways to model data as graphs and apply graph learning techniques to problems in domains including online recommender systems, knowledge graphs, biological networks, physical simulations and graph mining. The course covers many deep techniques (graph neural networks, graph deep generative models) catered to graph structures. We cover basic deep learning tutorials in this course. Knowledge of graphs as a data structure, and understanding of basic graph algorithms are essential for applying machine learning to graph-structured data. Familiarity with Python and important libraries such as Numpy and Pandas are helpful. A foundation of deep neural networks is highly recommended. Experience in machine Learning and Graph Theory are welcomed as well.

CPSC 584ob, Introduction to Human-Computer Interaction Marynel Vazquez
This course introduces students to the interdisciplinary field of human-computer interaction (HCI), with particular focus on human-robot interaction (HRI). The first part of the course covers principles and techniques in the design, development, and evaluation of interactive systems. It provides students with an introduction to UX design and user-centered research. The second part focuses on the emergent filed of HRI and several other nontraditional interfaces, e.g., AR/VR, tangibles, crowdsourcing. The course is organized as a series of lectures, presentations, a midterm exam, and a term-long group project on designing a new interactive system.

Prerequisites: CPSC 201 and CPSC 202 or equivalents. Students who do not fit this profile may be allowed to enroll with permission of the instructor.

CPSC 585oa, Applied Planning and Optimization Daniel Rakita
This course introduces students to concepts, algorithms, and programming techniques pertaining to planning and optimization. At a high level, the course teaches students how to break down a particular problem into a state-space or a state-action space, how to select an effective planning or optimization algorithm given the problem at hand, and how to ultimately apply the selected algorithm to achieve desired outputs. Concepts are solidified through grounded, real-world examples (particularly in robotics, but also including machine learning, graphics, biology, etc.). These examples come in the form of programming assignments, problem sets, and a final project. General topics include discrete planning, sampling-based path planning, optimization via matrix methods, linear programming, computational differentiation, non-linear optimization, and mixed integer programming. After the course, students are able to generalize their knowledge of planning and optimization to any problem domain. Knowledge of linear algebra and calculus is expected. Students should be familiar with matrix multiplication, derivatives, and gradients.

CPSC 5860b, Probabilistic Machine Learning Andre Wibisono
This course provides an overview of the probabilistic frameworks for machine learning applications. The course covers probabilistic generative models, learning and inference, algorithms for sampling, and a survey of generative diffusion models. This course studies the theoretical analysis of the problems and how to design algorithms to solve them. This course familiarizes students with techniques and results in literature and prepares them for research in machine learning. Prerequisites: Knowledge of machine learning, linear algebra, probability, and calculus.

CPSC 5870b, 3D Spatial Modeling and Computing Daniel Rakita
Several areas of computer science and related fields must model and compute how objects are situated in three-dimensional space over time, such as robotics, computer vision, computer graphics, computational physics, computational biology, aerospace engineering, and so on. This course teaches students how to computationally model the spatial configuration of and spatial relationships between objects over time. Topics covered include various methods for representing spatial configurations and transformations (such as transformation matrices, Euler angles, unit quaternions, dual quaternions, etc.), hierarchical chaining of spatial transformations, derivatives of spatial representations with respect to time, computing intersections and penetration depths between objects in space, interpolating over spatial representations (such as using splines), signal processing over spatial transformations, optimizing over spatial representations, and more. To develop these concepts rigorously, we draw from linear algebra, calculus, topology, Lie theory, and geometric algebra. Real-world examples from robotics, computer vision, and computer graphics are utilized to solidify these concepts, with programming assignments, problem sets, and a final project that allows students to apply what they have learned. Interactive visual aids created by the instructor are an integral part of lectures to help students connect mathematical concepts with spatial phenomena. Prerequisites: Undergraduate students should have taken CPSC 202 and CPSC 223. All students should have proficiency in programming with mathematical reasoning. A background in linear algebra and calculus is recommended but not required.

CPSC 5890b, Robot Learning Tesca Fitzgerald
This course explores methods for grounding machine learning algorithms in embodied, interactive robots. We cover topics including learning from demonstration, active learning, inverse reinforcement learning, representations for modeling high-level and low-level task information, and human factors for designing learning interactions. Students are asked to read and present research papers on these topics from top publication venues in AI, machine learning, robotics, and human-robot interaction. Students also complete lab assignments in which they implement and evaluate state-of-the-art methods for interactive robot learning on a physical robot arm. Prerequisite: CPSC 370/470/570 or an equivalent AI course (requires approval by instructor). Recommended: an introductory machine-learning course such as S&DS 265 or CPSC 481.

CPSC 6110a, Topics in Computer Science and Global Affairs Joan Feigenbaum and Ted Wittenstein
This course focuses on "socio-technical" problems in computing and international relations. These are problems that cannot be solved through technological progress alone but rather require legal, political, or cultural progress as well. Examples include but are not limited to cyber espionage, disinformation, ransomware attacks, and intellectual-property theft. This course is offered jointly by the SEAS Computer Science Department and the Jackson School of Global Affairs. It is addressed to graduate students who are interested in socio-technical issues but whose undergraduate course work may not have addressed them; it is designed to bring these students rapidly to the point at which they can do research on socio-technical problems. Prerequisites: Basics of cryptography and computer security (as covered in Yale's CPSC 467), networks (as covered in Yale's CPSC 433), and databases (as covered in Yale's CPSC 437) helpful but not required.

CPSC 6120b, Topics in Algorithmic Game Theory Yang Cai
The course focuses on algorithms and the complexity of equilibrium computation as well as its connection with learning theory and optimization. As many recent machine learning approaches have moved from an optimization perspective to an "equilibration" perspective, where a good model is framed as the equilibrium of a game. The intersection of game theory, learning theory, and optimization is becoming increasingly relevant. The goal of the course is to cover the fundamentals and bring students to the frontier of this active research area. Prerequisites: A course in algorithms (CPSC 365 or 366) and a course in probability theory (MATH/S&DS 241). A course in algorithmic game theory (CPSC 455/555) is helpful but not required.

CPSC 6130a, Digital Identity Infrastructure Michael Fischer
A digital identity system establishes a connection between a real person and an internet platform such as an online banking site or a social media platform. Current digital identity systems utilize an ad hoc collection of password-based and multi-factor authentication methods. The inconsistency of these methods leads to user confusion, inconvenience, lack of interoperability, poor privacy properties, and degraded security. Data breaches, account takeovers, and privacy violations have become the norm. Efforts to combat these abuses have only been marginally effective. This course presents design principles for an internet-wide digital identity standard to ameliorate most of these problems. It is based on established principles of commerce and law from the non-digital world such as isolation of sensitive data, distributed trust, rules of

evidence, and dispute-resolution procedures. A network of trusted agents maintain a distributed blockchain of transactions that provide evidence of authorization of internet transactions and assign responsibility for breaches of trust. Helpful but not required: basics of cryptography and computer security (as covered in Yale's CPSC 4670), distributed computing (as covered in Yale's CPSC 4650), and networks (as covered in Yale's CPSC 4330). Instructor permission required.

CPSC 6400b / AMTH 640b / MATH 6400b, Topics in Numerical Computation Vladimir Rokhlin
This course discusses several areas of numerical computing that often cause difficulties to non-numericists, from the ever-present issue of condition numbers and ill-posedness to the algorithms of numerical linear algebra to the reliability of numerical software. The course also provides a brief introduction to "fast" algorithms and their interactions with modern hardware environments. The course is addressed to Computer Science graduate students who do not necessarily specialize in numerical computation; it assumes the understanding of calculus and linear algebra and familiarity with (or willingness to learn) either C or FORTRAN. Its purpose is to prepare students for using elementary numerical techniques when and if the need arises.

CPSC 6440a / MATH 7440, Geometric and Topological Methods in Machine Learning Smita Krishnaswamy
This course provides an introduction to geometric and topological methods in data science. Our starting point is the manifold hypothesis: that high dimensional data live on or near a much lower dimensional smooth manifold. We introduce tools to study the geometric and topological properties of this manifold in order to reveal relevant features and organization of the data. Topics include: metric space structures, curvature, geodesics, diffusion maps, eigenmaps, geometric model spaces, gradient descent, data embeddings and projections, and topological data analysis (TDA) in the form of persistence homology and their associated "barcodes." We see applications of these methods in a variety of data types. Prerequisites: MATH 225 or 226; MATH 255 or 256; MATH 302 and CPSC 112. Students who completed MATH 231 or 250 may substitute another analysis course level 300 or above in place of MATH 302. Familiarity with algorithms/programming is beneficial.

CPSC 6900a, Independent Project I Lin Zhong
Independent Project I. By arrangement with faculty.

CPSC 6910a, Independent Project II Staff
By arrangement with faculty.

CPSC 6920a, Independent Project Staff
Individual research for students in the M.S. program. Requires a faculty supervisor and the permission of the director of graduate studies.

CPSC 6930a, MS Thesis Research I Holly Rushmeier
First term of thesis research for students in the two-year MS program in Computer Science None

CPSC 6940a, MS Thesis Research II Holly Rushmeier
Second term of thesis research for students in the two-year MS program in Computer Science.

CPSC 7520b / CB&B 7520b / MB&B 7520b / MB&B 753 / MB&B 754 / MCDB 7520b, Biomedical Data Science: Mining and Modeling Mark Gerstein and Matthew Simon

Biomedical data science encompasses the analysis of gene sequences, macromolecular structures, and functional genomics data on a large scale. It represents a major practical application for modern techniques in data mining and simulation. Specific topics to be covered include sequence alignment, large-scale processing, next-generation sequencing data, comparative genomics, phylogenetics, biological database design, geometric analysis of protein structure, molecular-dynamics simulation, biological networks, normalization of microarray data, mining of functional genomics data sets, and machine-learning approaches to data integration. Prerequisites: biochemistry and calculus, or permission of the instructor.

CPSC 7760b, Topics in Industrial AI Applications Xiuye (Sue) Chen

This seminar aims to familiarize students with cutting-edge topics in industrial AI research and their practical applications. We will explore a broad range of topics such as large language models, image generation, ML/AI systems considerations, autonomous vehicles, robotics, recommender systems, ambient intelligence, and AI applications in the life sciences and healthcare. Most sessions will be devoted to in-depth discussions of one to two key papers on modern AI applications. We will also feature a series of industry guest speakers, providing students with the opportunity to learn directly from practicing experts. In this seminar, students are expected to present papers, actively participate in class discussions, and work either individually or in groups on a final project that emphasizes the practical implementation of AI techniques. Students should be familiar enough with ML/AI concepts to read academic papers, and comfortable with programming to run open source code in the ML/AI space.

CPSC 9900a, Ethical Conduct of Research for Master's Students Yoehan Oh

This course forms a vital part of research ethics training, aiming to instill moral research codes in graduate students of computer science, math, and applied math. By devling into case studies and real-life examples related to research misconduct, students will grasp core ethical principles in research and academia. The course also offers an opportunity to explore the societal impacts of research in computer science, math, and applied math. This course is designed specifically for first-year graduate students in computer science/applied math/math. Successful completion of the course necessitates in-person attendance on eight occasions; virtual participation will not fulfill this requirement. In cases where illness, job interviews, or unforeseen circumstances prevent attendance, makeup sessions will be offered. This course is 0 credits for YC students. 0 Course cr

CPSC 9910a / MATH 9910a, Ethical Conduct of Research Yoehan Oh

This course forms a vital part of research ethics training, aiming to instill moral research codes in graduate students of computer science, math, and applied math. By delving into case studies and real-life examples related to research misconduct, students grasp core ethical principles in research and academia. The course also offers an opportunity to explore the societal impacts of research in computer science, math, and applied math. This course is designed specifically for first-year graduate students in computer science, applied math, and math. Successful completion of the course necessitates in-person attendance on eight occasions; virtual participation

does not fulfill this requirement. In cases where illness, job interviews, or unforeseen circumstances prevent attendance, makeup sessions are offered. o Course cr

CPSC 9920a or b, Academic Writing Staff
This course is an intensive analysis of the principles of excellent writing for Ph.D. students and scientists preparing a range of texts including research papers, conference posters, technical reports, research statements, grant proposals, correspondence, science and industry blogs, and other relevant documents. We look at the components of rhetorical positioning in the development of a clear, interesting, and rigorous science research paper. Some of the sub-genres we analyze and practice include the introduction, literature review, methodology, data commentary, results/discussion, conclusion, and abstract. In addition to the research paper, we practice other types of texts including research statements, requests for funding, bio-data statements, and blogs. We also discuss how writers can develop content and fluency as well as strategies for redrafting and editing. Students receive detailed feedback on their writing with a focus on clarity, precision, tone, and readability. o Course cr

ECE 4061b / ECE 8061b, Photovoltaic Energy Fengnian Xia
Electricity from photovoltaic solar cells is receiving increasing attention due to growing world demand for clean power sources. This course primarily emphasizes device physics of photovoltaics; statistics of charge carriers in and out of equilibrium; design of solar cells; and optical, electrical, and structural properties of semiconductors relevant to photovoltaics. Two laboratory sessions and a final project aid students in understanding both the applications and limitations of photovoltaic technology. The main objectives of this course are to equip students with the necessary background and analytical skills to understand and assess established and emerging photovoltaic technologies; to familiarize students with the diverse range of photovoltaic materials; and to connect materials properties to aspects of cell design, processing, and performance.

ECE 5021b / S&DS 5510b, Stochastic Processes Ilias Zadik
Introduction to the study of random processes, including Markov chains, Markov random fields, martingales, random walks, Brownian motion, and diffusions. Techniques in probability such as coupling and large deviations. Applications chosen from image reconstruction, Bayesian statistics, finance, probabilistic analysis of algorithms, genetics, and evolution.

ECE 5750a / CPSC 5750a / INP 7575a, Computational Vision and Biological Perception Steven Zucker
An overview of computational vision with a biological emphasis. Suitable as an introduction to biological perception for computer science and engineering students, as well as an introduction to computational vision for mathematics, psychology, and physiology students.

ECE 7181b, Advanced Electronic Devices Mengxia Liu
The science and technology of semiconductor electron devices. Topics include compound semiconductor material properties and growth techniques; heterojunction, quantum well, and superlattice devices; quantum transport; graphene and other 2-D material systems.

ECE 8061b / ECE 4061b, Photovoltaic Energy Fengnian Xia
Electricity from photovoltaic solar cells is receiving increasing attention due to growing world demand for clean power sources. This course primarily emphasizes device physics of photovoltaics; statistics of charge carriers in and out of equilibrium; design of solar cells; and optical, electrical, and structural properties of semiconductors relevant to photovoltaics. Two laboratory sessions and a final project aid students in understanding both the applications and limitations of photovoltaic technology. The main objectives of this course are to equip students with the necessary background and analytical skills to understand and assess established and emerging photovoltaic technologies; to familiarize students with the diverse range of photovoltaic materials; and to connect materials properties to aspects of cell design, processing, and performance.

ECE 8400a, Detection and Estimation Dionysis Kalogerias
Detection and Estimation refers to the development and study of statistical theory and methods in settings involving stochastic signals and, more generally, stochastic processes or stochastic data, where the goal is (optimal) testing of possibly multiple hypotheses regarding the generative model of the data, (optimal) signal estimation from potentially noisy measurements/observations, and parameter estimation whenever parametric signal/data models are available. Although these problems often come up in the context of signal processing and communications, the concepts are fundamental to the basic statistical methodologies used broadly across science, medicine, and engineering. The course has been designed from a contemporary perspective, and includes new and cutting-edge topics such as risk-aware statistical estimation and intrinsic links with stochastic optimization and statistical learning.

ECE 8680a, Emerging Materials and Technologies toward Sustainability Liangbing Hu
The goal of this course is to demonstrate the role of new materials and emerging technologies in solving one of the most critical socio-economic issues of our time —sustainability. The course focuses on electrochemical, electrical, optical, thermal, and mechanically functional materials and their use in energy devices. Topics to be covered include electrochemical energy conversion and storage (fuel cells and batteries), catalysts and membrane separations (fossil fuel and biomass energy conversion), electrified heating (Joule, plasma, microwave), solar thermal and fuel, thermoelectrics, energy efficient lighting, and building energy savings (light, thermal).

ECE 8750a, Introduction to VLSI System Design Rajit Manohar
Chip design. Provides background in integrated devices, circuits, and digital subsystems needed for design and implementation of silicon logic chips. Historical context, scaling, technology projections, physical limits. CMOS fabrication overview, complementary logical circuits, design methodology, computer-aided design techniques, timing, and area estimation. Case studies of recent research and commercial chips. Objectives of the course are (1) to give students the ability to complete the course project (design of a digital CMOS subsystem chip through layout), and (2) to understand the directions that future chip technologies may take. Selected projects are fabricated and packaged for testing by students. Prerequisite: circuits at the level of introductory physics and computer programming.

ECE 8880a, FPGA-Based Accelerator Design and Implementation Linghao Song
The goal of this course is to equip students with the skills to design and implement FPGA-based accelerators and deploy the generated bitstreams for real applications. Topics include FPGA programing using high level synthesis (HLS), dataflows, on-chip and off-chip memories, frequency tuning, and performance modeling and analysis of accelerator architectures. The course includes hands-on labs that cover both computation-intensive and memory-intensive workloads. It also introduces recent developments in FPGA technology and accelerator design. Prerequisites: coding skills and basic knowledge of computer systems.

ECE 9001b, Decisions and Computations across Networks A Stephen Morse
Within the field of network science there has long been interest in distributed computation and distributed decision-making problems of many types. Among these are consensus and flocking problems, the multi-robot rendezvous problem, distributed averaging, distributed solutions to linear algebraic equations, social networking problems, localization of sensors in a multisensor network, and the distributed management of robotic formations. The aim of this course is to explain what these problems are and to discuss their solutions. Related concepts from spectral graph theory, rigid graph theory, non-homogeneous Markov chain theory, stability theory, and linear system theory are covered. Prerequisite: although most of the mathematics needed are covered in the lectures, students taking this course should have a working understanding of basic linear algebra.

ECE 9020a, Linear Systems A Stephen Morse
Background linear algebra; finite-dimensional, linear-continuous, and discrete dynamical systems; state equations, pulse and impulse response matrices, weighting patterns, transfer matrices. Stability, Lyapunov's equation, controllability, observability, system reduction, minimal realizations, equivalent systems, McMillan degree, Markov matrices. Recommended for all students interested in feedback control, signal and image processing, robotics, econometrics, and social and biological networks.

ECE 9051a, Applied Digital Signal Process Roman Kuc
Random variables, central limit theorem estimations, and cost and risk functions. Processing techniques including estimating autocorrelation sequences, variance reduction and spectrum estimation and filter design.

ECE 9100a / MATH 7120a, Topics in Denoising and Structure Recovery from Data Boris Landa
Recovering signals and underlying structure from noisy observations is a fundamental problem in many areas of science and engineering. Over the past few decades, a rich body of work has emerged to address this challenge across diverse settings. A common guiding principle is to leverage structural assumptions—such as smoothness, sparsity, or low-rankness in the data—alongside models of the noise to enable effective recovery. This course explores both classical and modern approaches to denoising and structural data recovery, blending theoretical foundations with algorithmic and applied perspectives. Particular emphasis is placed on high-dimensional regimes relevant to modern data analysis, where noise can behave in counterintuitive ways, yet also exhibit predictable patterns that can be exploited for denoising. The course introduces tools and results from high-dimensional probability and random matrix theory that underpin many recent advances in this area.

ECE 9500a, How to Wirelessly Sense Almost Anything Staff
This seminar course introduces graduate students and senior undergraduates in EE/CS to wireless sensing. We explore various signals and sensing modalities, including radio frequency, mmWave, acoustics, and visible light. We cover fundamental principles such as battery-free computing, wireless localization, sensor security, health sensing, and backscatter networking. In this course, we examine wireless sensing applications such as seeing through walls, contactless vital sign monitoring, smart homes, ocean IoT, and smart agriculture, as well as multi-modal sensing for augmented reality headsets and robotics. Lectures introduce fundamental technologies through research paper discussions and readings. Additionally, students undertake a semester-long research project.

ECE 9631b, Network Algorithms and Stochastic Optimization Leandros Tassiulas
This course focuses on resource allocation models as well as associated algorithms and design and optimization methodologies that capture the intricacies of complex networking systems in communications computing as well as transportation, manufacturing, and energy systems. Max-weight scheduling, back-pressure routing, wireless opportunistic scheduling, time-varying topology network control, and energy-efficient management are sample topics to be considered, in addition to Lyapunov stability and optimization, stochastic ordering, and notions of fairness in network resource consumption.

ECE 9909a or b, Special Investigations Staff
Faculty-supervised individual projects with emphasis on research, laboratory, or theory. Students must define the scope of the proposed project with the faculty member who has agreed to act as supervisor, and submit a brief abstract to the director of graduate studies for approval.

ENAS 5000a, Mathematical Methods I Martin Pfaller
A beginning, graduate-level introduction to ordinary and partial differential equations, vector analysis, linear algebra, and complex functions. Laplace transform, series expansion, Fourier transform, and matrix methods are given particular attention. Applications to problems frequently encountered in engineering practice are stressed throughout.

ENAS 5080b, Responsible Conduct of Research Staff
Required of first-year students. Presentation and discussion of topics and best practices relevant to responsible conduct of research including academic fraud and misconduct, conflict of interest and conflict of commitment, data acquisition and human subjects, use and care of animals, publication practices and responsible authorship, mentor/trainee responsibilities and peer review, and collaborative science. o Course cr

ENAS 5170b / MB&B 5170b / MCDB 5170b / PHYS 5170b, Methods and Logic in Interdisciplinary Research Corey O'Hern and Emma Carley
This full PEB class is intended to introduce students to integrated approaches to research. Each week, the first of two sessions is student-led, while the second session is led by faculty with complementary expertise and discusses papers that use different approaches to the same topic (for example, physical and biological or experiment and theory).

ENAS 5180a / CBIO 635 / MB&B 6350a, Quantitative Methods in Biophysics Nikhil Malvankar, Julien Berro, and Yong Xiong
An introduction to quantitative methods relevant to analysis and interpretation of biological data. Topics include statistical testing, data presentation, and error analysis; introduction to artificial intelligence-based data analysis tools, Alpha Fold Tutorial, introduction to mathematical modeling of biological dynamics; and Fourier analysis in signal/image processing and macromolecular structural studies. Instruction in basic programming skills and data analysis using MATLAB; study of real data from MB&B research groups. Prerequisites: MATH 120 and MB&B 600 or equivalents, or permission of the instructors.

ENAS 5190b, Responsible Conduct of Research Staff
Required of first-year students in Chemical & Environmental Engineering, Electrical Engineering, and Mechanical Engineering & Materials Science. Presentation and discussion of topics and best practices relevant to responsible conduct of research including academic fraud and misconduct, conflict of interest and conflict of commitment, data acquisition and human subjects, use and care of animals, publication practices and responsible authorship, mentor/trainee responsibilities and peer review, and collaborative science. o Course cr

ENAS 5620b / AMTH 765b / CB&B 5620b / INP 562b / INP 7562b / MB&B 5620b / PHYS 5620b, Modeling Biological Systems II Thierry Emonet, Jing Yan, and Damon Clark
This course covers advanced topics in computational biology. How do cells compute, how do they count and tell time, how do they oscillate and generate spatial patterns? Topics include time-dependent dynamics in regulatory, signal-transduction, and neuronal networks; fluctuations, growth, and form; mechanics of cell shape and motion; spatially heterogeneous processes; diffusion. This year, the course spends roughly half its time on mechanical systems at the cellular and tissue level, and half on models of neurons and neural systems in computational neuroscience. Prerequisite: a 200-level biology course or permission of the instructor.

ENAS 5710b / MB&B 5910b / MCDB 5910b / PHYS 5710b, Integrated Workshop Corey O'Hern
This required course for students in the PEB graduate program involves a series of modules, co-taught by faculty, in which students from different academic backgrounds and research skills collaborate on projects at the interface of physics, engineering, and biology. The modules cover a broad range of PEB research areas and skills. The course starts with an introduction to MATLAB, which is used throughout the course for analysis, simulations, and modeling.

ENAS 6240b, Finding Yourself in the Future of Creativity John Kao
This course is for would-be entrepreneurs, future leaders wanting to drive creative agendas, and all of us who wish to harness and amplify our innate creativity to make a difference. It describes a set of driving forces that require a re-evaluation of how creativity works and how it can be practiced. These include expanded views of creative cognition and its relationship to advanced brain science, the growing connections between human creativity and machine intelligence, the role of culture and politics in shaping the gameboard for creativity's global spread, and finally an emerging ethical perspective on creativity. Courses on creativity, entrepreneurship, and leadership usually focus on the externalities—what to do, and how to analyze. This course by

contrast embraces the internalities, the critical human and cognitive factors that drive creative outcomes. To clarify these internalities, the course has been designed to balance didactic and experiential learning and is meant for students who have an appetite for self-assessment and engaging in personal exploration. Accordingly, the course integrates presentations, hands-on self-assessment exercises, directed readings, and collaborative projects.

ENAS 8000a, Smart City Engineering with IoT Andrei Khurshudov
A smart city is one that employs technology to gather data from various sources such as sensors, people, devices, vehicles, and buildings. This data is then used for optimal decision-making and control. Cities around the world are adopting "smart" technology, thereby transforming urban life. Utilizing the Internet of Things (IoT), cities like Barcelona, London, and Singapore aim to improve living standards, boost the economy, and enhance sustainability. They achieve this through innovations like intelligent streetlights, smart electric grids, and advanced traffic systems. The Internet of Things, a global network consisting of connected sensors, machines, devices, communication networks, and decision-making algorithms is facilitating a new wave of the industrial revolution. This course is designed for *both graduate and undergraduate students* and offers a comprehensive overview of the key technologies shaping contemporary and future smart cities. It delves into the foundational elements of IoT devices and applications, covering topics such as: data analytics using ML and AI (which will be used to address practical problems); smart sensors and interconnected devices; IoT data: formats, transmission, and storage; Cloud and Edge computing, and the associated trade-offs; connectivity and wireless communication technologies; device failure prevention and reliability modeling; and other relevant subjects.

MENG 5020b, Mechatronics Laboratory Madhusudhan Venkadesan
Hands-on synthesis of control systems, electrical engineering, and mechanical engineering. Review of Laplace transforms, transfer functions, software tools for solving ODEs. Review of electronic components and introduction to electronic instrumentation. Introduction to sensors, mechanical power transmission elements, programming microcontrollers, and PID control.

MENG 5041b, Applied Numerical Methods for Differential Equations Beth Anne Bennett
The derivation, analysis, and implementation of numerical methods for the solution of ordinary and partial differential equations, both linear and nonlinear. Additional topics such as computational cost, error estimation, and stability analysis are studied in several contexts throughout the course. MENG 5040 is not a prerequisite.

MENG 5050a, Computer-Aided Engineering Omer Subasi
Aspects of computer-aided design and manufacture (CAD/CAM). The computer's role in the mechanical design and manufacturing process; commercial tools for two- and three-dimensional drafting and assembly modeling; finite-element analysis software for modeling mechanical, thermal, and fluid systems.

MENG 5359a, Neuromuscular Biomechanics Madhusudhan Venkadesan
Mechanics and control of animal movement, including skeletal muscle mechanics, systems-level neural and sensory physiology, elements of feedback control, and optimal control. Deriving equations of motion for multibody mechanical systems that are

actuated by muscles or muscle-like motors; incorporating sensory feedback; analyzing system properties such as stability and energetics.

MENG 6278a, Advanced Robotic Mechanisms Aaron Dollar
TBD

MENG 7465a, Chemical Propulsion Systems Alessandro Gomez
Study of chemical propulsion systems. Topics include review of propulsion fundamentals; concepts of compressible fluid flow; development and application of relations for Fanno and Rayleigh flows; normal and oblique shock systems to various propulsion system components; engine performance characteristics; fundamentals of turbomachinery; liquid and solid rocket system components and performance.

MENG 7469a, Aerodynamics Juan de la Mora
Review of fluid dynamics. Inviscid flows over airfoils; finite wing theory; viscous effects and boundary layer theory. Compressible aerodynamics: normal and oblique shock waves and expansion waves. Linearized compressible flows. Some basic knowledge of thermodynamics is expected.

MENG 7475a, Fluid Mechanics of Natural Phenomena Amir Pahlavan
This course draws inspiration from nature and focuses on utilizing the fundamental concepts of fluid mechanics and soft matter physics to explain these phenomena. We study a broad range of problems related to (1) nutrient transport in plants, slime molds, and fungi and the adaptation of their networks in dynamic environments, (2) collective behavior and chemotaxis of swimming microorganisms, and (3) pattern formation in nature, e.g. icicles, mud cracks, salt polygons, dendritic crystals, and Turing patterns. We also discuss how our understanding of these problems could be used to develop sustainable solutions for the society, e.g. designing synthetic trees to convert CO_2 to oxygen, developing micro/nano robots for biomedical applications, and utilizing pattern formation and self-assembly to make new materials.

MENG 8664b, Forces on the Nanoscale Udo Schwarz
Modern materials science often exploits the fact that atoms located at surfaces or in thin layers behave differently from bulk atoms to achieve new or greatly altered material properties. The course provides an in-depth discussion of intermolecular and surface forces, which determine the mechanical and chemical properties of surfaces. In the first part, we discuss the fundamental principles and concepts of forces between atoms and molecules. Part two generalizes these concepts to surface forces. Part three then gives a variety of examples. The course is of interest to students studying thin-film growth, surface coatings, mechanical and chemical properties of surfaces, soft matter including biomembranes, and colloidal suspensions.

MENG 8672b, Electronic and Optical Properties of Energy Materials Diana Qiu
This course explores the electronic and optical properties of materials from the perspective of electronic and molecular structure with a special focus on the microscopic origin and design of properties of interest for energy harvesting, storage, and transport. The course begins by briefly introducing concepts in quantum mechanics, such as wave functions and the time-independent Schrödinger equations. Then, we explore electronic structure in the context of designing materials for energy harvesting and generation, such as photovoltaics, thermoelectrics, and piezoelectrics. We also study dynamical processes, such as hot electron relaxation, multi-exciton generation, charge

transport, and energy transport at a phenomenological level. Finally, we overview common energy storage materials, with a focus on solid-state batteries and solar fuels.

MENG 8673a, Introduction to Nanomaterials and Nanotechnology Cong Su
Survey of nanomaterial synthesis methods and current nanotechnologies. Approaches to synthesizing nanomaterials; characterization techniques; device applications that involve nanoscale effects.

MENG 8675b, Thermodynamics, Kinetics, and Structure of Materials Jan Schroers
This advanced-level course focuses on the thermodynamic and kinetic aspects of materials and how they define structure and properties. We first discuss thermodynamics relevant to materials. This includes thermodynamic laws, auxiliary functions to develop convenient equations of state to describe equilibrium, Gibbs Free Energy (G), experimental determination of G, model calculations of G such as ideal solutions and regular solutions, using G curves to construct equilibrium conditions, phase diagram constructions, reading of phase diagrams. We then focus on solidification which we develop from the phenomena of undercooling, nucleation and growth. Combining both allows us to predict microstructures formed during solidification far and close to equilibrium. We also discuss glass formation, the case when nucleation and growth can be suppressed, and the liquid freezes upon cooling into a glass.

MENG 9000a, Research Seminars in Mechanical Engineering & Materials Science Jan Schroers
The purpose of this course is to introduce graduate students to state-of-the-art research in all areas of Mechanical Engineering & Materials Science (MEMS), as well as related disciplines, so that students understand the range of current research questions that are being addressed. An important goal is to encourage students to explore research topics beyond their particular field of study and develop the ability to contextualize their work in terms of larger research questions in MEMS. We therefore require that MEMS Ph.D. students enrolled in this course attend at least eight research seminars during the term: six must be part of the official MEMS seminar series, and two can be from any other relevant Yale graduate department/program seminar series. This course is graded Sat/Unsat with sign-in sheets used to monitor attendance. Required of first- and second-year MEMS Ph.D. students. o Course cr

MENG 9900a, Special Investigations Staff
Faculty-supervised individual projects with emphasis on research, laboratory, or theory. Students must define the scope of the proposed project with the faculty member who has agreed to act as supervisor, and submit a brief abstract to the director of graduate studies for approval.

English Language and Literature

Linsly-Chittenden Hall, 203.432.2233
http://english.yale.edu
M.A., M.Phil., Ph.D.

Chair
Caleb Smith

Director of Graduate Studies
Jonathan Kramnick [F] (106a LC, 203.432.2226)

Professors Jessica Brantley, David Bromwich, Ardis Butterfield, Jill Campbell, Joe Cleary, Erica Edwards, Jacqueline Goldsby, Langdon Hammer, Margaret Homans, Cajetan Iheka, Jonathan Kramnick, Pericles Lewis, Stefanie Markovits, Feisal Mohamed, Stephanie Newell, Catherine Nicholson, John Durham Peters, Marc Robinson, Caleb Smith, Katie Trumpener, Shane Vogel, Michael Warner, R. John Williams, Ruth Yeazell

Associate Professors Joseph North, Juno Richards, Emily Thornbury, Sunny Xiang

Assistant Professors Anastasia Eccles, Marcel Elias, Jonathan Howard, Elleza Kelley, Naomi Levine, Joan Lubin, Joseph Miranda, Ernest Mitchell, Priyasha Mukhopadhyay, Nicole Sheriko, Lloyd Sy

FIELDS OF STUDY

Fields include English language and literature from Old English to the present, American literature, and Anglophone world literature.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

In order to fulfill the basic requirements for the program, a student must:

1. Complete twelve courses—six courses with at least one grade of Honors and a maximum of one grade of Pass by July 15 following the first year; at least twelve courses with grades of Honors in at least four of these courses and not more than one Pass by July 15 following the second year. One of these twelve courses must be ENGL 9090, The Teaching of English. Courses selected must include one course in at least three out of four designated historical periods: medieval, early-modern, eighteenth- and/or nineteenth-century, twentieth- and/or twenty-first-century. Students are also encouraged to take at least one seminar that adds geographic, linguistic, cultural, and/or methodological breadth to their course of study. Two of these courses may be taken in other departments with the approval of the DGS.
2. Satisfy the language requirement by the end of the second year. Two languages appropriate to the student's field of specialization, each to be demonstrated by (a) *passing a translation exam* administered by a Yale language department, at the conclusion of a GSAS Summer Language for Reading course, or (for languages not tested elsewhere at Yale) by the English department; (b) *passing an advanced literature course at Yale* (graduate or upper-level undergraduate, with director of graduate studies [DGS] approval); or (c) *passing both* ENGL 6500, Old English I, *and* ENGL 6501, Old English II, *or* ENGL 6500 *and* ENGL 6502, *Beowulf* and the Beowulf Complex.

3. Pass the oral examination before or as early as possible in the fifth term of residence. The exam consists of questions on four topics, developed by the student in consultation with examiners and subject to approval by the DGS.
4. Submit a dissertation prospectus, normally by January 15 of the third year.
5. Teach a minimum of two terms, since the English department considers teaching an integral part of graduate education. In practice, most students teach between four and six terms.
6. Submit a dissertation.

Upon completion of all predissertation requirements, including the prospectus, students are admitted to candidacy for the Ph.D. Admission to candidacy must take place by the end of the third year of study.

COMBINED PH.D. PROGRAMS

English and Black Studies

The Department of English Language and Literature also offers, in conjunction with the Department of Black Studies, a combined Ph.D. degree in English language and literature and Black studies. All requirements for the Ph.D. in English apply, with the following adjustments.

Coursework In years one and two, a student in the combined program will complete ten seminars in English, including ENGL 9090, The Teaching of English, one course in at least three out of four historical periods (medieval, early-modern, eighteenth- and/or nineteenth-century, twentieth- and/or twenty-first century), and four seminars in Black studies, including AFAM 5005, Theorizing Racial Formations; a history course; a social science course; and a literature course.

Languages Students in the combined program will be required to meet the foreign language requirement for the English Ph.D. degree by the end of the second year.

Qualifying Examination Qualifying oral exams will be administered jointly by the Departments of English and Black Studies, will follow the usual timeline and procedures for oral qualifying exams in English, and must have an Black studies component. A current tenured or ladder faculty member in Black Studies must serve on the qualifying examination committee.

Teaching The faculty in Black Studies and English consider teaching to be an essential component of graduate education, and students therefore will teach, under the supervision of departmental professors, in their third and fourth years.

Prospectus Students in the third year must satisfactorily complete AFAM 8095/AFAM 8096, The Dissertation Prospectus Workshop. Each student will be required to present his or her dissertation prospectus orally to the Black Studies faculty and to submit a written prospectus draft by the end of the spring term. Students will also participate in a prospectus conference with members of the English faculty.

Dissertation Committee The chair of the committee will be from the Department of English Language and Literature; at least one current tenured or ladder faculty member in Black Studies must serve on the committee.

English and Early Modern Studies

Doctoral students in English Language and Literature may apply in the second term of graduate study to the Program in Early Modern Studies to pursue a combined Ph.D. degree in English and early modern studies. All requirements for the Ph.D. in English apply, with the following adjustments.

Coursework In years one and two, a student in the combined program will complete ten seminars in English, including ENGL 9090, The Teaching of English; two courses on early modern texts and/or topics; one course in each of two out of three additional historical periods (medieval, eighteenth- and/or nineteenth-century, and/or twentieth- and/or twenty-first century); and two seminars in early modern studies, including EMST 7000, Workshop in Early Modern Studies, and one seminar outside of English. Students also participate in EMST 8000/EMST 8001, the Early Modern Studies Colloquium.

Qualifying Examination Students will follow the usual procedures for oral qualifying exams in English, with the additional requirement that at least two of their four lists must concentrate on early modern texts and topics.

Prospectus In addition to enrolling in ENGL 9093, the English Department Prospectus Workshop, in fall, third-year students in the combined program will enroll in EMST 9000, Professional Skills Workshop.

Dissertation Committee At least one faculty member affiliated with the Program in Early Modern Studies must be on the committee. The chair of the committee will be from the Department of English Language and Literature, but students in the combined program are encouraged to include at least one faculty member from outside of English on their committees.

English and Film and Media Studies

The Department of English Language and Literature also offers, in conjunction with the Film and Media Studies Program, a combined Ph.D. degree in English language and literature and film and media studies. For further details, see Film and Media Studies.

English and History of Art

The Department of English Language and Literature also offers, in conjunction with the Department of the History of Art, a combined Ph.D. degree in English language and literature and history of art. The requirements are designed to emphasize the interdisciplinarity of the combined degree program.

Coursework In years one and two, a student in the combined program will complete sixteen courses: ten seminars in English, including ENGL 9090, The Teaching of English, and one course in at least three out of four designated historical periods (medieval, early modern, eighteenth– and/or nineteenth-century, twentieth– and/or twenty-first century), and six in history of art, including HSAR 5500, the First-Year Colloquium, and one course outside the student's core area. Up to two cross-listed seminars may count toward the number in both units, reducing the total number of courses to fourteen.

Languages Two languages pertinent to the student's field of study, to be determined and by agreement with the advisers and directors of graduate studies. Normally the language requirement will be satisfied by passing a translation exam administered by one of Yale's language departments. One examination must be passed during the first year of study, the other by the end of the third year.

Qualifying Paper History of Art requires a qualifying paper in the spring term of the second year. The paper must demonstrate original research, a logical conceptual structure, stylistic lucidity, and the ability to successfully complete a Ph.D. dissertation. The qualifying paper will be evaluated by two professors from History of Art and one professor from English.

Qualifying Examination *Written exam:* addressing a question or questions having to do with a broad state-of-the-field or historiographic topic. Three hours, closed book, written by hand or on a non-networked computer. *Oral exam:* given one week after the written exam, covering four fields, including two in English (question periods of twenty minutes each, covering thirty texts each, representing three distinct fields of literary history) and three in history of art (twenty-five minutes each, fields to be agreed on in advance with advisers and DGS). Exam lists will be developed by the student in consultation with faculty examiners.

Teaching Two years of teaching—one course per term in years three and four—are required: two in English and two in History of Art.

Prospectus The dissertation prospectus must be approved by both English and History of Art. The colloquium will take place in the spring term of the third year of study. The committee will include at least one faculty member from each department. As is implied by its title, the colloquium is not an examination, but a meeting during which the student can present ideas to a faculty committee and receive advice from its members. The colloquium should be jointly chaired by the directors of graduate studies of both departments.

First Chapter Reading Students will participate in a first chapter reading (also known as a first chapter conference) normally within a year of advancing to candidacy (spring term of year four). The dissertation committee, including faculty members from both departments, will discuss the progress of the student's work in a seminar-style format.

Dissertation Defense The hour-long defense is a serious intellectual conversation between the student and the committee. Present at the defense will be the student's advisers, committee, and the directors of graduate studies in both English and History of Art; others may be invited to comment after the committee's questioning is completed.

English and Women's, Gender, and Sexuality Studies

The Department of English Language and Literature also offers, in conjunction with the Program in Women's, Gender, and Sexuality Studies, a combined Ph.D. in English language and literature and women's, gender, and sexuality studies. For further details, see Women's, Gender, and Sexuality Studies.

MASTER'S DEGREES

M.Phil. Students may declare their intention in the first or second term of the third year to complete an M.Phil. degree instead of the Ph.D. Students must first submit a research proposal and may request a teaching waiver for the term in which they complete the research project, typically in the second term of the third year or the first term of the fourth year. Permission to pursue the M.Phil. *en route* to the Ph.D., without additional research leave, may be granted by special permission of the DGS and the GSAS dean's office.

M.A. (en route to the Ph.D.) Students enrolled in the Ph.D. program may receive the M.A. upon completion of seven courses with at least one grade of Honors and a maximum of one grade of Pass, and the passing of one foreign language.

Terminal Master's Degree Program Students enrolled in the master's degree program must complete either seven term courses or six term courses and a special project within the English department. One or two of these courses may be taken in other departments with approval of the DGS. There must be at least one grade of Honors, and there may not be more than one grade of Pass. Students must also demonstrate proficiency in one foreign language, as described under Special Requirements for the Ph.D. Degree, above.

COURSES

ENGL 5040a / CPLT 5140a / GMAN 5140a, What the University Was Paul North
After this course, you might not know exactly where the university is going, but you should be able to say what it was once supposed to be, in its "modern" inception in Germany and in latter day materializations around the planet. The course is the interpretation of a particular dream. Who dreamed the dream of an institution that could be anywhere and contain everything important? How did its theorists think the unique nexus of power, economics, histories, and architecture that is, ideally at least, the university? How did they imagine it, given that it is a highly conflictual entity, riding the forefront of some transformations and at the same time codifying and regulating knowledges and social potentials? We read texts from the global archive called "critical university studies," concentrating on articulations of the problems in theoretical texts. These include Kant's *Conflict of the Faculties*, Schiller's *Letters on Aesthetic Education*, Nietzsche's *Anti-Education*, Derrida's *Eyes of the University*, Willy Thayer's *Non-Modern Crisis of the Modern University*, Fred Moten and Stefano Harney's *Undercommons*, and Roderick Ferguson's *The Reorder of Things*.

ENGL 5761a / AFAM 5610a / AMST 6612a / FREN 7610a, Caribbean Literary and Cultural Studies Marlene Daut
This course examines eighteenth- and nineteenth-century writing (in translation, where applicable) by writers from the Anglophone, Francophone, and Hispanophone islands that make up the Caribbean. Haitian independence in 1804 ushered in a vibrant and diverse print culture that included poetry, plays, newspapers, and historical writing. From the pages of *La Gazette Royale d'Hayti* (1811–1820), to the poems of Jean-Baptiste Romane (1807–1858), to the historical writings of Louis-Félix Boisrond-Tonnerre (1776–1806), to the operas of Juste Chanlatte (1766–1828), there arose a distinct nineteenth-century literary culture in Haiti. Beginning with national literary developments in Haiti, this course expands to consider writing from Barbados, Cuba,

Trinidad, Jamaica, Antigua, and Bermuda. These writings, both fictional and non-fictional, help us to think about whether and/or how a coherent early Caribbean literary tradition developed across geographical, linguistic, national, and imperial lines.

ENGL 5820b / AMST 6627b / FILM 6020b / RLST 6600b, Media and Religion John Peters and Kathryn Lofton
Media and religion are devices of information and agencies of order. This course proceeds from the possible synonymy of its organizing terms, using as a form of weekly debate the relationship between media and religion. Readings think about how religion and media generate meanings about human doings and their relations with ecological and economic systems while also being constitutive parts of those systems. Students develop projects that allow them to explore a relationship between concept and subject in humanistic study.

ENGL 6137a / AFAM 8250a / AFST 9937a, African Urban Cultures: Mediations of the City Stephanie Newell
This course approaches the study of African cities and urbanization through the medium of diverse texts, including fiction, nonfiction, popular culture, film, and the arts, as well as scholarly work on African cities. Through these cultural "texts," attention is given to everyday conceptualizations of the body and the environment, as well as to theoretical engagements with the African city. We study urban relationships as depicted in literature and popular media in relation to Africa's long history of intercultural encounters, including materials dating back to the 1880s and the 1930s. Previously ENGL 937.

ENGL 6500a / LING 5000a / MDVL 5700a, Old English I Emily Thornbury
The essentials of the language, some prose readings, and close study of several celebrated Old English poems.

ENGL 6502b / LING 5010b / MDVL 6051b, *Beowulf* and the Beowulf Complex Emily Thornbury
A close reading of *Beowulf* in Old English, within the modern and medieval critical landscapes. Prerequisite: a strong working knowledge of Old English (typically ENGL 500, or the equivalent).

ENGL 6535a / CPLT 5550a / MDVL 6035a, Postcolonial Middle Ages Marcel Elias
This course explores the intersections and points of friction between postcolonial studies and medieval studies. We discuss key debates in postcolonialism and medievalists' contributions to those debates. We also consider postcolonial scholarship that has remained outside the purview of medieval studies. The overall aim is for students, in their written and oral contributions, to expand the parameters of medieval postcolonialism. Works by critics including Edward Said, Homi Bhabha, Leela Gandhi, Lisa Lowe, Robert Young, and Priyamvada Gopal are read alongside medieval romances, crusade and jihād poetry, travel literature, and chronicles.

ENGL 6576b / ITAL 6578b / MDVL 6176, Medieval Women Mystics: Piety and Disobedience Jessica Brantley and Jane Tylus
How was female sanctity practiced in medieval Europe? How did mystical engagement, in particular, spark both piety and disobedience? How was mysticism explored in writing and the arts by women themselves—especially those women who would challenge the status quo by asserting their own direct connections to the divine? Finally, how do we "access" these medieval minds today, and to what extent do contemporary

theoretical concerns about gender identity, subjectivity, and alterity enable us to grapple with the intensely personal dynamics of mystical experience? We introduce these questions—and many others—in connection to the lives and works of five medieval women, beginning with Clare of Assisi, who fled her parents' wealthy home in the middle of the night to join her radical neighbor, Francis. We consider the writings of Bridget of Sweden, Catherine of Siena, and Julian of Norwich, all formative figures in the crisis-ridden fourteenth century who unsettled the boundaries between private and public, religious and "profane." Finally, we read the *Book of Margery Kempe* as a fifteenth-century record of how the mystical experiences of female saints inspired one bourgeois woman's negotiation between her piety and her community. Historical, cultural, and religious topics to be considered include: the influence of the emerging vernaculars on religious movements and texts; the reassessment of Biblical figures such as Mary, Mary Magdalene, Judith, and Ruth; the impact of marginal, possibly heretical groups such as the Beguines; and the rise of the mendicant orders and the resulting changes to monastic and convent life. If our funding applications are successful, we take a course trip to England and Italy during spring break.

ENGL 6611a / EMST 5611a, Renaissance Material Performance Nicole Sheriko
This course surveys the wide range of early modern English performance from commercial drama (Shakespeare, Jonson, Marlowe) to court masques and street theater. Across this range, the course considers the materiality of performance, focused especially on theatrical objects, bodies, and spaces. Special attention is paid to intertheatrical ways these elements are recycled within and between performances to center theatrical matter as a physical and conceptual resource. Topics may include props, costumes, cosmetics, boy actors, puppetry, prosthesis, theater architecture, texts, animals, environment, and sensory experience. Readings offer an introduction to the practical craft of early modern theatermaking and critical frameworks for interrogating early modern materiality.

ENGL 6721a / EMST 5210a / PLSC 6720a, Edmund Burke and the Age of Empire David Bromwich
A partial survey of the political writings of Burke in the context of the theory of empire and of revolution. We emphasize his writings on India and France, which reveal a common theme: innovation—sudden change in a way of life—always depends on violence, whether its agents are internal or external to the society. We touch on a wider subject: the birth of modern ideology, from the demand for systematic excuses to justify empire and revolution.

ENGL 6742b / WGSS 7769b, Fiction, Didacticism, and Political Critique: 1789–1818 Jill Campbell
A study of writings that seek a specific effect in their reader—whether didactic instruction and moral formation, or an instigation to take action toward political change—and their uneasy alliance in the late eighteenth and early nineteenth centuries with the literary genre of prose fiction. How do writings that seek to inform or reform the real person or the real world put fictional narratives to use? How is the genre of the novel shaped, explicitly or implicitly, by writing to a specific "end"? Texts include novels, tales for children, life-writing, poetry with a "cause," polemical essays; possible authors include Olaudah Equiano, Edmund Burke, William Godwin, Mary Wollstonecraft, Elizabeth Inchbald, Maria Edgeworth, Jane Austen, Anna Barbauld, and Mary Shelley.

ENGL 6774b, Henry James and Novel Theory Ruth Yeazell
A close reading of selected novels and tales by Henry James in light of critical and theoretical commentary from James's day to ours. Focus both on James's development as a novelist and on the history of novel criticism in the twentieth century.

ENGL 6830a, The Genre System Post-1945 Staff
This seminar considers the complex interactions between literary history and cultural history in the period from 1945 to the present. In the mid-twentieth-century US the "paperback revolution" coincided with "the new social movements." How did these emergent cultural processes articulate with one another? We study the negotiations between the classical and mass cultural genre systems, the format-specific affordances of the paperback original, the speciation of genre fictions and consolidation of minority and ethnic literatures as publishing categories, the provincialization of literary fiction as one among many fiction genres, and the reincorporation of genre elements into literary fiction since then. Readings include literary theory, sociology of literature, and novels by authors like William Burroughs, Toni Morrison, Thomas Pynchon, Colson Whitehead, Carmen Maria Machado, and Torrey Peters.

ENGL 6847a / AFAM 6227a, Black Environmental Thought Jonathan Howard
What if the greatest threat to life on Earth is not humanity in general, but the specific practice of human being indexed by whiteness? Since the advent of the "modern world," race has been a defining, though often obscured, fault line along which the human enterprise has unfolded. So what would a racial accounting of humanity's environmental harm entail? Who else are we as a species beyond the norms and aspirations enshrined by whiteness? And who must we become before Nature phases us out? If there is a future for humanity on Earth, it will not come apart from a serious reckoning with these questions. Guided by these questions, this course interrogates how the West has mutually imagined the category of the human as an aspiring independence from and dominion over Nature, on the one hand, and white, on the other. But beyond uncovering the unspoken whiteness of "the human" and its environmental harm, this course further takes up the alternative visions of human being and nature expressed within black nature writing. By undertaking a broad survey of this literary tradition, we consider the unique environmental perspectives of those, who, once considered no more than livestock, *were* the nature over which their masters ruled and consequently could not so easily imagine their humanity apart from it. Perhaps for this very reason, we may ultimately come to locate in black nature writing the resources for imagining a sustainable human life in nature, rather than apart from it.

ENGL 6860a / CPLT 8810a / WGSS 9960a, Literary Theory Caleb Smith
What is literary theory today, and what is its history? The aim of the course is to introduce students to central concepts in theory and explore their relation to method. We examine the variety of approaches available within the field of literary studies, including older ones such as Russian formalism, Critical Race Theory, New Criticism, deconstruction, Marxism, and psychoanalysis, as well as newer ones like actor-network theory and digital humanities research. We explore the basic tenets and histories of these theories in a way that is both critical and open-minded, and discuss their comparative advantages and pitfalls. The focus is on recurrent paradigms, arguments, and topics, and on transhistorical relations among our various schools of literary-theoretical thought. Readings might include work by René Wellek, Paul de Man,

Jacques Derrida, Gayatri Spivak, Bruno Latour, Judith Butler, Northrop Frye, Fred Moten, and many others.

ENGL 6868a, Literature and Political Modernity Joseph North
This course introduces students to a range of thinking about the relationship between literature and political modernity (meaning roughly, for this purpose, the period from the French Revolution to the present). Our guiding questions are: Where does the modern category of the "literary" come from, and what social purposes has it served What are the key features that characterize political modernity? How can we understand these literary developments and these political developments as part of a common process? We try especially to examine the relationship between the distinctively modern conception of literature as *aesthetic* writing and two of the key figures that have structured political modernity: the left-center-right spectrum and the concept of "the People."

ENGL 9090b, The Teaching of English Sunny Xiang and Felisa Baynes-Ross
An introduction to the teaching of literature and of writing with attention to the history of the profession and to current issues in higher education such as the corporatization of the university, the role of the state in higher education, and the precarity of the humanities at the present time. Weekly seminars address a series of issues about teaching: guiding classroom discussion; introducing students to various literary genres; addressing race, class, and gender in the teaching of literature; formulating aims and assignments; grading and commenting on written work; lecturing and serving as a teaching assistant; preparing syllabuses and lesson plans. Formerly ENGL 990.

ENGL 9091b, Public Criticism Workshop Juno Richards
A workshop in which graduate students develop their critical writing about literature and culture for nonspecialist audiences. We survey writing for diverse publics in a range of venues in order to explore the formal and intellectual possibilities of criticism today, as well as in the recent past. Students experiment in forms such as the book review, long-form essay, lyric essay, and profile. Questions discussed include how to convey specialized knowledge to a broad audience; how to establish and manage style, voice, and address; how to combine criticism and reporting or narrative; how magazine editors select and develop the writing they publish; how to edit writing for publication; how to pitch a piece. We host class visits from editors and writers. Applications, including a short writing sample and short personal statement describing the student's interest in public writing, are reviewed in fall 2025 for participation in the spring 2026 workshop.

ENGL 9092a, Advanced Pedagogy Heather Klemann
Training for graduate students teaching introductory expository writing. Students plan a course of their own design on a topic of their own choosing, and they then put theories of writing instruction into practice by teaching a writing seminar. Prerequisite: open only to graduate students teaching ENGL 114.

ENGL 9093a, Prospectus Workshop Elleza Kelley
A workshop in which students develop, draft, revise, and present their dissertation prospectuses, open to all third-year Ph.D. students in English.

ENGL 9095a, Directed Reading Staff
Designed to help fill gaps in students' programs when there are corresponding gaps in the department's offerings. By arrangement with faculty and with the approval of the DGS.

Environment

Kroon Hall, 203.432.5100
http://environment.yale.edu
M.S., M.Phil., Ph.D.

Dean
Ingrid Burke (Kroon, 203.432.5109)

Director of Doctoral Studies
Peter Raymond (Kroon 205, 203.432-0817, peter.raymond@yale.edu)

Professors Mark Ashton, Michelle Bell, Mark Bradford, Craig Brodersen, Marian Chertow, Liza Comita, Michael Dove, Daniel Esty, Justin Farrell, Eli Fenichel, Kenneth Gillingham, Matthew Kotchen, William Lauenroth, Xuhui Lee, Anthony Leiserowitz, Narasimha Rao, Peter Raymond, James Saiers, Oswald Schmitz, Karen Seto, David Skelly, Dorceta Taylor, Gerald Torres, John Wargo, Julie Zimmerman

Associate Professors Paulo Brando, Nyeema Harris, Yuan Yao

Assistant Professors Brianna Castro, Sparkle Malone, Arianna Salazar Miranda, Luke Sanford

FIELDS OF STUDY

Fields include agroforestry; biodiversity conservation; biostatistics and biometry; community ecology; ecosystems ecology; ecosystems management; energy and the environment; environmental and resource policy; environmental anthropology and sociology; environmental biophysics and meteorology; environmental chemistry; environmental ethics; environmental governance; environmental health risk assessment; environmental history; environmental justice; environmental law and politics; environmental management and social ecology in developing countries; forest ecology; green chemistry and engineering; hydrology; industrial ecology; industrial environmental management; plant physiology and anatomy; pollution management; population ecology; resource economics; silviculture; social ecology; stand development, tropical ecology, and conservation; sustainable development; urban ecology; urban geography; urban land cover change; urban planning; and water resource management.

Students admitted in 2020 or earlier have the option of receiving a degree in either forestry and environmental studies or environment. Students admitted in 2021 and subsequent years will receive a degree in environment.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Students are required to take ENV 900, Doctoral Student Seminar and Responsible Conduct of Research, in the first year of their program. Courses of study are individually designated through consultation between degree candidates and their advisers and dissertation committees. The amount of coursework required will depend on the previous training of the student, but the normal requirement for a student with no previous graduate training is three or four courses per term for four terms. The program of each student will be evaluated at the end of the first year of residence. At least two term grades of Honors are required in the first two years of study; however,

it is anticipated that grades of Honors or High Pass will be achieved in two-thirds of all courses taken. A written and oral qualifying examination is required upon completion of the course requirements. Students are expected to take the examination by the end of their second year, although this can be extended to the third year in cases with appropriate extenuating circumstances. At the time of the qualifying examination, the student must present a prospectus of the research work proposed for the dissertation. Successful completion of the qualifying examination and submission of the prospectus will result in admission to candidacy. Upon completion of the dissertation, the candidate must make unbound copies of the dissertation available to the faculty and appear for an oral examination at a time and place designated by the director of doctoral studies. Copies of the approved dissertation must be submitted to the graduate school. Depending upon the nature of the dissertation topic, completion of the Ph.D. degree normally requires five years.

Teaching and research experiences are regarded as integral parts of the doctoral training program in Environment. All students are required to serve as teaching fellows (ten hours per week) for four terms. The nature of the teaching assignment is determined in cooperation with the student's major adviser and the director of doctoral studies. With the permission of the director of doctoral studies, the total teaching requirement may be reduced for students who are awarded fellowships supported by outside funding. Regardless of outside funding, all doctoral students must serve as teaching fellows for a minimum of two terms.

COMBINED PH.D. PROGRAM

The School of the Environment offers a combined Ph.D. degree program with the Department of Anthropology.

Eligibility and Master's Degrees

In general, eligibility for entry into the combined degree program is the same as for entering either the YSE or the anthropology doctoral program. Prior award of a master's degree is generally preferred for entry into the YSE doctoral program but not the anthropology doctoral program. Therefore, the desirability of a prior master's degree will be weighed on a case-by-case basis among applicants. Combined degree students will receive (upon petition) an M. Phil. degree from the Graduate School of Arts and Sciences (GSAS) after passing their comprehensive exams.

Application

Prospective combined degree students must initially apply either to Anthropology or to YSE but not to both at the same time. They should, however, as per the current GSAS application process, indicate their interest in the combined degree on the application form. Once accepted in the initially chosen doctoral program, the student's file will be considered in the second program and a recommendation made on the combined degree application that will be communicated by the graduate school. Admitted students will be allocated to the initially chosen program as their primary administrative home but will enter Yale as members of the combined degree program. Being turned down for entry into the combined degree program at this point does not preclude reapplication in the following semester.

Students previously accepted to YSE or the Department of Anthropology may submit a petition to enter the combined degree program. The first step is securing the support of their prospective principal adviser and the director of graduate studies (DGS) for either YSE or anthropology, as appropriate. In order to meet the demands of the combined degree in a timely manner, it is best if this second application is made as soon as possible in the student's doctoral program, ideally no later than the last week in October during the first semester of graduate study at Yale and not later than the end of the first semester. To help make this possible, such applications will be reviewed on an ad hoc basis as they are submitted, without being held to the normal annual calendar for doctoral applications. However, applications to the combined program should in content and all other respects follow the norms of the regular doctoral application (the sole difference being that applicants should specifically address in the statement-of-purpose why they are interested in the combined program). The YSE doctoral admissions committee and the anthropology faculty would review the application. In the latter case, the departmental graduate registrar must receive the application at least one week before a regularly scheduled faculty meeting. If admitted, the applicant will then submit the proposal (countersigned by both DGSs) to the associate dean of the graduate school, who will make the final decision regarding admission. A positive decision by the dean will constitute formal admission into the combined degree program.

Requirements of the Combined Degree

The requirements of the combined doctoral degree are the same as those of the doctoral degrees of YSE and Anthropology (which are detailed in the bulletins of the respective institutions), with the following exceptions or clarifications.

COURSEWORK

Students are required, upon acceptance into the combined degree program, to draw up a program of coursework. Students are required to take twelve units/courses which will be apportioned among Anthropology, YSE, and other university departments as appropriate, based on consultations with the student's committee. The twelve courses must include one exam-oriented independent study. During their first three semesters in the program, combined degree students must take (a) ENV 900, Doctoral Student Seminar and Responsible Conduct of Research (taken in year one), and (b) any additional required coursework in YSE and Anthropology as outlined by each subfield for combined degree students.

TEACHING REQUIREMENTS

The teaching fellow requirements of the combined program vary depending upon whether the student first entered into Anthropology or YSE. Combined students entering from Anthropology are expected to serve as teaching fellows for four semesters, as required by the GSAS. The exact timing of teaching depends on the scheduling of Ph.D. research. Students are eligible to work as teaching fellows starting in year two of their program of study. The GSAS expectation is that they will teach mostly during years three and four, but students in the combined program who conduct field research during some of this time can defer their teaching requirement accordingly. If students receive a sixth year of support, then they will be expected to teach for an additional two semesters. The total teaching requirement is effectively

reduced for those students who are awarded fellowships supported by non-Yale and non-GSAS Yale funding sources.

Students entering the program from YSE are also expected to serve as teaching fellows for four semesters during their first five years in the program, and they become eligible to do so during year two. If students take the available sixth year of support, they will be expected to teach for an additional two semesters (one of which must be at a level of twenty hours per week as opposed to the normal ten). With the permission of the director of doctoral studies (DDS), the total teaching requirement may be reduced for students who are awarded fellowships supported by outside funding.

DOCTORAL COMMITTEE

Combined degree students will be assigned an adviser in both YSE and Anthropology upon admission to the combined program. As soon as possible thereafter, but not later than the end of the second semester of their first year in the program, each student must constitute a formal doctoral committee. The student's principal advisers in YSE and Anthropology will serve as cochairs of the committee. The committee should have one additional member drawn from tenure-track Yale faculty; one more member from Yale or even from outside Yale can be added if that is deemed necessary by the student and cochairs.

EXAMS, PROSPECTUS, AND DISSERTATION

Combined degree students will take their comprehensive exams during their fourth semester of study. This will be a written examination composed of two parts. The first part of the examination will be taken over four or five hours on a single day and will be based entirely on the required sequence of seminars taken in YSE and Anthropology. The second part of the examination will also be taken over four or five hours on the next day or within a week of the first part and will be based on elective courses and bibliographies of anthropological and inter-disciplinary environmental studies research pertaining to a world area and/or topic (for example sub-Saharan Africa or global climate change) that the student has chosen for conduct of dissertation field research. Both parts of the written examination will be taken starting in the last week of March and the examination will be written by the student's committee. Both parts of the written examination will consist of six to eight questions, of which three to four will have to be answered. Both parts of the exam, if permitted by the student's committee, may also be answered as a take home and submitted a week later. The entire committee will sit in an oral examination of the entire written exams within two weeks of the completion of all written examinations. Remote participation by telephone conference call is permitted where necessary. The exam will consist of a brief presentation/overview by the student, followed by questioning by the committee. There are only two possible exam outcomes: Pass, or Fail. If a student fails, he/she is dismissed from the graduate school.

All combined students must prepare a comprehensive dissertation prospectus and a field paper in close consultation with their committee, and following current Anthropology and YSE guidelines. The prospectus document is typically 1500 to 2000 words long, and the field paper is 8,000 to 10,000 words long. These documents also form the basis for dissertation research grant proposals for Yale sources and external competitions. The student must defend this prospectus in a formal oral defense before the entire committee (and other interested faculty members). The oral defense is held

within the department that serves as the student's administrative home. There are several possible outcomes to the defense: unconditional Pass, Pass conditional upon specified revisions to the prospectus, or Fail. If the student fails the examination, the committee and DGSs will together prescribe the remedy, which may include scheduling a second defense. If the student fails a second time, they will be dismissed from the graduate school. A successful defense of this prospectus/field paper satisfies the oral defense required by YSE and the Department of Anthropology and is required for admission to candidacy.

A final version of this prospectus must be filed with the DGS and the student's advisory committee's endorsement of this document must be brought before the entire Anthropology faculty for approval. Depending on their progress and readiness, combined degree students may complete these prospectus/field paper requirements in their fourth, fifth, or sixth semester of study. Passing qualifying examinations and approval of the prospectus and field paper by the home department after a successful defense before the committee complete requirements for the student to attain candidacy or All but Dissertation (ABD) status. At this point the student can petition for the M. Phil. degree from the GSAS.

The completed dissertation must be defended, following YSE guidelines, before a meeting of the entire committee (and other interested faculty members). The defense will consist of a brief presentation or overview by the student, followed by questioning by the committee. There are three possible outcomes to the defense: unconditional Pass, Pass conditional upon specified revisions to the dissertation, or Fail. In the event of failure, the committee and DGSs will together prescribe the remedy, which may include scheduling a second defense. If the student fails a second time, they will be dismissed from the graduate school. Following a successful defense, three formal reader's reports must then be prepared for presentation to the DGSs of Anthropology and YSE. At least two of these must come from tenured Yale faculty, and at least one must come from the YSE faculty and at least one from the Anthropology faculty. The readers must be recommended by the appropriate DGS and approved by the GSAS.

For more information contact the program coordinators Michael Dove (Anthropology; michael.dove@yale.edu) or Kalyanakrishnan Sivaramakrishnan (YSE; kalyanakrishnan.sivaramakrishnan@yale.edu).

MASTER'S DEGREES

M.Phil. (en route to the Ph.D.) Students may petition for this degree after they have passed the qualifying exam and advanced to candidacy. Applications for this master's degree are not accepted.

M.S. (en route to the Ph.D.) This degree is normally granted only to students who are withdrawing from the Ph.D. program. Applications for this master's degree are not accepted. Requirements that must be met for award of the M.S. are (1) successful completion of two years of course work in residence with two grades of Honors; (2) a written prospectus; (3) fulfillment of one term of the teaching requirement. Students who are eligible for or who have already received the M.Phil. will not be awarded the M.S.

For information on the terminal master's degrees offered by the Yale School of the Environment (the Master of Forestry, Master of Forest Science, Master of

Environmental Management, and Master of Environmental Science degrees), visit the school's website, http://environment.yale.edu, or contact Admissions Director, Yale School of the Environment, 195 Prospect Street, New Haven CT 06511.

REQUIRED COURSE

All Ph.D. students are required to take the following course in the fall term of their first year. For a complete list of ENV courses, see the School of the Environment bulletin, available online at https://catalog.yale.edu/environment, and Yale Course Search at https://courses.yale.edu.

ENV 900a, Doctoral Student Seminar and Responsible Conduct of Research
This course provides the foundation for doctoral study at the School of the Environment. Students learn what it means to do scholarly research as well as become adept with philosophy of science and research methodology and proposal writing, as a basis for exploring diverse approaches to formulating and addressing research questions. Students work with their advisers to put these concepts and principles into practice to develop the basis for their dissertation research (including building bibliography, identifying and crafting research questions, formulating research hypotheses, and drafting a research proposal). Students further learn about funding opportunities and procedures for submitting grants. The course also covers professional ethics and responsible conduct of research, including ethical approaches to inquiry and measurement, data acquisition and management, authorship and publication, peer review, conflicts of interest, mentoring, collaborative research, and animal and human subjects research. Finally, the course explores ethical ways to advocate for the application of scholarly knowledge in the interest of environmental problem solving. Weekly assigned readings support concepts and issues addressed in class. Students present their embryonic research ideas in class and use feedback from the group to further develop their ideas. 3 Course cr

European and Russian Studies

The MacMillan Center
242 Luce Hall, 203.432.3107
http://europeanstudies.macmillan.yale.edu
M.A.

Chair
Julia Adams (*Sociology*)

Director of Graduate Studies
Isaac Nakhimovsky (*History; Humanities*)

Professors Bruce Ackerman (*Law*), Julia Adams (*Sociology*), Lauren Benton (*History; Law*), Dirk Bergemann (*Economics*; *Computer Science*), Paola Bertucci (*History*), R. Howard Bloch (*French*), Edyta Bojanowska (*Slavic Languages and Literatures*), Marijeta Bozovic (*Slavic Languages and Literatures*; *Film and Media Studies*; *Women's, Gender, and Sexuality Studies*), David Bromwich (*English*), Paul Bushkovitch (*History*), Francesco Casetti (*Humanities*; *Film and Media Studies*), Carolyn Dean (*History*; *French*), Carlos Eire (*History*; *Religious Studies*), Fatima El-Tayeb (*Ethnicity, Race and Migration*; *Women's, Gender, and Sexuality Studies*), Emily Erikson (*Sociology*), Paul Franks (*Philosophy*; *Judaic Studies*; *Religious Studies*), Paul Freedman (*History*), Bryan Garsten (*Political Science*; *Humanities*), John Geanakoplos (*Economics*), Bruce Gordon (*Divinity*; *History*), Philip Gorski (*Sociology*), Alice Kaplan (*French*), Paul Kennedy (*History*), John MacKay (*Slavic Languages and Literatures*; *Film and Media Studies*), Ivan Marcus (*History*; *Religious Studies*), Millicent Marcus (*Italian Studies*), Isabela Mares (*Political Science*), Stefanie Markovits (*English*), Alan Mikhail (*History*), Fiesal Mohamed (*English*), Samuel Moyn (*Law*; *History*), Fatima Naqvi (*German*; *Film and Media Studies*), Paul North (*German*), Mark Peterson (*History*), Douglas Rogers (*Anthropology*), Pierre Saint-Amand (*French*), Maurice Samuels (*French*), Peter Swenson (*Political Science*), Katie Trumpener (*Comparative Literature*; *English*), Jesús Velasco (*Spanish and Portuguese*), Miroslav Volf (*Divinity*), Kirk Wetters (*German*), James Whitman (*Law*), Fabrizio Zilibotti (*Economics*)

Associate Professors Jennifer Allen (*History*), Sergei Antonov (*History*), Molly Brunson (*Slavic Languages and Literatures*), Marcela Echeverri (*History*), José-Antonio Espín-Sánchez (*Economics*), Hussein Fancy (*History*), Isaac Nakhimovsky (*History*; *Humanities*), Ayesha Ramachandran (*Comparative Literature*), William Rankin (*History*)

Assistant Professors Jinyi Chu (*Slavic Languages and Literatures*), Marcel Elias (*English*), Samuel Hodgkin (*Comparative Literature*), Egor Lazarev (*Political Science*), Cormac O'Dea (*Economics*), Giulia Oskian (*Political Science*), Carolyn Roberts (*African American Studies*; *History*), Claire Roosien (*Slavic Languages and Literatures*), Nari Shelekpayev (*Slavic Languages and Literatures*)

Lecturers Marnix Amand (*Economics*), Fadila Habchi (*African American Studies*; *American Studies*), Mordechai Levy-Eichel (*Political Science*), George Syrimis (*Hellenic Studies*; *Religious Studies*)

Senior Lectors Marion Gehlker (*German*), Krystyna Illakowicz (*Slavic Languages and Literatures*), Maria Kaliambou (*Hellenic Studies*), Constantine Muravnik (*Slavic Languages and Literatures*), Julia Titus (*Slavic Languages and Literatures*)

The European Studies Council at the MacMillan Center promotes innovative research on Europe's past and present in the context of regional and global interactions. The council collaborates with schools and departments throughout Yale to support faculty, students, and visiting scholars by sharing their interdisciplinary expertise on European affairs with the broader public. The council aims to foster a wider understanding of Europe as both a place and an idea, reflecting the evolving nature of the region and its network of connections throughout the world. The geographical scope of the council's activities extends from Ireland to the lands of the former Soviet Union (Russia, Ukraine, Belarus, the Caucasus, and central Asia). The council's definition of Europe transcends conventional divisions between Western, Central, and Eastern Europe, and includes the Balkans and Russia. The U.S. Department of Education has repeatedly designated the council a National Resource Center and a FLAS Center under its HEA Title VI program. Further information on the council and the Graduate Certificate of Concentration in European Studies is provided under Non-Degree-Granting Programs, Councils, and Research Institutes in this bulletin.

The council administers an M.A. program in European and Russian Studies (E&RS). This M.A. program is unusual in its embrace of all of Europe, east as well as west. The program allows students to choose a regional focus while also ensuring familiarity with those parts of Europe and Eurasia (Russia, Ukraine, Belarus, the Caucasus, and Central Asia) outside of that focus. As an interdisciplinary program, the E&RS M.A. allows for concentration in a variety of humanities (languages, literatures, history, art, music) and social science (political science, economics, sociology, anthropology) disciplines, as well as law. The program is suited both to students who wish to pursue further academic studies and to students interested in pursuing careers in policy, journalism, teaching, human rights, development, and NGOs.

FIELDS OF STUDY

European and Eurasian languages and literatures; economics; history; human rights; journalism; law; music; policy; political science; sociology; and other social sciences.

SPECIAL REQUIREMENTS FOR THE M.A. DEGREE

All students must complete sixteen graduate-level term courses (or their equivalent) related to European and Russian studies. When applying to the program, students will specify either Russia, Eastern Europe, and Eurasia, or Western and Central Europe, as an area of primary concentration. For students focusing on Russia, East Europe, and Eurasia two of the sixteen required courses (excluding language courses) must concern the nations of Western and Central Europe. For those focusing on Western and Central Europe, two courses must concern Russia, Eastern Europe, and Eurasia. Students are further required to take at least one course in at least three of the four broadly-defined fields of study relevant to the program: history (including history of art, history of science, and history of music), literature, social sciences, and law. Additionally, in their first year, students must enroll in one course focusing on methodology in a chosen discipline (e.g., history, comparative literature, sociology, anthropology, political science).

Only one of the sixteen graduate-level term courses may be taken for audit. Courses graded Satisfactory/Unsatisfactory cannot be counted toward the sixteen-course requirement of the program. All students must meet the minimum graduate school grade requirement of an overall grade average of High Pass, including a grade of Honors in at least one one-credit graduate course (for students enrolled in one-year programs), or in at least two one-credit graduate courses (for students enrolled in two-year programs).

As a requirement for graduation, all students must demonstrate at least L4 proficiency in two modern European or Eurasian languages other than English. These two languages must include at least one directly related to their area of concentration—i.e. students focusing on Russia, Eastern Europe, and Eurasia will need to demonstrate knowledge of Russian, an East European, or Eurasian language; those focusing on Western and Central Europe will need to demonstrate knowledge of one of the appropriate regional languages.

A maximum of four of the sixteen courses required for completion of the degree may consist of language courses, even though these courses have undergraduate course numbers and undergraduate grading modes. In order to count towards the degree, these language classes must be taken for a grade, not for audit. Further undergraduate-level language classes, beyond these four, can be taken for credit or audited, but will not count towards the sixteen courses required for graduation. Graduate-level seminars taught in language departments are unaffected by this four-course maximum; these are counted as regular graduate courses.

Students already possessing language skills must arrange to receive certification of proficiency by the relevant language department. Most often this involves completing a placement or proficiency examination; in some cases, the director of graduate studies may certify native language skills. Because each language department administers these exams in its own way, students must make arrangements individually with the appropriate departments. Students with Russian competence must receive the grade of 1+ or higher on the ACTFL/ETS Rating Scale as administered by the Slavic Languages and Literatures department at Yale, including reading, oral, and grammar portions. Students who have met the European or Eurasian language proficiency degree requirement may study a non-European or Eurasian language provided the courses are approved by the DGS.

As part of the program's commitment to outreach, each M.A. student is required to volunteer to support area-specific academic or cultural programming at a local school or community organization. This can be arranged through Yale's Office of New Haven Affairs public school partnerships, or depending on the topic, through the Fortunoff Video Archive for Holocaust Testimonies curriculum development program. Students are also encouraged to independently explore opportunities at local institutions, libraries, and nonprofits.

In all cases, students will comply with the Policies and Regulations of the Yale Graduate School of Arts and Sciences, especially regarding degree requirements and academic standing.

Through agreements negotiated by the MacMillan Center, the European Studies Council offers joint master's degrees with the Law School, the School of the

Environment, and the School of Public Health. Application for admission must be made to both the graduate school and the desired professional school, with notation made on each application that the applicant would like to be considered for the joint-degree program. Refer to http://macmillan.yale.edu/academic-programs/joint-degree-programs and contact the European and Russian Studies registrar for up-to-date information.

THE MASTER'S THESIS

A master's thesis is required. The topic must be approved by the DGS and the thesis advised by a faculty member with expertise in the chosen topic. M.A. students must register for E&RS 9500, which may not be taken for audit and is counted toward the sixteen required courses. For the purposes of preparatory research, students may register for one additional independent study with their potential adviser in a semester prior to taking E&RS 9500. The master's thesis must be submitted in accordance with departmental guidelines; it is due in two copies in the student's second year on a date in April as specified by the council.

Program materials are available upon request to the European Studies Council, Yale University, PO Box 208206, New Haven CT 06520-8206.

COURSES

E&RS 618b / RUSS 7670b, Empire in Russian Culture Edyta Bojanowska
Interdisciplinary exploration of Russia's modern imperial culture, especially of the nineteenth century. How did this culture reflect, shape, and challenge imperial reality? How did the multiethnic and multiconfessional empire figure in negotiations of Russian national identity? Other topics include versions of Russian and Soviet Orientalism and colonialism, representations of peripheral regions, relations between ethnic groups, and the role of gender and race in Russia's imperial imagination. Materials combine fiction, poetry, travel writing, painting, and film, with readings in postcolonial studies, history, political science, and anthropology. Most readings are assigned in translation, although students with a knowledge of Russian are encouraged to read the primary texts in the original; the language of seminar discussions will be English. Students with an interest in comparative studies of empire are welcome.

E&RS 6000a / RSEE 6550a / SLAV 6550a / UKRN 6550a, Reading Multicultural Ukraine Uilleam Blacker
The lands that make up today's Ukraine have, throughout history, been part of numerous empires and states, from the Romanov and Habsburg Empire to the Soviet Union via Poland, Romania, Hungary and more. These territories, where states come and go and borders shift, have been inhabited by a diverse array of peoples speaking and writing in multiple languages. Writers here wrote in Ukrainian, Russian, Yiddish, Polish, German, Crimean Tatar, and other languages. These writers are usually studied as part of separate national literatures, yet in many cases they held multiple identities, wrote in two or more languages, and belonged to more than one cultural sphere. This course views Ukraine as a richly complex region that challenges the "national literature" framework and pushes us to examine the ways in which supposedly separate literary traditions overlap and hybridize in intricate and fascinating ways. Students explore Ukraine from the Carpathians to Crimea, via Kyiv and Kharkiv, through the works of its writers, reading the work of poets at the peak of their national canons

alongside forgotten and marginalized voices. All readings and class discussions are in English. Undergraduate students must obtain the permission of the instructor prior to enrolling.

E&RS 6900a / FILM 6127a / RSEE 6120a / SLAV 6120a / UKRN 6120a, Cinematic Ukraine: Culture, Identity, and Memory Olha Tytarenko
This course traces the evolution of Ukrainian cinema from the avant-garde experiments of the 1920s to the vibrant post-2014 film resurgence. Exploring themes of national identity, historical memory, and resistance to political and cultural oppression, we analyze how filmmakers have shaped Ukraine's self-conception through film. Topics include the poetic cinema of the 1960s, post-Soviet transition films, and contemporary works responding to war and cultural sovereignty. Students engage critically with cinematic language, narrative structures, and visual aesthetics while incorporating perspectives from postcolonial theory and memory studies. The course features guest lectures from Ukrainian film directors and hands-on cinematographic workshops. Weekly thematic units pair films with historical and theoretical readings, offering a dynamic exploration of Ukraine's place in global cinema and cultural history.

E&RS 9400a or b, Independent Study Staff
By arrangement with faculty. If you are a non-European & Russian Studies graduate student, you must seek permission of the DGS of European & Russian Studies.

E&RS 9500b, Master's Thesis Staff
By arrangement with faculty.

Film and Media Studies

Humanities Quadrangle, 1st floor, 203.436.4668
http://filmstudies.yale.edu
M.Phil., Ph.D.

Chair
Fatima Naqvi

Director of Graduate Studies
John MacKay

Professors Marijeta Bozovic (*Slavic Languages and Literatures*; *Women's, Gender, and Sexuality Studies*), Francesco Casetti (*Humanities*), Marta Figlerowicz (*Comparative Literature*; *English Language and Literature*), Aaron Gerow (*East Asian Languages and Literatures*), Brian Kane (*Music*), John MacKay (*Slavic Languages and Literatures*), Millicent Marcus (*Italian Studies*), Charles Musser (*American Studies*), Fatima Naqvi (*Germanic Languages and Literatures*), John Durham Peters (*English Language and Literature*), Katie Trumpener (*Comparative Literature*; *English Language and Literature*), Laura Wexler (*American Studies*; *Women's, Gender, and Sexuality Studies*), R. John Williams (*English Language and Literature*)

Assistant Professor Neta Alexander

Visiting Professor Leighton Pierce

Professor in the Practice Thomas Allen Harris (*African American Studies*)

Senior Lecturer Camille Thomasson

Lecturers Jonathan Andrews (*Art*), Shakti Bhagchandani, Oksana Chefranova, Claire Demoulin, Wanda Strauven

FIELDS OF STUDY

Film and media studies is an interdisciplinary field. Students have the option to apply for admission to one of two tracks within the program: either solely to the Ph.D. in Film and Media Studies or to a combined program track involving one of the following disciplines: Black studies, American studies, comparative literature, East Asian languages and literatures, English, French, German, history of art, Italian studies, and Slavic languages and literatures. In addition to acquiring a firm grounding in the methods and core material of film and media studies (and, for the combined degree track students, another discipline), all students are expected to coordinate a plan of study involving comprehensive knowledge of one or more areas of specialization.

Through coursework, examinations, and the dissertation, candidates in a combined degree program link a film and media specialty with the participating discipline. Directors of graduate studies from both programs monitor the candidate's plans and progress.

To be considered for admission to the combined degree track, applicants must indicate both Film and Media Studies and one of the participating departments/programs listed

above. Students seeking admission to Film and Media Studies alone should indicate only Film and Media Studies on their application.

For students already admitted into another department or program, retroactive admissions into the combined Ph.D. with Film and Media Studies is possible during the first year of coursework. Such retroactive admission must be done in consulation with the directors of graduate studies of Film and Media Studies and of the department into which the student was admitted.

In addition to the Ph.D. program, Film and Media Studies offers students in the graduate school's other doctoral programs the chance to obtain the Graduate Certificate in Film and Media Studies. See Film and Media Studies, under Non-Degree Granting Programs, Councils, and Research Institutes, in this bulletin.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Every student selected for the combined program track is subject to the supervision of the Film and Media Studies program and the relevant participating department. A written protocol between each department and Film and Media Studies outlines the requirements and schedule to be borne in mind as a plan of study is worked out in consultation with the director of graduate studies (DGS) of Film and Media Studies and the DGS of the participating department. In all cases, students are required to take FILM 6010 as well as at least five additional film and media studies seminars. The final course paper for one of those five additional courses must be on a topic focused on the history or historiography of film/media. Course requirements vary for participating departments. By the third year, students advance to candidacy by completing qualifying examinations and a dissertation prospectus.

Students in the stand-alone Film and Media Studies track are held to the same Department of Film and Media Studies requirements and deadlines as students in the combined degree track: twelve graduate-level courses, including the required courses listed above and four additional Film and Media Studies seminars.

In addition, students in both tracks are expected to complete the following requirements:

Qualifying Examinations Qualifying examinations follow the regulations of the participating department with at least one member of the Film and Media Studies Executive Committee participating. Students pursuing the stand-alone Ph.D. in Film and Media Studies should consult the DGS for details about the format of the examinations and formation of the examining committee.

Dissertation Prospectus The dissertation prospectus is presented to a faculty committee or the entire faculty of the participating department for combined degree students. The prospectus is also submitted to the prospectus committee of Film and Media Studies for approval.

Defense of Method A defense of method occurs when the dissertation is nearing completion, one or two terms before submission. The purpose of this defense is to provide guidance and feedback at a critical stage, in order to assist the dissertation's final form. At least three faculty readers meet with the student; the DGS of Film and Media Studies is (and, for students in the combined degree program, the DGS of the participating department is also) invited to participate. For combined degree students,

at least one examiner of the dissertation must be a member of the Film and Media Studies Executive Committee and one must be from the participating department; for students in the stand-alone track, two-thirds of the dissertation committee members should be a member of the Film and Media Studies Executive Committee.

The faculty in Film and Media Studies considers participation in the Teaching Fellows Program to be essential to the professional preparation of graduate students. Students normally teach in years three and four. Every student may expect to assist in two Film and Media Studies courses, one of which will very likely be Introduction to Film Studies (FILM 1501) or Introduction to Media (FILM 1601). Students in the stand-alone track are expected to teach in the two courses above as well as two other courses in either film and media studies or an allied program, with the permission of the DGS.

MASTER'S DEGREE

M.Phil. See Degree Requirements under Policies and Regulations.

COURSES

FILM 873a and FILM 8730a / EALL 5810a, Japanese Cinema and Its Others Kirsten Seuffert

Critical inquiry into the myth of a homogeneous Japan through analysis of how Japanese film and media historically represent "others" of different races, ethnicities, nationalities, genders, and sexualities, including women, black residents, ethnic Koreans, Okinawans, Ainu, undocumented immigrants, LGBTQ minorities, the disabled, youth, and monstrous others such as ghosts.

FILM 6010a / CPLT 9170a / ENGL 920, Foundations of Film and Media John MacKay

The course sets in place some undergirding for students who want to anchor their film interest to the professional discourse of this field. A coordinated set of topics in film theory is interrupted first by the often discordant voice of history and second by the obtuseness of the films examined each week. Films themselves take the lead in our discussions.

FILM 6020b / AMST 6627b / ENGL 5820b / RLST 6600b, Media and Religion John Peters and Kathryn Lofton

Media and religion are devices of information and agencies of order. This course proceeds from the possible synonymy of its organizing terms, using as a form of weekly debate the relationship between media and religion. Readings think about how religion and media generate meanings about human doings and their relations with ecological and economic systems while also being constitutive parts of those systems. Students develop projects that allow them to explore a relationship between concept and subject in humanistic study.

FILM 6050a, Film and Media Studies Certificate Workshop Neta Alexander and Fatima Naqvi

The workshop is built on students' needs and orientations. It is aimed at helping the individual trajectories of students and at deepening the topics they have met while attending seminars, conferences, and lectures. Students are required to present a final qualifying paper demonstrating their capacity to do interdisciplinary work. The workshop covers two terms and counts as one regular course credit. Open only to

students pursuing the Graduate Certificate in Film and Media Studies. Prerequisite: FILM 601. ½ Course cr

FILM 6127a / E&RS 6900a / RSEE 6120a / SLAV 6120a / UKRN 6120a, Cinematic Ukraine: Culture, Identity, and Memory Olha Tytarenko

This course traces the evolution of Ukrainian cinema from the avant-garde experiments of the 1920s to the vibrant post-2014 film resurgence. Exploring themes of national identity, historical memory, and resistance to political and cultural oppression, we analyze how filmmakers have shaped Ukraine's self-conception through film. Topics include the poetic cinema of the 1960s, post-Soviet transition films, and contemporary works responding to war and cultural sovereignty. Students engage critically with cinematic language, narrative structures, and visual aesthetics while incorporating perspectives from postcolonial theory and memory studies. The course features guest lectures from Ukrainian film directors and hands-on cinematographic workshops. Weekly thematic units pair films with historical and theoretical readings, offering a dynamic exploration of Ukraine's place in global cinema and cultural history.

FILM 6310a / AMST 8808a / WGSS 6310a, Media, Embodiment, and the Senses Neta Alexander

This graduate seminar examines the intersections of critical disability studies and media theory to challenge conventional understandings of communication, technology, and culture. Through critical engagement with contemporary film, media, art, and design, this course explores how all technology functions as "assistive" technology and interrogates the pervasive idealization of able-bodiedness. Readings, screenings, discussions, and practice-based assignments encourage students to rethink normative assumptions about the body, ability, and accessibility, moving beyond audio-visual approaches to media.

FILM 6460a / GMAN 5460a, Uwe Johnson's Anniversaries: From A Year in the Life of Gesine Cresspahl Austen Hinkley

Uwe Johnson's *Anniversaries: From A Year in the Life of Gesine Cresspahl* remains a monument of postwar German literature—and it was written in and about New York City. Across its 367 short chapters (each corresponding to a day of the year), the novel unfolds on three levels: the historical present in New York, memories and family history from Germany, and reporting from the *New York Times* on current events. The result is a view of life, politics, and history in the middle of the twentieth century that is as rich and expansive as it is fragmented. The social and political climate of New York in the late '60s is put into contact with memories of the rise of Nazism in Germany; reporting on the Vietnam war, the civil rights movement, and the Prague Spring is refracted through the lenses of the protagonist's past life in East Germany and her new life raising her daughter alone in New York. This course undertakes a close reading of Johnson's sprawling novel with attention to its many historical, political, and literary contexts. Readings from the novel will be complemented by relevant short readings in theories of media, politics, literature, and history. No prior knowledge of German language and literature is required.

FILM 6810a / AMST 7740a / WGSS 741a, The Photographic Memory Workshop Laura Wexler

This seminar considers landmark examples of photography's cultural work in producing, cementing and erasing individual and collective memory. Topics to be considered include but are not confined to "memory, post-memory and counter-

memory"; "the biopolitics of images"; "the visuality of violence"; "photography's place and space"; and the "potential history of photography." Students are invited to develop and present their own case studies on topics of interest. Readings encompass: *The Unseen Truth* by Sarah Lewis; *Camera Geologica* by Siobhan Angus; *The Unintended* by Monica Huerta; *Race Stories* by Maurice Berger; *Through a Native Lens* by Nicole Dawn Strathman; *When a Photograph is Home* by Leigh Raiford; *From These Roots* by Tamara Lanier; and *Collaboration: A Potential History of Photography* by Ariella Azoulay, Wendy Ewald, Susan Meiselas, Leigh Raiford, and Laura Wexler. Guest lectures and travel to exhibitions are anticipated.

FILM 6900a / CPLT 9013a / SPAN 6330a, Third Cinema: Arts and Politics in Latin America Moira Fradinger

This seminar studies the articulation of art and politics proposed by the world renowned film movement usually identified as "Third Cinema" that took shape in Latin America roughly between 1955 and 1982. Continental in scope, the movement has also been called "New Latin American Cinema" joining the "new waves" of the global sixties and expanding its influence throughout the countries of the Non-Aligned Movement. The seminar examines the category of "Third cinema," first formulated in Solanas's and Getino's 1969 "Manifesto Towards a Third Cinema" and opposed to "First Cinema" (Hollywood) and "Second Cinema" ("cinema d'auteur" or independent film art). The manifesto's political thinking will be framed in terms of contemporary political ideas about "the third way" or "the non-aligned third world" as well as put in dialogue with an array of film manifestos emerging at this time in the region. The seminar engages concepts such as "imperfect cinema," "urgent cinema," "cinema novo," "aesthetics of hunger," "liberation cinema"; the "camera as expropiator of image-weapons," and so forth. The seminar casts a wide net in terms of the corpus, which includes a minimum of two films per week, from countries such as Argentina, Chile, Uruguay, Brazil, Bolivia, Peru, Colombia, Venezuela, Haiti, Cuba, and Mexico. Taught in English; knowledge of Spanish and Portuguese is not required but certainly useful.

FILM 7350a / AMST 8832a, Documentary Film Workshop Charles Musser

This workshop in audiovisual scholarship explores ways to present research through the moving image. Students work within a Public Humanities framework to make a documentary that draws on their disciplinary fields of study. Designed to fulfill requirements for the M.A. with a concentration in Public Humanities.

FILM 7620a / GMAN 6050, Weimar Cinema Fatima Naqvi and Claire Demoulin

The German cinema, 1919–1930. Expressionist films and films of the New Objectivity. The pressures of technology and the other arts—especially painting—on cinema; issues of spectatorship, visual pleasure, and distraction in the context of a national cinema. Readings by Simmel, Kracauer, Benjamin, and others. Films by Murnau, Lang, Pabst, Lubitsch, Brecht, von Sternberg, and others. Conducted in English, with readings in English.

FILM 7790a / ITAL 8783a, Italian Film Ecologies: Yesterday, Today, and Tomorrow Millicent Marcus

Landscape and the natural environment have never occupied "background" status in Italian film. Given the spectacular visual presence of its terrain—thanks to the relative proximity of mountain chains and the long seacoast—and given the pivotal importance of farming and pasturage in this traditionally agrarian economy, the synergy between the human and natural worlds has played a prominent role in Italian filmmaking since

the very inception of the industry. Most recently, two developments have pushed this issue to the forefront of scholarly attention: the advent of ecocriticism, which found one of its earliest and most influential champions in Serenella Iovino, and the establishment of regional film commissions, grassroots production centers that sponsored cinematic works attuned to the specificity of "the local." The course includes study of films that predate our current environmental consciousness, as well as recent films that foreground it in narrative terms. In the case of the older films, which have already attracted a great deal of critical commentary over time, we work to shift our interpretive frame in an "eco-friendly" direction (even when the films' characters are hardly friends of the environment). Among the films considered are *Le quattro volte, Il vento fa il suo giro, L'uomo che verrà, Gomorra, L'albero degli zoccoli, Riso amaro, Red Desert*, *Christ Stopped at Eboli,* and *Il ladro di bambini*. We screen one film a week and devote our seminars to close analysis of the works in question.

FILM 7830a / AMST 7783a, The Historical Documentary Charles Musser
This course looks at the historical documentary as a method for carrying out historical work in the public humanities. It investigates the evolving discourse sand resonances within such topics as the Vietnam War, the Holocaust, and African American history. It is concerned with the relationship of documentary to traditional scholarly written histories as well as the history of the genre and what is often called the "archival turn."

FILM 8740a / EALL 8920a, Japanese New Wave Cinema Kirsten Seuffert
This course explores the "New Wave" in Japanese cinema in the context of the rise of "new wave" across cinemas in the American sphere in the period roughly between 1955 and 1975. It focuses on both local contexts and global flows in the turn to experimental filmmaking in Japan, paying particular attention to how films sought to make social and political interventions in both content and form. We analyze New Wave films and critical writing by asking what they can tell us about Japan's postwar, high-speed economic growth, student and counterculture movements, and place in the Cold War order. We also consider what the Japanese New Wave tells us about the possibilities of cinema: its global simultaneity, transcultural movement, and historical trajectory. Topics include the legacy of World War II in Japan and cinema as a mode for narrating history; the rise of global youth culture in the context of postwar economic growth; cinema and protest against the U.S.-Japan Security Treaty; the aesthetic use of sex, violence, and politics to shock mainstream culture; documentary as a site for radical experimentation; the studio system, independent filmmaking, and transformations of the Japanese film industry; and what is meant by "modernist" and "avant-garde" in New Wave cinema.

French

Humanities Quadrangle, 3rd floor, 203.432.4900
http://french.yale.edu
M.A., M.Phil., Ph.D.

Chair
Maurice Samuels

Director of Graduate Studies
Jill Jarvis

Professors R. Howard Bloch, Dominique Brancher, Ardis Butterfield (*English*), Marlene Daut, Carolyn Dean (*History*), Kaiama L. Glover (*Black Studies*), Alice Kaplan, Pierre Saint-Amand, Maurice Samuels

Associate Professors Morgane Cadieu, Thomas Connolly, Jill Jarvis

Affiliated Faculty Carol Armstrong (*History of Art*)

FIELDS OF STUDY

Fields include French literature, criticism, theory, and culture from the early Middle Ages to the present, and the French-language literatures of Africa, the Caribbean, and the Maghreb.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

- Candidates must demonstrate proficiency in two languages (in addition to English and French). Proficiency is defined as the successful completion of one year of study at the college level or reading proficiency at the graduate level. Students must fulfill one language requirement no later than the beginning of their third term of study. The second language requirement must be satisfied before the prospectus can be approved.
- During the first two years of study, students normally take fourteen term courses. These must include Old French (FREN 6110) and at least two graduate-level term courses outside the department. They may include one term of an approved language course taken as a means of fulfilling one of the language requirements, and as many as four graduate-level term courses outside the department. Methods and Techniques in the Italian and French Classroom (FREN 6700) is also required for students in their second year. At the end of the first year of study, a grade of Honors must be obtained in at least two graduate term courses taught by core faculty within the French department. By the end of the second year, a grade of Honors must be obtained in at least four graduate term courses taught by core faculty within the French department. The total required number of Honors in French department courses taught by core faculty is thus four. (Core faculty are faculty appointed in French, as opposed to affiliated faculty.)
- A qualifying oral examination takes place during the sixth term. The examination is designed to demonstrate students' mastery of the French language, their knowledge and command of selected topics in literature, and their capacity to present and discuss texts and issues.

- After having successfully passed the qualifying oral examination, students are required to submit a dissertation prospectus for approval, normally no later than the end of the term following the oral examination.

In order to be admitted to candidacy for the Ph.D., students must complete all predissertation requirements, including the prospectus. Students must be admitted to candidacy by the end of the seventh term.

Teaching is considered an integral part of the preparation for the Ph.D. degree, and all students are required to teach for at least one year. Opportunities to teach undergraduate courses normally become available to candidates in their third year, after consideration of the needs of the department and of the students' capacity both to teach and to fulfill their final requirements. Prior to teaching, students take a language-teaching methodology course.

COMBINED PH.D. PROGRAMS

The French department also offers three combined Ph.D.s: one in French and Black studies (in conjunction with the Department of Black Studies), one in French and early modern studies (in conjunction with the Early Modern Studies Program), and one in French and film and media studies (in conjunction with the Film and Media Studies Program). Students in all of these combined degree programs are subject to all the requirements for a Ph.D. in French, with exceptions noted below. In addition, they must fulfill certain requirements particular to the combined program.

French and Black Studies

This program is most appropriate for students who intend to concentrate in and write a dissertation on the literature of the francophone Caribbean. Students take fourteen term courses, including Theorizing Racial Formations (AFAM 5005), which is a required course for all first-year graduate students in the combined program, and three other graduate-level Black studies courses: (1) a history course, (2) a social science course, and (3) a course in Black literature or culture. Ten of the remaining twelve courses are devoted to the full spectrum of periods and fields in French and francophone literature and culture. Students in the combined degree program should fulfill the French department's language requirements by gaining proficiency in either a Creole language of the Caribbean or Spanish, as well as by demonstrating competence in a second foreign language that is directly relevant to the study of the Caribbean. The students' oral examinations normally include two topics of Black content. The dissertation prospectus must be approved by the director of graduate studies (DGS) both in the French department and in Black Studies, and final approval of the dissertation must come from both departments. For further details see Black Studies.

French and Early Modern Studies

The Department of French offers, in conjunction with the Early Modern Studies Program, a combined Ph.D. in French and Early Modern Studies. For further details see Early Modern Studies.

French and Film and Media Studies

For students in the combined Ph.D. program in French and Film and Media Studies, the oral examination will normally include one topic on film theory and one on French film. Both the dissertation prospectus and the final dissertation must be approved by the French department and the program in Film and Media Studies. In addition, Film and Media Studies requires a dissertation defense. For further details see Film and Media Studies.

MASTER'S DEGREES

M.Phil. See Degree Requirements under Policies and Regulations.

M.A. Students who withdraw from the Ph.D. program may be eligible to receive the M.A. degree if they have met the requirements and have not already received the M.Phil. degree. For the M.A., students must successfully complete one of the language requirements and eight courses, of which at least six are in French. Two grades of Honors in French are required, and the remaining grades must average High Pass.

Program materials are available on the department's website at http://french.yale.edu/academics/graduate-program.

COURSES

FREN 6100a / MDVL 5615a, Old French R Howard Bloch
An introduction to the Old French language, medieval book culture, and the prose romance via study of manuscript Yale Beinecke 229, The Death of King Arthur, along with a book of grammar and an Old French dictionary. Primary and secondary materials are available on DVD. Work consists of a weekly in-class translation and a final exam comprised of a sight translation passage, a familiar passage from Yale 229, and a take-home essay. No previous study of Old French necessary, although a knowledge of French is essential. Conducted in English.

FREN 6700b / ITAL 6570b / LING 5640b / SPAN 5000b, Principles of Language Teaching and Learning Staff
Introduction to the basic principles of second-language acquisition theory, focusing on current perspectives from applied linguistics, sociolinguistics, and psycholinguistics. Topics include language teaching methodology, communicative and task-based approaches, learner variables, intercultural competence, and models of assessment.

FREN 6900a, Contemporary French Literature in the Making Morgane Cadieu
A survey of landmark contemporary novels coupled with a workshop. On the one hand, we read important twenty-first-century novels and narratives, discuss literary movements, genres, and trends, and explore contemporary literary life (media, prizes, publishing houses, literary quarrels). On the other hand, students are in charge of selecting and giving a presentation on a novel of their choice from the fall 2025 list of new releases. This way, we practice and compare different types of literary criticism, so as to acquire the tools to examine contemporary literature in the making. Graduate seminar taught in French. Seminar taught in French open to graduate students and to undergraduate students who completed at least one course in French in the 2000-4000 range

FREN 7000a / FREN 700 / HIST 6312a, Readings in Modern European Cultural History Carolyn Dean
This seminar introduces students to the various lines of inquiry informing modern cultural history in the twentieth century, with an emphasis on interdisciplinarity and method. the course asks how historians as well as scholars in other disciplines constitute culture as an object of inquiry and addresses different approaches to historicizing culture. Its two main aims are to explore different themes in modern European cultural history and to investigate the different ways that scholars interpret the relationship between symbolic representation and historical change.

FREN 7610a / AFAM 5610a / AMST 6612a / ENGL 5761a, Caribbean Literary and Cultural Studies Marlene Daut
This course examines eighteenth- and nineteenth-century writing (in translation, where applicable) by writers from the Anglophone, Francophone, and Hispanophone islands that make up the Caribbean. Haitian independence in 1804 ushered in a vibrant and diverse print culture that included poetry, plays, newspapers, and historical writing. From the pages of *La Gazette Royale d'Hayti* (1811–1820), to the poems of Jean-Baptiste Romane (1807–1858), to the historical writings of Louis-Félix Boisrond-Tonnerre (1776–1806), to the operas of Juste Chanlatte (1766–1828), there arose a distinct nineteenth-century literary culture in Haiti. Beginning with national literary developments in Haiti, this course expands to consider writing from Barbados, Cuba, Trinidad, Jamaica, Antigua, and Bermuda. These writings, both fictional and non-fictional, help us to think about whether and/or how a coherent early Caribbean literary tradition developed across geographical, linguistic, national, and imperial lines.

FREN 8120b / MDVL 6112b, The Old French Fable and Fabliaux R Howard Bloch
A study of Marie de France's 103 animal tales and some of the anonymous "Ysopets" as well as of the 170 comic verse tales whose veins of satire, parody, comedy of language, situation, character, and farce are at the root of the European comic tradition. We read the fables and the fabliaux against the background of twelfth- and thirteenth-century social, religious, and literary culture. Fables to be read in the bilingual (Old French and English) edition of Harriet Speigel and fabliaux in the recently published bilingual edition, with translations by Ned Dubin. Conducted in English.

FREN 8190b, Montaigne Beyond Skepticism: Learning to Read the *Essais* Dominique Brancher
Que sais-je? What do I know? This is Montaigne's motto, engraved on a medal in 1576 at the writer's request. At the crossroad of disciplines, this seminar explores how Michel de Montaigne develops a philosophy of doubt by literary means. We see that he does not naively or theoretically subscribe to the skeptical tradition, but rather proposes a practical and singular use of a non-judgmental attitude in the writing of *Les Essais*— the early modern masterpiece of the French literature of the self. We read essays on topics such as: idleness, education, eroticism, and imagination. These texts are coupled with short, theoretical excerpts (Sextus Empiricus, Diogène Laërce, Henri Estienne). Readings and discussion in French.

FREN 8980a / CPLT 8980a, Fin-de-siècle France Maurice Samuels
The course examines major French literary and artistic movements of the last decades of the nineteenth century (Naturalism, Decadence, Symbolism) in their cultural context. Weekly reading assignments pair literary texts with contemporary theoretical/medical/political discourse on such topics as disease, crime, sex, poverty, colonialism,

nationalism, and technology. Literary authors include Barbey, Mallarmé, Maupassant, Rachilde, Villiers, and Zola. Theorists include Bergson, Freud, Krafft-Ebing, Le Bon, Nordau, Renan, and Simmel. Some attention also paid to the visual arts. Prerequisite: reading knowledge of French.

FREN 9650b / AFST 9965b / CPLT 7290b, On Violence: Politics and Aesthetics across the Maghreb Jill Jarvis

This humanities laboratory investigates North African literary texts and other aesthetic works that document, theorize, and disrupt forms of state violence. How might these works—as well as our practices as humanities scholars, critics, curators, co-creators—run counter to state-sanctioned memory projects or compel rethinking practices of testimony, archiving, and justice in the face of enduring colonial occupation, institutionalized racism, and the state-sponsored violence that continues to take place on scales or in forms that are difficult to frame or fathom? Works by Fanon, Djebar, Kateb, Mechakra, Meddeb, Rahmani, Mouride, Hawad, Binebine, and many others. The seminar is an RITM Humanities Laboratory designed to cultivate new forms of collaborative and experimental humanities scholarship. See Canvas page for a more complete description. Conducted in English. Prerequisite: reading knowledge of French.

FREN 9700a or b, Directed Reading Staff

By arrangement with faculty.

FREN 9710a or b, Independent Research Staff

"As previously approved"

Genetics

Sterling Hall of Medicine I313, 203.785.5846
http://medicine.yale.edu/genetics
M.S., M.Phil., Ph.D.

Chair
Valerie Reinke

Directors of Graduate Studies
James Noonan
Zhaoxia Sun

Professors Allen Bale, Susan Baserga (*Molecular Biophysics and Biochemistry*), Kristen Brennand (*Psychiatry*), Martina Brueckner (*Pediatrics/Cardiology*), Keith Choate (*Dermatology*), Lynn Cooley, Daniel DiMaio, Casey Dunn (*Ecology and Evolutionary Biology*), Joel Gelernter (*Psychiatry*; *Neuroscience*), Antonio Giraldez, Peter Glazer (*Therapeutic Radiology*), Valentina Greco, Daniel Greif (*Internal Medicine/Cardiovascular Medicine*), Jeffrey Gruen (*Pediatrics*), Murat Gunel (*Neurosurgery*), Ira Hall, Marc Hammarlund, Arthur Horwich, Yong-Hui Jiang, Mustafa Khokha (*Pediatrics*), Kenneth Kidd (*Emeritus*), Peining Li, Haifan Lin (*Cell Biology*), Maurice Mahoney (*Emeritus*), Shrikant Mane, Arya Mani (*Internal Medicine/Cardiovascular Medicine*), Margaret McGovern (*School of Medicine*), Michael Nitabach (*Cellular and Molecular Physiology*), James Noonan, Valerie Reinke, Margretta Seashore (*Emerita*), Nenad Sestan (*Neuroscience*), Stefan Somlo (*Internal Medicine/Nephrology*), Sherman Weissman, Hongyu Zhao (*Public Health*; *Biostatistics*)

Associate Professors Sidi Chen, Nadya Dimitrova (*Molecular, Cellular, and Developmental Biology*), Smita Krishnaswamy, Bluma Lesch, Janghoo Lim, Jun Lu, Mandar Muzumdar, Stefania Nicoli (*Internal Medicine/Cardiovascular Medicine*), Sabrina Nunez, In-Hyun Park, Michele Spencer-Manzon, Zhaoxia Sun, Silvia Vilarinho (*Medicine*; *Pathology*), Siyuan Wang, Andrew Xiao, Hui Zhang

Assistant Professors Xin Bi, Grace Chen (*Immunobiology*), Maurizio Chioccioli (*Comparative Medicine*), Nada Derar, Teodoro Jerves Serrano, Nicole Lake, Monkol Lek, Deqiong Ma, Diyendo Massilani, Rosa Munoz Xicola, Steven Reilly, Trevor Sorrells, Berna Sozen, Kaelyn Sumigray, Jia Di Wen, Frederick Wilson (*Internal Medicine/Oncology*), Chen Zhao

FIELDS OF STUDY

Cancer genetics: oncogenesis and tumor suppression, tumor progression, and metastasis. Cellular and developmental genetics: the genetic basis of germline development, skin development, internal organ development, stem cell development, genetic control and the role of the cilium, cytoskeleton, cell fate determination, cell cycle progression, cell migration, cell signaling, growth control and cell death during development, homeostasis and aging. Genomics: genome mapping, genome modification, high-throughput technology, evolutionary genetics, and functional genomics. Human genetics: genetic basis of human disease, chromosome rearrangements, population and quantitative genetics. Molecular genetics: chromosome structure and function, genetic recombination, mosaic genetics, viral genetics, DNA

damage repair, ribosome biogenesis, protein folding, neurodegenerative diseases, non-coding RNA function, and the regulation of gene expression. Model Organism Genetics: forward genetic screens and targeted genetic manipulations in *Drosophila*, *C. elegans*, zebrafish, frogs, mouse, organoids, and stem-cell-based embryo models.

To enter the Ph.D. program, students apply to the Molecular Cell Biology, Genetics, and Development (MCGD) track within the interdepartmental graduate program in Biological and Biomedical Sciences (BBS), https://medicine.yale.edu/bbs.

REQUIREMENTS FOR THE PH.D. DEGREE

The Ph.D. program in genetics is designed to provide the student with a broad background in general genetics and the opportunity to conduct original research in a specific area of genetics. The student is expected to acquire a broad understanding of genetics, spanning knowledge of at least three basic areas of genetics, which include molecular, cellular, organismal genetics and genomics. Normally this requirement is accomplished through the satisfactory completion of formal courses, many of which cover more than one of these areas. Advanced graduate study becomes increasingly focused on the successful completion of original research and the preparation of a written dissertation under the direct supervision of a faculty adviser along with the guidance of a thesis committee.

Laboratory Rotations and Choosing a Thesis Adviser Students must complete rotations in at least three laboratories in their first year in the MCGD program before selecting a thesis adviser. The student's dissertation adviser must hold a primary or secondary appointment in Genetics in order for the student to join the department.

Courses Students typically take two to three courses each term and three research rotations (GENE 9110, GENE 9120, GENE 9130) during the first year and are required to pass at least five graduate level courses that are taken for a grade. The required Graduate Student Seminar course (GENE 6750/GENE 6760, two terms, graded Satisfactory/Unsatisfactory) is taken in the second year. In addition to all other requirements, students must successfully complete GENE 9000 and GENE 9010, Research Skills and Ethics I and II, prior to the end of their first year of study. In their fourth year of study, all students must successfully complete MCDB 5040, RCR Refresher for Senior BBS Students. Students must meet the Graduate School's Honors requirement by the end of the fourth term of full-time study. Students must also maintain a High Pass average as required by the graduate school.

Qualifying Exam The qualifying exam (informally, QE or Quals) is an essential step in graduate-student training. The overarching goal is to provide a launching pad for the student to embark on a successful thesis project. The qualifying exam typically spans eight weeks and must be completed by December 15 in the student's second year. The exam consists of three parts:

1. A five-week reading period during which the student discusses a selection of primary research articles with each of three Qualifying Committee faculty readers. The adviser will not be a member of the Qualifying Committee and will not participate in the oral defense.

2. A two-week writing period during which the student writes an original research proposal modeled on the NIH F31 NRSA application and focused on the student's planned thesis work.
3. A one-week presentation period during which the student prepares an oral defense of the research proposal. The exam culminates in a two-hour oral defense of the research proposal, during which the committee provides feedback on the student's oral and written presentations and evaluates the readiness of the student to proceed with their proposed research.

Dissertation Prospectus and Admission to Candidacy By January 15 of their third year, each student must prepare a written summary of the proposed nature and scope of the thesis research, together with a provisional title for the dissertation, following the format described in the *Genetics Department Handbook*. This document should be written in clear, plain English with minimal jargon, abbreviations, or colloquialisms. The student's adviser must review the prospectus and indicate their approval in writing via an email to the DGS. The student then sends the prospectus and the adviser's approval to their DGS, who may require additional changes, for review. Once the DGS has approved the prospectus, the student sends the prospectus and approval emails to the Genetics registrar for their file and so it may be noted on their transcript. Students will not be admitted to candidacy nor will they be allowed to register for their fourth year of study without an approved prospectus.

In order to be admitted to candidacy, the student must fulfill (1) all course requirements, (2) the Honors requirement, (3) the qualifying examination, (4) the dissertation prospectus, and (5) the holding a satisfactory Thesis Committee meeting, at the conclusion of which, the committee will give their assent for the student to be admitted to candidacy. Upon completion of these requirements, final approval for admission to candidacy is granted during a subsequent faculty meeting—usually in late spring of the third year of study.

Thesis Committee The Thesis Committee normally comprises three to four faculty members, including the student's adviser, and is assembled by the student in consultation with the thesis adviser. At least two members (including the adviser) must have primary or secondary appointments in the Department of Genetics. If a committee member outside of Yale is included, the committee should consist of: the advisor, two Yale faculty members, and the outside committee member, making four members in total. Names of committee members should be submitted to the DGS for approval, with the Genetics registrar copied, within the first month of the spring semester of the student's second year. Students in years two and three at are required to meet with their committee at least once per year, while students in year four and beyond are required to meet with their committee every six months.

Teaching and Departmental Presentations An important aspect of graduate training in genetics is the acquisition of communication and teaching skills. Students participate in departmental presentation seminars and two terms (or the equivalent) of teaching. Teaching activities are drawn from a diverse menu of lecture, laboratory, and seminar courses given at the undergraduate, graduate, and medical school levels. Students are not expected to teach until they pass their qualifying exam. Students are also expected to present in the departmental Research in Progress seminar.

M.D.-PH.D. STUDENTS

M.D.-Ph.D. students affiliate with the Department of Genetics graduate program via a different route than other incoming graduate students in the department, resulting in some modification of the academic requirements for the Ph.D. portion of the M.D.-Ph.D. degree. Typically, one or more research rotations are done during the first two years of medical school (in many cases, the first rotation is done during the summer between years one and two). No set number of research rotations is required. M.D.-Ph.D. students officially affiliate with the Department of Genetics after selecting a thesis adviser and consulting with the director of graduate studies (DGS). M.D.-Ph.D. students interested in Genetics are required to consult with the DGS prior to formal affiliation to determine an appropriate set of courses tailored to the student's background and interests.

The courses, rotations, and teaching requirements for M.D.-Ph.D. students entering the Genetics graduate program (see below) are modified from the normal requirements for Ph.D. students. Besides the modifications in these three requirements, M.D.-Ph.D. students in the Department of Genetics are subject to all of the same requirements as the other graduate students in the department.

Laboratory Rotations and Choosing a Thesis Adviser One or more rotations are necessary to identify a thesis adviser. No set number of research rotations is required. The student's dissertation adviser must hold a primary or secondary appointment in Genetics in order for the student to join the department.

Courses Four graduate-level courses taken for a grade are required. (Yale graduate-level courses taken for a grade during medical school may be counted toward this requirement at the discretion of the DGS.) Coursework is aimed at providing a firm basis in genetics and in cellular molecular mechanisms, with graduate-level proficiency in genetics, cell biology, and biochemistry.

Required courses: In addition to the four graduate-level courses, all M.D.-Ph.D. students must take: Graduate Student Seminar (GENE 6750 and GENE 6760, two terms, graded Satisfactory/Unsatisfactory); Responsible Conduct of Research (B&BS 5501, graded Satisfactory/Unsatisfactory); and, in their fifth year of study, RCR Refresher for Senior BBS Students (MCDB 5040).

Electives: Other courses may be taken in a wide variety of fields relevant to the biological and biomedical sciences.

Qualifying Exam M.D.-Ph.D. students take their qualifying exam in the second year in the Ph.D. program. The structure of the qualifying exam is identical to that for other Ph.D. students in genetics as described above.

Dissertation Prospectus and Admission to Candidacy M.D.-Ph.D. students submit their prospectus in their second year in the Ph.D. program once their qualifying exam has been completed, but no later than April 30 following their exam. Each student must prepare a written summary of the proposed nature and scope of the thesis research, together with a provisional title for the dissertation, following the format described in the *Genetics Department Handbook*. This document should be written in clear, plain English with minimal jargon, abbreviations, or colloquialisms. The student's adviser must review the prospectus and indicate their approval in writing via an email to

the DGS. The student then sends the prospectus and the adviser's approval to their DGS, who may require additional changes, for review. Once the DGS has approved the prospectus, the student sends the prospectus and approval emails to the Genetics registrar for their file and so it may be noted on their transcript. Students will not be admitted to candidacy nor will they be allowed to register for their fourth year of study without an approved prospectus.

In order to be admitted to candidacy, the student must fulfill (1) all course requirements, (2) the Honors requirement, (3) the qualifying examination, (4) the dissertation prospectus, and (5) the holding of a satisfactory Thesis Committee meeting, at the conclusion of which meeting the committee will give their assent for the student to be admitted to candidacy. Upon completion of these requirements, final approval for admission to candidacy is granted during a subsequent faculty meeting.

Thesis Committee The composition of the Thesis Committee for M.D.-Ph.D. is the same as for Ph.D. students as described above. M.D-Ph.D. students are required to have one Thesis Committee meeting per year, beginning the term after passing their qualifying exam, and two meetings per year beginning in the fourth year in the Ph.D. program.

Teaching and Departmental Presentations One term of teaching is required. Previous teaching while enrolled at the Yale School of Medicine may count toward this requirement at the discretion of the DGS. Students are also expected to present in the departmental Research in Progress seminar.

MASTER'S DEGREES

M.Phil. Students are not admitted for this degree. The M.Phil. is awarded only to students who are continuing for the Ph.D. Students must have completed all of their course requirements, their qualifying exam, and have been admitted to candidacy as described above to be awarded this degree. Students will be automatically petitioned by the university for a M.Phil. after successful completion of the requirements at the end of the third year. No additional action is required on the part of the student.

M.S. Students are not admitted for this degree. They may receive this recognition if they leave Yale without completing the qualifying exam but have satisfied the course requirements as described above, as well as the Graduate School's Honors requirement. Students who are eligible for or who have already received the M.Phil. will not be awarded the M.S.

Prospective applicants are encouraged to visit the BBS website (https://medicine.yale.edu/bbs), MCGD Track.

COURSES

GENE 6250a / MB&B 6250a / MCDB 6250a, Basic Concepts of Genetic Analysis Jun Lu

The universal principles of genetic analysis in eukaryotes are discussed in lectures. Students also read a small selection of primary papers illustrating the very best of genetic analysis and dissect them in detail in the discussion sections. While other Yale graduate molecular genetics courses emphasize molecular biology, this course focuses on the concepts and logic underlying modern genetic analysis.

GENE 6450a / CB&B 6470a, Statistical Methods in Human Genetics Hongyu Zhao
Probability modeling and statistical methodology for the analysis of human genetics data are presented. Topics include population genetics, single locus and polygenic inheritance, linkage analysis, quantitative trait analysis, association analysis, haplotype analysis, population structure, whole genome genotyping platforms, copy number variation, pathway analysis, and genetic risk prediction models. Offered every other year. Prerequisites: genetics; BIS 505; S&DS 541 or equivalent; or permission of the instructor.

GENE 6550a / CB&B 6550a, Stem Cells: Biology and Application In-Hyun Park
This course is designed for first-year or second-year students to learn the fundamentals of stem cell biology and to gain familiarity with current research in the field. The course is presented in a lecture and discussion format based on primary literature. Topics include stem cell concepts, methodologies for stem cell research, embryonic stem cells, adult stem cells, cloning and stem cell reprogramming, and clinical applications of stem cell research. Prerequisites: undergraduate-level cell biology, molecular biology, and genetics.

GENE 6630b / AMTH 5520b / CB&B 6663b / CPSC 5520b, Deep Learning Theory and Applications Smita Krishnaswamy
Deep neural networks have gained immense popularity within the past decade due to their success in many important machine-learning tasks such as image recognition, speech recognition, and natural language processing. This course provides a principled and hands-on approach to deep learning with neural networks. Students master the principles and practices underlying neural networks, including modern methods of deep learning, and apply deep learning methods to real-world problems including image recognition, natural language processing, and biomedical applications. Course work includes homework, a final exam, and a final project—either group or individual, depending on enrollment—with both a written and oral (i.e., presentation) component. The course assumes basic prior knowledge in linear algebra and probability. Prerequisites: CPSC 202 and knowledge of Python programming.

GENE 6750a and GENE 6760b, Graduate Student Seminar: Critical Analysis and Presentation of Scientific Literature Siyuan Wang and Trevor Sorrells
Students gain experience in preparing and delivering seminars and in discussing presentations by other students. A variety of topics in molecular, cellular, developmental, and population genetics are covered. Required of all second-year students in Genetics. Graded Satisfactory/Unsatisfactory.

GENE 7340b / MB&B 7340b / MBIO 7340b, Molecular Biology of Animal Viruses Walther Mothes and Maudry Laurent-Rolle
Lecture course with emphasis on mechanisms of viral replication, oncogenic transformation, and virus-host cell interactions.

GENE 7600b, Genomic Methods for Genetic Analysis Steven Reilly and Bluma Lesch
Introduction to the analysis and interpretation of genomic datasets. The focus is on next-generation sequencing (NGS) applications including RNA-seq, ChIP-seq, and exome and whole genome sequencing. By the end of this time-intensive, practical problem-set based course, each student will be able to process and analyze large-scale NGS datasets and interpret the results. This course is intended only for graduate students who are interested in applying genomic approaches in their thesis research.

A basic familiarity with working in a UNIX/Linux computing environment or prior experience with a programming language is *not* required but can be useful. Extra resources will be made available prior to the course starting for students without any programming experience. Prerequisite: permission of the instructor. Interested students must contact the instructor early in the fall term to discuss their prior experience and expectations for the course. Enrollment limited to approximately twenty-five students.

GENE 7770b / MCDB 6770b, Mechanisms of Development Kaelyn Sumigray and Salil Garg

An advanced graduate seminar on animal development focusing on conserved mechanisms that govern germline development, embryogenesis, and somatic differentiation in molecular detail. The course runs parallel to the spring session of the Department of Genetics Seminar Series and is divided into two components: six Yale faculty-led lectures on core concepts in development and six combined journal club/student-led discussions with outside developmental biology speakers on their cutting-edge research. Over the course of the semester, small student groups are responsible for presenting one journal club-formatted discussion on two papers selected from the outside speaker's lab, as well as emceeing a dedicated question and answer session between the class and the speaker. This course provides a rare opportunity for Yale students to actively engage with world leaders on their work in developmental genetics, epigenetics, and cell biology, as well as learn essential skills in experimental thinking and scientific communication. The course grade is based on 40 percent take-home problems, 40 percent class participation and 20 percent student-led journal club/distinguished speaker question-and-answer session. There are no official prerequisites. However, some familiarity with concepts and techniques of modern biology is necessary to get the most out of the course.

GENE 9000a / CBIO 9000a / MCDB 9000a, Research Skills and Ethics I Andrew Xiao

This course consists of a weekly seminar that covers ethics, writing, and research methods in cellular and molecular biology as well as student presentations ("rotation talks") of work completed in the first and second laboratory rotations.

GENE 9010b / CBIO 9010b / MCDB 9010b, Research Skills and Ethics II Chenxiang Lin

This course consists of a weekly seminar that covers ethics, writing, and research methods in cellular and molecular biology as well as student presentations ("rotation talks") of work completed in the third laboratory rotation.

GENE 9110a / CBIO 9110a / MCDB 9110a, First Laboratory Rotation Andrew Xiao

First laboratory rotation for Molecular Cell Biology, Genetics, and Development (MCGD) and Plant Molecular Biology (PMB) track students.

GENE 9120a / CBIO 9120a / MCDB 9120a, Second Laboratory Rotation Andrew Xiao

Second laboratory rotation for Molecular Cell Biology, Genetics, and Development (MCGD) and Plant Molecular Biology (PMB) track students.

GENE 9130b / CBIO 9130b / MCDB 9130b / MCDB 913b and MCDB 9130b, Third Laboratory Rotation Andrew Xiao

Third laboratory rotation for Molecular Cell Biology, Genetics, and Development (MCGD) and Plant Molecular Biology (PMB) track students.

Germanic Languages and Literatures

Humanities Quadrangle, Third Floor
http://german.yale.edu
M.A., M.Phil., Ph.D.

Chair and Director of Graduate Studies
Kirk Wetters

Professors Rüdiger Campe, Fatima Naqvi, Paul North, Sophie Schweiger, Kirk Wetters

Affiliated Faculty Jennifer Allen (*History*), Thomas Connolly (*French*), Fatima El-Tayeb (*Ethnicity, Race and Migration*; *Women's, Gender, and Sexuality Studies*), Paul Franks (*Philosophy*), Gundula Kreuzer (*Music*; *Theater and Performance Studies*), John Peters (*English*; *Film and Media*), Steven Smith (*Political Science*), David Sorkin (*History*), Nicola Suthor (*History of Art*), Katie Trumpener (*Comparative Literature*; *English*; *Film and Media*)

FIELDS OF STUDY

German literature and culture from the Middle Ages to the twenty-first century in Germany, Austria, and Switzerland; literary and cultural theory; literature and philosophy; literature and science; media history and theory; visuality and German cinema.

REQUIREMENTS FOR THE PH.D. DEGREE

The faculty in German considers teaching to be essential to the professional preparation of graduate students. Four terms of teaching are required, but six is the norm. Teaching usually takes place in years three and four, but students may seek teaching in any term. Students normally teach undergraduate language courses under supervision for at least three terms. Other teaching experiences are available thereafter in literature, theory, film, etc.

Students are required to demonstrate, besides proficiency in German, a reading knowledge of one other foreign language in the third term of study.

In the first two years of study, students take four courses per term. Of these sixteen courses, one must be GMAN 5010, Methods of Teaching German as a World Language; and at least one must be taken in pre-nineteenth-century topics. Three of the sixteen courses in the first four terms may be audited. Up to two of the courses taken for credit may be directed readings under the supervision of a faculty member, with the approval of the DGS. Up to two credits may be awarded for prior graduate-level work, provided the student's first-year record at Yale is good and the total number of courses taken for credit at Yale are not fewer than twelve.

A written examination must be taken at the end of the fifth term of study, followed by an oral discussion approximately a week after the written exam. A dissertation prospectus should be submitted no later than the end of the sixth term. All students will be asked to defend the prospectus in a discussion with the faculty. The defense will take place before the prospectus is officially approved, usually in late April or May of the sixth term. Students are admitted to candidacy for the Ph.D. upon completion of all

predissertation requirements, including the prospectus. Candidates who wish to write the dissertation in a language other than English, in this case in German, should notify the DGS at the prospectus defense.

After the submission of the prospectus, the student's time is devoted mainly to the preparation of the dissertation. A dissertation committee will be set up for each student at work on the dissertation. It is expected that students will periodically pass their work along to members of their committee, so that faculty members in addition to the dissertation adviser can make suggestions well before the dissertation is submitted. Drafts of each chapter must be submitted in a timely fashion to all members of the student's committee: the first chapter should be submitted to the committee by February 1 of the fourth year of study; the second chapter should be submitted by January 1 of the fifth year. There will be a formal review of the first chapter. After the dissertation is submitted, the DGS convenes a defense colloquium with the candidate, the committee, the department, and invited guests.

Two concentrations are available to graduate students: Germanic Literature and German Studies. There are special combined degrees with Film and Media Studies and Early Modern Studies; see below.

SPECIAL REQUIREMENTS FOR THE GERMANIC LITERATURE CONCENTRATION

During the first two years of study, students are required to take sixteen term courses, four of which may be taken outside the department. Three courses may be audited.

SPECIAL REQUIREMENTS FOR THE GERMAN STUDIES CONCENTRATION

During the first two years of study, students are required to take sixteen term courses, seven of which may be taken outside the department. Three of those courses may be audited. Students are asked to define an area of concentration and to meet with appropriate advisers from within and outside the department.

COMBINED PH.D. PROGRAM WITH FILM AND MEDIA STUDIES

The Department of Germanic Languages and Literatures also offers, in conjunction with the Film and Media Studies Program, a combined Ph.D. in Germanic Languages and Literatures and Film and Media Studies. For further details, see Film and Media Studies. Applicants to the combined program must indicate on their application that they are applying both to Film and Media Studies and to Germanic Languages and Literatures. All documentation within the application should include this information.

COMBINED PH.D. PROGRAM WITH EARLY MODERN STUDIES

The Department of Germanic Languages and Literatures also offers, in conjunction with the Early Modern Studies Program, a combined Ph.D. in Germanic Languages and Literatures and Early Modern Studies Program. For further details, see Early Modern Studies.

MASTER'S DEGREES

M.Phil. Students receive an M.Phil. degree upon completion of all requirements for the Ph.D. except teaching, prospectus, and dissertation; that is to say: proficiency in a language other than German or English, 16 course credits, and the qualifying exam. This degree is awarded en route after requirements are met. See Degree Requirements under Policies and Regulations.

M.A. Students who withdraw from the Ph.D. program may be eligible to receive the M.A. degree if they have met the requirements and have not already received the M.Phil. degree. For the M.A., students must successfully complete eight for-credit graduate-level courses taken at Yale and demonstrate the knowledge of another foreign language other than English or German chosen in consultation with the DGS. Transferred courses cannot be counted toward the M.A. Candidates in combined programs will be awarded the M.A. only when the master's degree requirements for both programs have been met.

Further information is available upon request to the Registrar, Department of Germanic Languages and Literatures, Yale University, PO Box 208210, New Haven CT 06520-8210; email, german@yale.edu.

COURSES

GMAN 5020a / CPLT 5020a, Capitalism as a Form of Life Rahel Jaeggi
The critique of capitalism is thriving. But what, exactly, is the problem with capitalism? Is it flawed, unjust, irrational, or harmful? Is it evil or foolish—or does it simply fail to function? In other words, on what grounds can capitalism be criticized? Setting aside the simplistic accusation of individual greed, three distinct strategies of critique can be identified. First, there is the functional critique: capitalism, as a social and economic system, is inherently dysfunctional and prone to crises. The second is the moral critique, which argues that capitalism relies on exploitation and perpetuates injustice. The third is the ethical critique, which claims that life under capitalism is fundamentally alienating or impoverished, preventing individuals from achieving true human flourishing. These three accusations are as old as capitalism itself. They appear not only in "progressive" or emancipatory movements but also in nostalgic and conservative responses to the profound social changes capitalism has brought about. They are found in theoretical debates, political manifestos, literature, and film. This course explores these three lines of critique through a philosophical lens as well as through an examination of literature and films that engage with the issue. The central idea—that capitalism is not merely an economic system but a pervasive way of life that as such warrants critique—is made vivid and comprehensible through this exploration. Readings include Max Weber, Karl Marx, Werner Sombart, Georg Simmel, Theodor W. Adorno, Jürgen Habermas, Nancy Fraser, Upton Sinclair, Bertold Brecht, Thomas Piketty, Kim Stanley Robinson, and Quinn Slobodian.

GMAN 5030a / PHIL 5523a, The Frankfurt School Jacob McNulty and Rahel Jaeggi
The Frankfurt School of Critical Theory was (is) a group of eclectic interdisciplinary Marxist philosophers and social scientists, active from the 1920s to the present. Most were German Jews born around the turn of the twentieth century. The Frankfurt School were a group of thinkers in almost perpetual exile. Simultaneously critical

of American capitalism and of Soviet communism, they were expelled from their native Germany in the wake of Hitler's rise to power. They also often lacked any intellectual safe haven, finding themselves at odds much philosophical and social-scientific orthodoxy (positivism, neo-Kantianism, "value-free" social science etc.). The critical theorists of the Frankfurt School sought to re-actualize ideas from the philosophical tradition, especially from Kant and Hegel, in order to address the complex realities of modern society: mass culture; fascism, totalitarianism, and authoritarianism; world war; imperialism; secularization; irrationality, sexuality, and aggression; and so on. This class looks at critical theory from a philosophical perspective, focusing on its claim to fuse traditional philosophy and radical social science. We begin with Max Horkheimer's "Traditional and Critical Theory," the school's founding document which announces a break with the received "objectifying" approach to science and philosophy and inaugurates another based on the conviction that knowledge-production is continuous with economic production. We then consider the elusive worldview of Walter Benjamin, a fusion of religious mysticism and historical Marxism which would be so influential for the school. During the bulk of the course, we read two landmark works of first-generation critical theory. The first, Adorno and Horkheimer's *Dialectic of Enlightenment* develops a universal history and fundamental anthropology that understands the human being as seeking relief from fear by assimilating the unfamiliar to the unfamiliar. It places the legacy of the Enlightenment in question laying responsibility for the horrors of the twentieth century at its door. We also read Adorno's *Minima Moralia*, a more personal, reflective work which foregrounds other less overtly political preoccupations of the institutes, e.g. modernism in literature and the arts; subjectivity, consciousness, and erotic desire; childhood, the family, and self-formation. We conclude by taking up Habermas's attempt to revive the Enlightenment project together with a version of Kant's transcendental project based on "the linguistic turn." In this unit, we focus on selections from *Structural Transformation of the Public Sphere* and *Theory of Communicative Action*. Prerequisite: at least one prior course in philosophy, preferably in Kant or political philosophy.

GMAN 5060a / CPLT 5065a, Bad Books Kirk Wetters
Traditional humanities education always focused on "greatness"—but there is no denying the critical value and sometimes even the enjoyment of poor performances. In a world governed by norms and standards (against the appearance of laxness and relativism), "badness" and amateurism are inevitable. "Bad" works can be extremely popular and influential (e.g., in the cases of pseudoscience, misinformation, racism, antisemitism). The "bad" archive contributes to a reevaluation of critical standards, forms of official and unofficial censorship, freedom of speech and the function of taboos. The course explores famous works that have been considered aesthetically, morally, ideologically and politically pernicious (stopping short, however, of screeds and manifestos like Hitler's *Mein Kampf*). Nevertheless, this course warrants a strong content warning. The range of our considerations is partly based on the students' wishes and judgments.

GMAN 5100a, "Sprachkrise"—Philosophies & Language Crises Sophie Schweiger
The crisis of language predates the invention of ChatGPT (who may or may not have helped write this syllabus). This course delves into the concept of language crises and its long history from a philosophical and literary perspective, examining how crises of language are represented in literature and how they reflect broader philosophical

questions about language, identity, and power. We explore different philosophical approaches to language, such as the history of language and philology (Herder, Humboldt, Nietzsche), structuralism and post-structuralism (Saussure), analytical and pragmatic philosophies (Wittgenstein), phenomenology and deconstruction (Heidegger), and analyze how these theories shape our understanding of language while simultaneously evoking its crisis. The course also examines how such language crises are represented and produced in literature and the arts, how authors and artists approach the complexities of language loss, and how crises help birth alternative systems of signification. Through close readings of literary texts by Hofmannsthal, Musil, Bachmann, et. al., we analyze the symbolic and metaphorical significance of language crises as well as the ethical and political implications of language loss for (cultural) identity. Experimental use of language such as DaDa artwork, performance cultures, and "Sprachspiel" poetry by the "Wiener Gruppe," as well as contemporary KI/AI literature, further complement the theoretical readings. By exploring language crises through the lens of philosophy and literature, we gain a deeper understanding of the role of language—and its many crises—in shaping our understanding of ourselves and our communities.

GMAN 5140a / CPLT 5140a / ENGL 5040a, What the University Was Paul North
After this course, you might not know exactly where the university is going, but you should be able to say what it was once supposed to be, in its "modern" inception in Germany and in latter day materializations around the planet. The course is the interpretation of a particular dream. Who dreamed the dream of an institution that could be anywhere and contain everything important? How did its theorists think the unique nexus of power, economics, histories, and architecture that is, ideally at least, the university? How did they imagine it, given that it is a highly conflictual entity, riding the forefront of some transformations and at the same time codifying and regulating knowledges and social potentials? We read texts from the global archive called "critical university studies," concentrating on articulations of the problems in theoretical texts. These include Kant's *Conflict of the Faculties*, Schiller's *Letters on Aesthetic Education*, Nietzsche's *Anti-Education*, Derrida's *Eyes of the University*, Willy Thayer's *Non-Modern Crisis of the Modern University*, Fred Moten and Stefano Harney's *Undercommons*, and Roderick Ferguson's *The Reorder of Things*.

GMAN 5333a, Kafka Paul North
A name, a puzzle to be solved, a mirage-like figure provoking writers like Jorge Luis Borges to step beyond staid literary models, Jew, German, subject of the Kingdom of Bohemia, accident insurance lawyer, inventor of a device to make table saws safe, abject sufferer of tuberculosis, critic of philosophy and European culture, misogynist, queer, dreamer and recorder of dreams, jokester, refuter of Kierkegaard, challenger to Nietzsche, fabulist, reader of Freud, reader of Flaubert, reader of . . ., writer of short prose pieces "in a single breath," diarist, novelist. Kafka.

GMAN 5460a / FILM 6460a, Uwe Johnson's Anniversaries: From A Year in the Life of Gesine Cresspahl Austen Hinkley
Uwe Johnson's *Anniversaries: From A Year in the Life of Gesine Cresspahl* remains a monument of postwar German literature—and it was written in and about New York City. Across its 367 short chapters (each corresponding to a day of the year), the novel unfolds on three levels: the historical present in New York, memories and family history from Germany, and reporting from the *New York Times* on current events. The

result is a view of life, politics, and history in the middle of the twentieth century that is as rich and expansive as it is fragmented. The social and political climate of New York in the late '60s is put into contact with memories of the rise of Nazism in Germany; reporting on the Vietnam war, the civil rights movement, and the Prague Spring is refracted through the lenses of the protagonist's past life in East Germany and her new life raising her daughter alone in New York. This course undertakes a close reading of Johnson's sprawling novel with attention to its many historical, political, and literary contexts. Readings from the novel will be complemented by relevant short readings in theories of media, politics, literature, and history. No prior knowledge of German language and literature is required.

GMAN 5710b / CPLT 7880b, Robert Musil's *Man without Qualities:* The End of the Novel Rudiger Campe

Musil's gigantic *Man without Qualities* (published 1930–33, 1943) is one of the quintessential modernist (interwar) European novels. After looking into Musil's earlier narrative experiments, the course begins with the close reading of part I of the novel and then focuses on the main strands of its narrative network: modernization and mysticism; the end of old Europe and the rise of fascism; the Vienna Circle's epistemology and the legal doctrine of accountability; love and violence. The intertwining of essay and narration in the novel, the theory of the novel in the novel, and the question of prose as form are at the core of the course. Readings in English or German. Discussions in English.

GMAN 6500b / CPLT 5240b, Critique and Crisis Kirk Wetters

In our time, when everyone is suspected of being hypercritical, it is not surprising that the limits of critique, its function, and institutional location are called to question. The idea of "post-critique" has been much discussed in recent years. This course develops critical models, primarily from the German tradition, in order to show the great variety of options available beyond the "hermeneutics of suspicion." Topics include post-critique, the history of critique/criticism, the Romantic concept of critique, traditional vs. critical theory, historicism, philology vs. hermeneutics, science (*Wissenschaft*) vs. the critique of positivism. Main protagonists include Kant, Schiller, Schlegel, Nietzsche, Dilthey, Max Weber, Lukács, Husserl, Benjamin, Adorno, Koselleck, Szondi, Gadamer, Gumbrecht, Latour, Felski.

GMAN 7090b / CPLT 6180b / JDST 7680b, Walter Benjamin's Critical Theory Paul North

Careful analysis of central texts in Benjamin's oeuvre in the context of his philosophical, political, and literary reading.

History

Humanities Quadrangle, 2nd floor, 203.432.1366
http://history.yale.edu
M.A., M.Phil., Ph.D.

Chair
Regina Kunzel

Director of Graduate Studies
Jennifer Allen (203.432.1361)

Professors Sunil Amrith, Lauren Benton, Paola Bertucci, Ned Blackhawk, David Blight, Daniel Botsman, Paul Bushkovitch, Deborah Coen, Stephen Davis, Carolyn Dean, Fabian Drixler, Carlos Eire, Omnia El Shakry, David Engerman, Paul Freedman, Joanne Freeman, John Gaddis, Beverly Gage, Bruce Gordon, Greg Grandin, Valerie Hansen, Robert Harms, Elizabeth Hinton, Matthew Jacobson, Paul Kennedy, Jennifer Klein, Regina Kunzel, Noel Lenski, Kathryn Lofton, Mary Lui, Daniel Magaziner, J.G. Manning, Ivan Marcus, Joanne Meyerowitz, Alan Mikhail, Samuel Moyn, Nicholas Parrillo, Mark Peterson, Stephen Pitti, Claire Priest, Laura Robson, Naomi Rogers, Edward Rugemer, Paul Sabin, David Sorkin, Elli Stern, John Harley Warner, Arne Westad, John Witt, Jonathan Wyrtzen, Taisu Zhang

Associate Professors Jennifer Allen, Rohit De, Marcela Echeverri Muñoz, Anne Eller, Hussein Fancy, Crystal Feimster, Andrew Johnston, Isaac Nakhimovsky, Vanessa Ogle, Joanna Radin, William Rankin, Alden Young

Assistant Professors Alvita Akiboh, Sergei Antonov, Zeinab Azarbadegan, Maura Dykstra, Joe Glynias, Benedito Machava, Nana Osei Quarshie, Carolyn Roberts, Hannah Shepherd, Nurfadzilah Yahaya

Senior Lecturer Jay Gitlin

FIELDS OF STUDY

Fields include ancient, medieval, early modern, and modern Europe (including Britain, Russia, and Eastern Europe), United States, Latin America, East Asia, South and Southeast Asia, Middle East, Africa, Jewish history; and diplomatic, environmental, ethnic, intellectual, labor, legal, military, political, religious, social, and women's history, as well as the history of science and medicine (see the section in this bulletin on the History of Science and Medicine).

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Language Requirements

All students must pass examinations in at least one foreign language by the end of the first year. Students are urged to do everything in their power to acquire adequate linguistic training before they enter Yale and should at a minimum be prepared to be examined in at least one language upon arrival. Typical language requirements for major subfields are as follows:

African Either (1) French and German or Portuguese or Dutch-Afrikaans; (2) French or German or Portuguese and Arabic; or (3) French or German or Portuguese or

Dutch-Afrikaans and an African language approved by the director of graduate studies (DGS) and the faculty adviser.

American One language relevant to the student's research interests approved by the adviser and DGS.

Ancient German and either French or Italian and two ancient languages, one of which must be Greek or Latin and the second of which can be either the second classical language or another ancient language (e.g., Hebrew, Aramaic/Syriac, Demotic, Coptic, Classical Armenian, Sanskrit).

Chinese Chinese and Japanese; additional languages like French, Russian, or German may be necessary for certain dissertation topics.

East European The language of the country of the student's concentration plus two of the following: French, German, Russian, or an approved substitution.

Global/International Two languages to be determined by the DGS in consultation with the adviser.

Japanese Japanese and one additional language, as approved by the student's adviser and the DGS.

Jewish Modern Hebrew and German, and additional languages such as Latin, Arabic, Yiddish, Russian, or Polish, as required by the student's areas of specialization.

Latin American Spanish, Portuguese, and French.

Medieval French, German, and Latin.

Middle East Arabic, Persian, or Turkish (or modern Hebrew, depending on area of research) and a major European research language (French, German, Russian, or an approved substitute).

Modern Western European (including British) French and German; substitutions are permitted with the approval of the DGS.

Russian Russian plus French or German with other languages as required.

South Asia One South Asian language and a second relevant research language, whether another South Asian or a European or Asian language.

Southeast Asian Choice of Dutch, French, Spanish, Portuguese, Chinese, Sanskrit, or Arabic, plus one or more Southeast Asian language (e.g., Bahasa Indonesian, Burmese, Khmer, Lao, Malay, Tagalog, Thai, Tetum, or Vietnamese). In certain cases, Ph.D. dissertation research on Southeast Asia may also require knowledge of a regional or local language, e.g., Balinese or Cham.

Foreign students whose native language is not English may receive permission during their first year to hand in some written work in their own language. Since, however, the dissertation must be in English, they are advised to bring their writing skills up to the necessary level at the earliest opportunity.

Additional Requirements

During the first year of study, students normally take six term courses, including Approaching History (HIST 5000), which is required of first-year students. During the second year of study, they may opt to take four to six term courses, with the approval of their adviser and the DGS. One of these courses must be the Prospectus Seminar (HIST 5100), which is required of second-year students. The ten courses taken during the first two years should normally include at least six chosen from those offered by the department. Students must achieve Honors in at least two courses in the first year, and Honors in at least four courses by the end of the second year, with a High Pass average overall. Courses graded in the Satisfactory/Unsatisfactory mode (HIST 9998) count toward the course work requirement but do not count toward the Honors requirement. Courses that count for less than one full credit per term do not count toward the coursework requirement, including EMST 7000 and EMST 7001 for those in the combined program with Early Modern Studies.

Two of the ten courses must be research seminars in which the student produces an original research paper from primary sources. The Prospectus Seminar (HIST 5100) does not count as a research seminar. All graduate students, regardless of field, will be required to take two seminar courses in a time period other than their period of specialty.

Students in their second year should choose their courses so that at least one course will prepare them for a comprehensive examination field. Some fields offer reading seminars specifically designed to help prepare students for examination; others encourage students to sign up for Directed Reading (HIST 9998) with one of their examiners. Students should, in consultation with their major field examiner and the DGS, register for Field Studies (HIST 5250), which is a half-credit course and does not count toward the coursework requirements.

Students should discuss the following options with their advisers before choosing one:

Option 1 Students take exams during the fourth semester of graduate study (i.e., the second semester of year two). The Comprehensive Statement of Intention Form must be submitted by the end of the third semester.

Option 2 Students take exams during the fifth semester of graduate study (i.e., the first semester of year three). The Comprehensive Statement of Intention Form must be submitted by the end of the fourth semester.

Students in good academic standing may, with adviser approval, request scheduling comprehensive examinations in the sixth semester.

All students must submit the Comprehensive Statement of Intention Form by the end of the fourth semester.

Students will have a choice of selecting three or four fields of concentration: a major field and either two or three minor fields. The examination must contain one minor field that deals fifty percent or more with the historiography of a region of the world other than the area of the student's major field. The examination will have a written component that will be completed before the oral component. For their major field, students will either write a historiographical essay of 8,000 words, maximum, or

prepare a syllabus for an undergraduate lecture class in the field; this is to be decided in consultation with the major field examiner. For each of the minor fields, the student will prepare a syllabus for an undergraduate lecture class in the field. All of these are to be written over the course of the examination preparation process and will be due not less than two weeks prior to the oral portion of the examination. The oral examination examines the students on their fields and will, additionally, include discussion of the materials produced for the written component of the examination. For those students who choose two minor fields, the major field will be examined for sixty minutes and the minor fields will be examined for thirty minutes each. For those students who choose three minor fields, each field will be examined for thirty minutes.

In order to advance to candidacy, all students must pass a prospectus colloquium. This should be completed by the end of the sixth term. The prospectus colloquium offers students an opportunity to discuss the dissertation prospectus with their dissertation committee in order to gain the committee's advice on the research and writing of the dissertation and its approval for the project. The dissertation prospectus provides the basis of grant proposals.

Both the comprehensive examinations and the prospectus colloquium must be held by the end of the sixth term.

Completion of ten term courses (including HIST 5000 and HIST 5100), the language requirements of the relevant field, the comprehensive examinations, and the prospectus colloquium will qualify a student for admission to candidacy for the Ph.D., which must take place by the end of the third year of study.

It is also possible for students who have completed extensive graduate work prior to entering the Yale Ph.D. program to complete course work sooner. Students may petition for course waivers based on previous graduate work (up to three term courses) only after successful completion of the first year.

Students normally serve as teaching fellows during four-six terms to acquire professional training. Ordinarily, students teach in their third year and two subsequent years. During their first term of teaching, students must attend training sessions run by the Poorvu Center for Teaching and Learning and work with the associate director of graduate studies to discuss any matters of concern. Students in more advanced years may have the opportunity to teach as associates in teaching (ATs), in conjunction with a faculty member, or by leading discipline-specific writing seminars on their own. Both options are available only through a competitive process. Interested students should consult with their advisers and the DGS for further information.

By the end of their ninth term, students are required to submit a chapter of their dissertation to the dissertation committee. This chapter will then be discussed with the student by the committee, in a chapter conference, to give the student additional advice and counsel on the progress of the dissertation. This conference is designed to be an extension of the conversation begun in the prospectus colloquium and is not intended as a defense. Its aim is to give students early feedback on the research, argument, and style of the first writing accomplished on the dissertation.

No less than one month before students plan to submit their dissertations, a relatively polished full draft of the dissertation should be discussed with the student by the

dissertation committee, in a dissertation defense of one to two hours, to give the student additional advice and counsel on completing the dissertation or on turning it into a book, as appropriate. Students are required to submit the draft to their committee in sufficient time for the committee to be able to read it (approximately one month). This defense is designed to give students advice on the overall arguments and the final shape of the dissertation or book, and to leave time for adjustments coming out of the discussion.

The fellowship package offered to Ph.D. students normally includes twelve months of fellowship support for two terms of research and writing without any teaching duties. With the approval of the academic adviser and the DGS, students may choose to take the fellowship terms at any point after they have advanced to candidacy and before the end of their sixth year. Students are prohibited from teaching during research and writing fellowship terms.

Students who have not submitted the dissertation by the end of the sixth year need not register in order to submit. If, however, students wish to register for a seventh year for good academic reasons, they may petition for extended registration. The petition, submitted to the History DGS, will explain the academic reasons for the request. Only students who have completed the first chapter conference will be considered for extended registration.

EVALUATION OF FIRST- AND SECOND-YEAR GRADUATE STUDENTS

At the end of each term, the DGS will ask faculty members whether they have serious concerns about the academic progress of any first- or second-year students in the Ph.D. program. Faculty members who have such concerns will provide written feedback to the DGS at the DGS's request. The DGS will use discretion in ensuring that feedback is provided in a clear and effective manner to any students about whom there are concerns. We expect such concerns to be rare.

Toward the end of the academic year, the History faculty will hold a special meeting to review each first- and second-year student in the program. The purpose of the meeting is to assess students' academic progress. In order for second-year students to proceed to the third year, they must demonstrate through written work, classroom performance, and participation in departmental activities that they have the ability to: (a) speak and write clearly; (b) conduct independent research at a high level; and (c) develop coherent scholarly arguments. A faculty vote will be taken at the conclusion of the review meeting to decide whether each second-year student may stay in the program. In the unusual case that a majority of faculty present and voting determine that a student may not continue, the student will be informed in writing and withdrawn from the program. The review meeting must be a full faculty meeting, but faculty members with no knowledge of the students under review may abstain from the vote, and their abstentions will not count in the total. Those members of the faculty who have worked with or know the students being evaluated are required to attend. In the event that any necessary faculty members absolutely cannot be present, they may send their views in writing to the DGS, who will read them at the meeting.

A student informed of a vote of dismissal from the program may submit a formal letter of appeal within two weeks, accompanied by supporting documentation (research or

other scholarly work), to the Graduate Advisory Committee. The Graduate Advisory Committee will render a final decision within two weeks of receipt of the appeal. Any members of the Graduate Advisory Committee who have worked directly with the student will recuse themselves from the final vote on the case.

COMBINED PH.D. PROGRAMS

History and Black Studies

Students applying for transfer into the combined Ph.D. program must already have taken AFAM 5005 or be taking it in the term of application, must provide a plan outlining the AFAM courses already taken and those they will take, and must submit a research statement that explains how the combined Ph.D. will advance their research interests.

Students must provide two letters of recommendation: one from their adviser in the joint department or program, unless that adviser is jointly appointed with Black Studies, in which case a letter from the student's DGS in the joint department or program is required *and* a second letter from a faculty member in Black Studies who commits to being the student's adviser throughout the completion of the dissertation.

Students cannot apply sooner than the second term of the first year and must apply by January 3, which is the deadline for Black Studies' annual admissions cycle. Preference will be given to students in the second year of their Ph.D. program. Applications will receive a faculty vote early in the spring term to approve or reject, and results will be communicated to the student no later than spring break.

History and Classics

The combined degree program in classics and history, with a concentration in ancient history, is offered by the Departments of Classics and History for students wishing to pursue graduate study in the history of the ancient Mediterranean and western Eurasia. Students are admitted with a primary home in either History or Classics.

The combined degree in classics and history offers students a comprehensive education in the fundamental skills and most current methodologies in the study of the ancient Greek and Roman Mediterranean and its interaction with Eurasian and African cultures and landscapes. Its object is to train leaders in research and teaching by preparing them to handle the basic materials of ancient history through mastery of the traditional linguistic and technical skills. At the same time the combined degree in classics and history encourages students to rediscover, reshape, and repurpose traditional and nontraditional source materials using the most up-to-date and sophisticated tools at the historian's disposal.

Students are called on to complete coursework in two ancient languages, historical theory, intra- and interdisciplinary skills, and fundamental research seminars. Interdisciplinary expertise is fostered through the annual seminar coordinated through the Yale Program for the Study of Ancient and Premodern Cultures and Societies (Archaia) and through required study in ancillary fields. Exams are rigorous and aimed at helping students hone skills and explore new terrain in ancient studies. Students are encouraged to take advantage of Yale's superior collections and library resources in order to explore new avenues in their learning and approaches to historical problems.

Yale's outstanding faculty in classics, history, and related disciplines, such as Near Eastern languages and cultures, religious studies, art history, and anthropology, work together to ensure broad and deep learning that will enable our students to become world leaders in the field.

REQUIREMENTS FOR THE COMBINED PH.D. DEGREE IN CLASSICS AND HISTORY

1. A minimum of twelve term courses, including:
    - The historical methods and theory course Approaching History (HIST 5000).
    - The Archaia core seminar (CLSS 7000 or equivalent).
    - Two graduate-level courses in two separate ancient languages. For students who are admitted in Classics, these must be Greek and Latin. Students who are admitted in History must study either Greek or Latin, and they may study both but may also choose another ancient language to fulfill this requirement. The surveys of Greek and Latin literature offered by Classics are encouraged but not mandatory for fulfillment of this requirement.
    - Two skills courses. These may include topics selected from epigraphy (epigraphy courses may be used to fulfill the language requirement concurrently); archaeology; art history; papyrology; numismatics; digital data, GIS, digital humanities, vel sim.; an advanced course in a non-classical ancient language (no more than one such course may be used in fulfillment of this requirement). Students are also encouraged to take advantage of educational opportunities outside of Yale (American Numismatic Society Summer Seminar; an archaeological excavation, e.g., the Gabii project).
    - Four courses (at least two of which must be research seminars) in the history of the ancient Mediterranean world. Historical courses that have a heavy skill component may be used concurrently to fulfill the skills requirement.
    - Two courses outside of ancient Mediterranean history, to be taken in programs outside of the Department of Classics. these are meant to introduce students to different historical periods, regions, and methodologies. Possibilities include (but are not limited to): social sciences (economics, anthropology, sociology, environmental science, statistics); religion (religious studies, Divinity School, Jewish studies); Near Eastern languages and civilizations (Egyptian language, Hebrew, Aramaic, Syriac, Arabic); anthropology and archaeology; or physical and biological sciences (paleoclimatology, ecology and forestry, genetics, medicine). Students should discuss course selection with the two directors of graduate studies.
2. Classics proseminar offering an introduction to the discipline of classics and its various subdisciplines, to be taken in the first year in residence (not for credit).
3. Practice translation exams in Greek and/or Latin, depending on which languages are required for the student's program, based on texts assigned from the appropriate classics and history Ph.D. reading lists. These exams are taken before the beginning of the first and third terms and are meant to help students prepare for the qualifying translation exams to be taken before the beginning of the fifth term in the program.

4. Departmental reading examinations in German, and in either French or Italian, or approved Yale courses or examinations that demonstrate reading proficiency in these languages (e.g., by achieving a grade of A in German/French/Italian for Reading Knowledge or by passing proficiency exams administered by Yale's modern language departments). The department will also accept certain certificates of proficiency in French, German, or Italian in lieu of these exams, as listed in the Department of Classics *Graduate Handbook*. One modern language exam is to be passed by the end of the first year in residence and the second by the end of the second year in residence.
5. Translation examinations in two ancient languages. For students admitted through Classics, these must be Greek and Latin. For students admitted through History, at least one must be either Greek or Latin. Greek and Latin examinations will be based on the Classics and History Greek and Latin Ph.D. reading lists and will consist of a choice of eight passages in each language. For each language, students will be required to translate four of the eight passages, to include one verse passage, one documentary text (epigraphy/papyrology), and two passages of prose from literary sources. Some history students may find that expertise in another language —such as Hebrew, Aramaic/Syriac, Demotic, Coptic, Classical Armenian, a Persic language, or Sanskrit—is most beneficial for their research and teaching trajectory. Reading lists for these nonclassical languages will be devised by the student in collaboration with the faculty adviser and other relevant member(s) of the Yale faculty and fixed in writing no later than the end of the fourth term in residence. Examinations in these languages will also consist of a choice from eight passages, of which students must translate four, to be set and evaluated by faculty expert in the given language. Translation exams in all languages must be taken at the beginning of the fifth term in residence.
6. A general examination in ancient history during the third year and no later than the end of the sixth term in residence. This is to be broken into one major and two or three minor fields. For the major field, students must prepare an 8,000-word essay in advance of the oral examination. For the minor fields, students must prepare (also in advance) a syllabus for an undergraduate class. The written essays and syllabi must be submitted by a fixed date, typically on the Friday before Thanksgiving or spring break. Oral exams will be completed shortly afterward to ensure time for the completion of the dissertation prospectus.
7. A dissertation prospectus by the end of the sixth term in residence.
8. A dissertation. By the end of their ninth term, students are required to submit a chapter of their dissertation, which will be discussed with the student by the committee in a chapter conference.

History and Early Modern Studies

Coursework The required number of courses and timeline for coursework follows the Department of History guidelines for history students in the combined program. In general, it is expected that courses in early modern studies constitute about one-third of the student's doctoral coursework, and at least one course with an early modern focus must be taken outside the student's primary department. Students will also enroll in EMST 7000/EMST 7001 and EMST 8000/EMST 8001 during the second year, neither of which count towards the total number of courses required for the Ph.D. in history. In

the spring of third year, students in the Department of History are also encouraged, but not required, to enroll in EMST 9000.

Advising A student's academic adviser is a member in the Department of History. A student may also choose to have as co-adviser a faculty member affiliated with the Program in Early Modern Studies who is not affiliated with History.

Language Requirement The language requirement follows the Department of History requirements.

Qualifying Exams Qualifying exams will follow the Department of History requirements with one added requirement that at least half the exam content must be about early modern subjects (the equivalent of one and a half fields if the student completes three fields, two fields if the student completes four fields).

Prospectus and Admission to Candidacy Procedures for the prospectus follow Department of History guidelines. At least one faculty member affiliated with the Program in Early Modern Studies must be on the committee. Upon completion of all predissertation requirements, including the prospectus, students are admitted to candidacy for the combined Ph.D. degree.

Dissertation At least one faculty member affiliated with the Program in Early Modern Studies must be on the dissertation committee.

Teaching A student's teaching assignments are determined by the Department of History, with every effort made to assign a student to at least one course (or course equivalent) in early modern studies.

MASTER'S DEGREES

M.Phil. Students who have completed all requirements for admission to candidacy for the Ph.D. may receive the M.Phil. degree.

M.A. (en route to the Ph.D.) Students enrolled in the Ph.D. program may qualify for the M.A. degree upon completion of a minimum of seven graduate term courses at Yale, of which two must have earned Honors grades and the other five courses must average High Pass overall. Students must also pass an examination in one foreign language.

A student in the Ph.D. program in American Studies who wishes to obtain an M.A. degree in History, rather than an M.A. in American Studies, must include in the courses completed at least two research seminars in the History department.

Students enrolled in the Ph.D. program in Political Science may qualify for the M.A. degree in History, rather than an M.A. in Political Science, upon completion of a minimum of six graduate term courses in History at Yale, of which two must have earned Honors grades and the other four courses must average High Pass overall. A student must include in the six courses completed at least two research seminars in the History department.

Terminal Master's Degree Program For this terminal master's degree, students must pass seven term courses, four of which must be in history; substantial written work must be submitted in conjunction with at least two of these courses, and Honors grades are expected in two courses, with a High Pass average overall. An undergraduate language course, statistics course, or other applicable course in a technological

"language" may count for one course credit toward the graduate degree with approval of the DGS. All students in this program must pass an examination in one foreign language. Financial aid is not available for this program.

More information is available on the department's website, http://history.yale.edu.

COURSES

HIST 5000a, Approaching History: Problems, Methods, and Theory Omnia El Shakry and Greg Grandin
An introduction to the professional study of history, which offers new doctoral students an opportunity to explore (and learn from each other about) the diversity of the field, while also addressing issues of shared concern and importance for the future of the discipline. By the end of the term participants have been exposed to some of the key methodological and theoretical approaches historians have developed for studying different time periods, places, and aspects of the human past. Required of and restricted to first-term History Ph.D. students.

HIST 5250a or b / HSHM 5250a or b, Field Studies Staff
This course does not count toward the coursework requirements for the Ph.D. or M.A. ½ Course cr

HIST 5804a and HIST 5805b / ANTH 8897a and ANTH 8898b / HSAR 6841a and HSAR 6842b / HSHM 7691a and HSHM 7692b, Topics in the Environmental Humanities Paul Sabin
This is the required workshop for the Graduate Certificate in Environmental Humanities. The workshop meets six times per term to explore concepts, methods, and pedagogy in the environmental humanities, and to share student and faculty research. Each student pursuing the Graduate Certificate in Environmental Humanities must complete both a fall term and a spring term of the workshop, but the two terms of student participation need not be consecutive. The fall term each year emphasizes key concepts and major intellectual currents. The spring term each year emphasizes pedagogy, methods, and public practice. Specific topics vary each year. Students who have previously enrolled in the course may audit the course in a subsequent year. This course does not count toward the coursework requirement in history. Open only to students pursuing the Graduate Certificate in Environmental Humanities. ½ Course cr per term

HIST 5807a, Modern Europe Colloquium Jennifer Allen
The Modern Europe Colloquium brings six to eight scholars working in the field of modern European history to the university each year to present their work. This course does not count toward the coursework requirements in History. ½ Course cr

HIST 5809a, Race and Slavery Working Group Edward Rugemer
This workshop is a seminar of works-in-progress by graduate students and faculty touching on racism, slavery, emancipation, and colonial projects in the Atlantic world up to the year 1900. Participants are expected to read the essay prior to attendance. A longer description can be found here: https://rswg.yale.edu. ½ Course cr

HIST 6002b / CLSS 7680b / MDVL 7002b, Human Migration in Antiquity Noel Lenski
This course examines the processes of human migration in premodern societies with an emphasis on ancient Rome. It explores voluntary and forced migrations, their

motivations, processes, and outcomes. Particular attention is paid to sources and problems in the period of late antiquity, when human migration helped drive the collapse of the Roman Empire.

HIST 6030b / RLST 6080b, Approaches to the Study of Christianity in Late Antiquity Stephen Davis

This proseminar addresses key methodological and historiographical issues in the periodization and commodification of late antiquity as a field of inquiry, focusing especially on Christianity from the rise of Constantine (313) to the Council of Chalcedon (451). Part one of the course focuses on theories and methods that have marked the study of late ancient Christianity in recent decades, including the analysis of discourse, sexuality and gender, bodies and ritual practice, and hybridity and ethnic identities. Part two focuses on a series of case studies, including the rise of Constantine, North African ecclesiastical resistance, the role of bishops and councils, barbarians and Roman borders, monasticism, pilgrimage, and the cult of the saints. The course concludes with a consideration of early Christian archaeology. The course is designed for EMWAR students with a primary or secondary area of concentration in Early Christianity, Late Ancient Christianity, Christianity and Judaism in the Hellenistic East, and West Asian Religions of the Sasanian and Early Islamic Eras. The course also provides important historical context for students concentrating in New Testament and in Scriptures and their Interpretation in Antiquity. Students interested in completing a seminar-based exam in connection with the course are encouraged to speak with the instructor. EMWAR area of concentration designations: EarXty, LateXty, XtyJudEast, WAR.

HIST 6048a / CLSS 7435a, Greek Social History (600–250 BCE): New Approaches Jessica Lamont

This advanced seminar introduces students to new ways of researching ancient Greek social history, with a focus on communities across the ancient Greek world between c. 600 and 250 BCE, from Sicily to Thasos to the northern Black Sea. Newly published inscriptions and epigraphic corpora drive and structure the course. Major topics of study include: ancient Greek oracles (Delphi, Dodona, dice oracles), divination, women, religious cults and ritual practice, sacred laws, "magical" rites (spells, curses, and incantations), Greek colonization, north Aegean Thasos, and more.

HIST 6150b / EMST 6150b / RLST 6790b, Popular Religion in Europe, 1300–1700 Carlos Eire

Readings and discussion in recent scholarship on the history of religion in the Christian West in the late medieval and early modern periods.

HIST 6155b / JDST 764b / MDVL 7155b / RLST 7770b, Jews in Muslim Lands from the Seventh through the Sixteenth Century Ivan Marcus

Introduction to Jewish culture and society in Muslim lands from the Prophet Muhammad to Suleiman the Magnificent. Topics include Islam and Judaism; Jerusalem as a holy site; rabbinic leadership and literature in Baghdad; Jewish courtiers, poets, and philosophers in Muslim Spain; and the Jews in the Ottoman Empire.

HIST 6157b / JDST 7206b / MDVL 7157b / RLST 6160b, How the West Became Antisemitic: Jews and the Formation of Europe, 800–1500 Ivan Marcus

This seminar explores how medieval Jews and Christians interacted as religious societies between 800 and 1500.

HIST 6171a, History and Culture of Russia to 1725 Paul Bushkovitch
The major phases of Russian history from the tenth century, covering the major historiographical controversies and sources. Russian or German helpful but not required.

HIST 6173b, Russia, the USSR, and the World, 1855–1945 Paul Bushkovitch
Political and economic relations of Russia/Soviet Union with Europe, the United States, and Asia from tsarism to socialism.

HIST 6176a, New Approaches to Russian and Eurasian History: The Archival Revolution Sergei Antonov
A reading seminar addressing recent work on Russian and Soviet history grounded in the ongoing "archival revolution" that began in the late 1980s. After reviewing the major earlier paradigms, we examine how they were overturned or significantly modified by archival-based evidence. Topics include the development of government and the law; historical actors and places marginalized by the earlier historiography, such as non-capital regions, the middle classes, conservatism, religion, and (more generally) non-state structures; and Russia's position in the imperial, Soviet, and post-Soviet periods as a vast and complex multiethnic political entity. Class discussions in English. Readings in English with Russian options available.

HIST 6191a, Convivencia: Coexistence Medieval and Early Modern Hussein Fancy and Stuart Schwartz
The word "convivencia" has been used to describe the coexistence of Jews, Christians, and Muslims across medieval and early modern Iberian history. For some, "convivencia" signified peaceful coexistence, from which all benefitted materially and culturally. For others, "convivencia" is an idealization or dangerous fiction. In this course, we examine the coexistence of Jews, Christians, and Muslims across medieval and early modern Iberia, North Africa, and the Americas. We test "convivencia" as a historical concept and practice. Students write one short historiographical essay and one research essay.

HIST 6229a / JDST 7261a / MDVL 7229a / RLST 7730a, Jews and the World: From the Bible through Early Modern Times Ivan Marcus
The course is a comprehensive introduction for GS students as well as YC students. It serves as a window course to pre-modern Jewish history. For YC students this can lead to taking seminars on more limited topics. For graduate students it is a good preparation for comprehensive exams and provides a model survey course to be offered later on as an instructor.

HIST 6280b, Readings in European Intellectual History Isaac Nakhimovsky
A review of current and classic scholarly literature on early modern European intellectual history, from Renaissance to Revolution.

HIST 6312a / FREN 700 / FREN 7000a, Readings in Modern European Cultural History Carolyn Dean
This seminar introduces students to the various lines of inquiry informing modern cultural history in the twentieth century, with an emphasis on interdisciplinarity and method. the course asks how historians as well as scholars in other disciplines constitute culture as an object of inquiry and addresses different approaches to historicizing culture. Its two main aims are to explore different themes in modern European cultural history and to investigate the different ways that scholars interpret the relationship between symbolic representation and historical change.

HIST 6321a, Protestantism and the Third Reich: Collaboration and Defense Bruce Gordon and Volker Leppin

This course explores the question of why virtually all German Protestants in the Third Reich either collaborated with National Socialism or chose strategies for survival over resistance. The eminent Protestant professor of theology, Paul Althaus, declared in 1933, "our Protestant churches have greeted the turning point of 1933 as a gift and miracle of God." The roots of Protestant responses to the Third Reich lay in the Imperial Christianity leading to WWI and the chaos of Weimar Germany. Recent scholarship has overturned older narratives of brave resistance and demonstrated that well-known figures such as Karl Barth and Dietrich Bonhoeffer were anomalies in a Protestant culture of passivity and silence. German Protestant churches remained quiet as Jews were deported. Working with primary sources, students explore the mentalities of collaboration in churches (German Christians) and universities as well as the character of the Confessing Church. The course concludes with the legacy of collaboration and nonresistance.

HIST 6610a / PLSC 6400a, Advanced Topics in Modern Political Philosophy Giulia Oskian

This seminar explores key concepts in modern political philosophy at a level appropriate for graduate students (to help prepare for the political theory field exam) and for advanced undergraduates who have completed substantial course work in intellectual history and/or political theory.

HIST 7000a, Topics, Themes, and Methods in U.S. History Beverly Gage and Joanne Meyerowitz

Exploring key readings in U.S. history, this seminar introduces important areas of research, members of the Yale faculty, and resources for research at Yale and beyond. Highly recommended for first and second year doctoral students in US History. Open to other interested graduate students with permission of the instructors.

HIST 7100a, Readings in Early American History Mark Peterson

This readings seminar introduces students to the historical literature on European colonization of North America and the Caribbean, from the sixteenth century to the age of the American Revolution. It covers major themes in the scholarship, including European-Indigenous American contact and conflict, the rise of African chattel slavery, the institutional and political development of colonial America's societies and economies, the formation and dissolution of Britain's American empire, and the emergence of new American cultures. The assigned readings connect classics in this very rich scholarly field to recent works. As such, the course serves as excellent preparation for comprehensive exam fields, but also offers students interested in doing advanced research in this period the opportunity to explore promising topics.

HIST 7200a / AMST 8835a, Research in Recent U.S. History Regina Kunzel and Joanne Meyerowitz

Students conduct research in primary sources and write original essays on post-1945 U.S. history. Readings include scholarly articles that might serve as models for students' research projects.

HIST 7260b / AMST 9003b / PHUM 9003b, Introduction to Public Humanities Karin Roffman

What is the relationship between knowledge produced in the university and the circulation of ideas among a broader public, between academic expertise on the one hand and nonprofessionalized ways of knowing and thinking on the other? What is possible? This seminar provides an introduction to various institutional relations and to the modes of inquiry, interpretation, and presentation by which practitioners in the humanities seek to invigorate the flow of information and ideas among a public more broadly conceived than the academy, its classrooms, and its exclusive readership of specialists. Topics include public history, museum studies, oral and community history, public art, documentary film and photography, public writing and educational outreach, the socially conscious performing arts, and fundraising. In addition to core readings and discussions, the seminar includes presentations by several practitioners who are currently engaged in different aspects of the Public Humanities. With the help of Yale faculty and affiliated institutions, participants collaborate in developing and executing a Public Humanities project of their own definition and design. Possibilities might include, but are not limited to, an exhibit or installation, a documentary, a set of walking tours, a website, a documents collection for use in public schools.

HIST 7290b, U.S. Empire Alvita Akiboh

One of the most cherished pieces of national mythology is that the United States, while an incredibly powerful country, has never been an empire. Scholars in the fields of U.S. diplomatic history, U.S. foreign relations, and U.S. and the World have made it their mission to debunk that myth. This course does not seek to settle the issue, but rather it seeks to better understand the particular ways in which the United States has historically projected power abroad since its founding and how scholars have chosen to approach this history.

HIST 7304a / AMST 7705a / RLST 7050a, Readings in Religion and American Society Tisa Wenger and Jamil Drake

This seminar explores intersections of religion and society in North American history from the colonial period to the present as well as methodological problems important to their study. The course is designed to give graduate students a working knowledge of the field by examining key historiographical trends and influential approaches in recent years. It is not a specialized research seminar, but it does require a basic understanding of historiography. We think together about the sources, conversation partners, methods, and key interventions of each text we read.

HIST 7400a / AMST 7741a, Indians and Empires Ned Blackhawk

This course explores recent scholarship on Indian-imperial relations throughout North American colonial spheres from roughly 1500 to 1900. It examines indigenous responses to Spanish, Dutch, French, English, and lastly American and Canadian colonialism and interrogates commonplace periodization and geographic and conceptual approaches to American historiography. It concludes with an examination of American Indian political history, contextualizing it within larger assessments of Indian-imperial and Indian-state relations.

HIST 7430b / AFAM 8128b, Politics and Belonging in Post-Emancipation Americas Anne Eller

This course examines literature about emancipation contests throughout the Americas, with a preponderance of texts about the Caribbean and the US South. The hemispheric

approach seeks working peoples' negotiations within, outside, and across national frames. The course builds on decades of literature that dismantle old binaries between enslavement and "freedom," considering contests from 1804 through World War I. The course ponders freedom's many meanings, from the intimate to the electoral. Land, gendered power and violence, state services, and state abuse are key themes. Finally, alternative political allegiances and local authorities, often outside the auspices of a formal state, will animate discussions.

HIST 7500b / AMST 7768b / ER&M 6680b, Asian American History and Historiography Mary Lui
This reading and discussion seminar examines Asian American history through a selection of recently published texts and established works that have significantly shaped the field. Major topics include the racial formation of Asian Americans in U.S. culture, politics, and law; U.S. imperialism; U.S. capitalist development and Asian labor migration; and transnational and local ethnic community formations. The class considers both the political and academic roots of the field as well as its evolving relationship to "mainstream" American history.

HIST 8100b, Research in Modern International/Global History Vanessa Ogle and Alden Young
This seminar provides an opportunity for graduate students to write a research paper on international/global history, broadly defined to include diplomacy, economic relations, social movements, cultural and intellectual connections, and other topics. The first part of the seminar includes readings and class discussions that focus on hands-on strategies and tactics for historical research and academic writing. Later seminar meetings are oriented toward benchmarks and workshops on students' own research projects.

HIST 8102a, Historiography of Modern Global and International Affairs Arne Westad
This graduate reading seminar surveys major themes in the historiography of modern global and international affairs from the late nineteenth century up to today. Through reading both classic and recent research, students familiarize themselves with key debates that have shaped the historical understanding of modern international affairs.

HIST 8105b, Histories of Global Development David Engerman
This is a graduate reading seminar that explores recent approaches to the history of global development. While the focus is on scholarship written by historians, we also examine works in the social sciences that have shaped—or should shape—historical scholarship. The seminar is designed for students pursuing graduate work in history; undergraduates and students outside the history department should meet with the instructor by the end of the first week of the semester to discuss their interests.

HIST 8116a, Ports, Cities, and Empires Jay Gitlin and Paul Kennedy
A study of the relationship between imperialism and urbanism from the early modern period to the twentieth century. Topics include Roman medieval precedents; the uses and meanings of walls; merchant colonies and Latin Quarters; modernist urban planning and the International Style in Africa and the Middle East; comparative metro system in Paris, Algiers, and Montreal; decolonization and imperial nostalgia. Cities to be discussed include Delhi/New Delhi, New Orleans, Dublin, Cape Town, Tel Aviv, Addis Ababa, and many others. Permission of the instructor is required.

HIST 8130b / AFAM 7196b / AMST 7796b, Slave Systems in World History Edward Rugemer

Slavery has been a protean institution in world history, with pre-historic origins and nearly countless manifestations across time and place. This readings course explores the history of slavery over the *longue duree*, moving through time from the ancient world through the nineteenth century with readings on some of the major slave systems in world history. One goal of the course is to situate the well-known slave systems of the Americas within a broader historical context. Student writing includes a historiographical essay on one of the major slave systems discussed in the course.

HIST 8160a / ANTH 6841a / ENV 836a / PLSC 7790 / SOCY 7170a, Agrarian Societies: Culture, Society, History, and Development Louisa Lombard and Marcela Echeverri Munoz

An interdisciplinary examination of agrarian societies, contemporary and historical, Western and non-Western. Major analytical perspectives from anthropology, economics, history, political science, and environmental studies are used to develop a meaning-centered and historically grounded account of the transformations of rural society. Team-taught.

HIST 8202a, Latin America and the World Greg Grandin

Dipesh Chakrabarty, in *Provincializing Europe*, calls Europe "hyper-real," since it looms so large in the historical imagination. We can then think of Latin America as "hypo-real," its influence notably muted in what has come to be called the "new international history," in books that have explored the global origins of concepts—such as internationalism, human rights, sovereignty, populism, development, debates over the nature of capitalism, and multilateralism—and institutions that define modern times. This seminar will try to fill in the blank; readings will cover sweeping periods of hemispheric and world history, related to the realm of law, slavery, economics, ideology, politics, and culture.

HIST 8210a, Colonial Latin America and its Historiography Marcela Echeverri Munoz

This course reviews the historiography of Colonial Latin America, providing a view of the field. We read classic works and more recent contributions by scholars on Native American worlds; the encounter and formation of Iberian colonial societies in the Americas; environments and economies; Atlantic and global connections; slavery and race relations; ethnicity and indigeneity; law and politics; and the Age of Revolutions and Independence.

HIST 8321a / AFST 8833a, Agrarian History of Africa Robert Harms

The course examines changes in African rural life from precolonial times to the present. Issues to be examined include land use systems, rural modes of production, gender roles, markets and trade, the impact of colonialism, cash cropping, rural-urban migration, and development schemes.

HIST 8401a, Middle East History: Theories and Methods Alan Mikhail and Zeinab Azarbadegan

As an introduction to graduate studies in the history of the Middle East, this seminar addresses various theoretical and methodological approaches to the student of the early modern and modern Middle East. We read both canonical texts that have shaped the field and newer innovative works, all the while paying particular attention to the

changing nature of historical debates on the history of the Middle East. We explore themes such as capitalism, tradition and modernity, gender and sexuality, Orientalism, colonialism, postcolonial theory, global history, nationalism, and the nature of the early modern and modern state. Open to graduate students in any department.

HIST 8532a, Song-Dynasty China (960–1276): Modern Before Europe? Valerie Hansen

Did any society attain early modernity before Europe did so in 1500–1600? China did during the Song dynasty (960–1275). Consideration of economic output, meritocratic recruitment of the bureaucracy via civil service examinations, printing, levels of education and literacy (among both men and women), urban life, and foreign trade. Seminar members may choose to do either a research paper comparing China and Europe or a historiograhic essay.

HIST 8600a / SAST 8200a, Readings in South Asia: Across the Disciplines Rohit De and Sunil Amrith

Since the emergence of subaltern studies in the 1980s, South Asian historiography has been dominated by debates over the methods and theory that have come to influence the broader discipline of history. The seminar introduces participants to the major debates in South Asian studies through reading the original texts alongside newer scholarship addressing the themes of bureaucracy, secularism, visual media, political economy, and the environment.

HIST 8620a, Readings in the History of Southeast Asia Nurfadzilah Yahaya

This graduate seminar explores the major works in the history of Southeast Asia from the earliest period until modern day in their many facets—political, cultural, and social. Our focus is on questions or regional boundaries, interpretation of sources, methodology, periodization, and translation.

HIST 8831a / RLST 8331a, Psychoanalysis as Theory and Practice Omnia El Shakry

This course serves as an introduction to the psychoanalytic tradition through a reading of its foundational Freudian as well as post-Freudian texts. Centered on the "so-called Copernican revolution to which Freud himself compared his discovery," we attend primarily to the lineaments of the unconscious. Our readings will focus on Sigmund Freud and the Anglophone tradition (Klein, Winnicott, Bion, Bollas). In addition, there is special emphasis on questions of race (through Frantz Fanon and Afro-pessimism) and religion (through new work on psychoanalysis and Islam). Throughout the seminar, we remain attuned to the elements of psychoanalysis that enable us to engage the most pressing ethical questions of our times of war and death.

HIST 8900b / AFAM 7119b / HSHM 7710b, Researching and Writing Histories of Health, Medicine, and Science Carolyn Roberts

This small graduate seminar is for students currently researching and writing histories of health, science, and medicine. Students learn about slow scholarship, the politics of the archive, and research organization and management and explore the craft of writing. Preference is given to graduate students in history, the history of science and medicine, and African American studies.

HIST 8902b / AFAM 7152b / AMST 8867b / HSHM 7610b, Researching and Writing Medicine, Health, and Empire Carolyn Roberts

This small graduate seminar is for students currently engaged in research and writing projects that touch on issues related to health, medicine, science, or the body in

the context of slavery, colonialism, or neocolonialism. Students will explore their relationship to the craft of writing, their identity as "authors," the politics of the archive, the methodological and evidentiary challenges in their work, and tools that will level up their research organization and management skills. The course provides graduate students with a balance of support and independence as they further their research and writing projects. Graduate students in any discipline are warmly invited to participate in a compassion-based research community that prioritizes values of deep listening, presence, and care

HIST 8910a / HSHM 7100a, Problems in Science Studies Marco Ramos
Exploration of the methods and debates in the social studies of science, technology, and medicine. This course covers the history of the field and its current intellectual, social, and political positioning. It provides critical tools—including feminist, postcolonial, and new materialist perspectives—to address the relationships among science, technology, medicine, and society.

HIST 8911b / HSHM 7020b, Problems in the History of Science Ayah Nuriddin
Surveys current methodologies through key theoretical and critical works. Students encounter major twentieth-century methodological moments that have left lasting imprints on the field: positivism and anti-positivism, the sociology of knowledge, actor-network theory, and historical epistemology, as well as newer approaches focusing on space, infrastructure, translation, and exchange. We also consider central conceptual problems for the field, such as the demarcation of science from pseudoscience; the definition of modernity and the narrative of the Scientific Revolution; vernacular science, the colonial archive, and non-textual sources.

HIST 8912a / HSHM 7130a, Geography and History Bill Rankin
A research seminar focused on methodological questions of geography and geographic analysis in historical scholarship. We consider approaches ranging from the Annales School of the early twentieth century to contemporary research in environmental history, history of science, urban history, and more. We also explore interdisciplinary work in social theory, historical geography, and anthropology and grapple with the promise (and drawbacks) of GIS. Students may write their research papers on any time period or geographic region, and no previous experience with geography or GIS is necessary. Open to undergraduates with permission of the instructor.

HIST 8916a / HSHM 7520a, Historicizing the Atmosphere Deborah Coen
Recent scholarship brings the atmosphere from the background to the foreground of history. Inspired in part by present-day problems of climate change, air pollution, airborne viruses, and police brutality, humanities scholars are teasing out the historical specificity of experiences of the atmosphere. A focus on the atmosphere allows historians to make connections between local, embodied practices and planetary processes. We explore ways to periodize the atmosphere's history, from its invention in the seventeenth century to its weaponization in the twentieth. While some scholars in the humanities are working in partnership with the natural sciences, others present their work as complements to or critiques of science. We consider how scientific and cultural analyses of the atmosphere can build on each other as well as the tensions between them. Authors include Leo Spitzer, Peter Sloterdijk, Shigehisa Kuriyama, Christina Sharpe, Timothy Choi, and Kimberly Bain. Students have the option of a creative final project or a historical research paper.

HIST 8931a / HSHM 7010a, Problems in the History of Medicine and Public Health John Warner
An examination of the variety of approaches to the social and cultural history of medicine and public health. Readings are drawn from recent literature in the field, sampling writings on health care, illness experiences, and medical cultures in Asia, Latin America, Europe, and the United States from antiquity through the twenty-first century. Topics include the role of gender, class, ethnicity, race, religion, and region in the experience of sickness and healing; the intersection of lay and professional understandings of the body; and the role of the marketplace in shaping cultural authority, professional identities, and patient expectations.

HIST 8932b / HSHM 7360b / WGSS 7730b, Health Politics, Body Politics Naomi Rogers
A reading seminar on struggles to control, pathologize, and normalize human bodies, with a particular focus on science, medicine, and the state, both in North America and in a broader global health context. Topics include disease, race, and politics; repression and regulation of birth control; the politics of adoption; domestic and global population control; feminist health movements; and the pathologizing and identity politics of disabled people.

HIST 8942b / EMST 8160b / HSHM 7160b, Early Modern Science and Medicine Paola Bertucci
The course focuses on recent works in the history of science and medicine in the early modern world. We discuss how interdisciplinary approaches—including economic and urban history, sociology and anthropology of science, gender studies, art and colonial history—have challenged the classic historiographical category of "the Scientific Revolution." We also discuss the avenues for research that new approaches to early modern science and medicine have opened up, placing special emphasis on the circulation of knowledge, practices of collecting, and visual and material culture.

HIST 9997a or b / HSHM 9970a or b, Pedagogy Seminar Staff
Faculty members instruct their Teaching Fellows on the pedagogical methods for teaching specific subject matter. o Course cr

HIST 9998a or b, Directed Readings Staff
Offered by permission of the instructor and DGS to meet special requirements not covered by regular courses. Graded Satisfactory/Unsatisfactory.

HIST 9999a or b, Directed Research Staff
Offered by arrangement with the instructor and permission of DGS to meet special requirements.

History of Art

Loria Center, Rm. 251, 203.432.2668
http://arthistory.yale.edu
M.A., M.Phil., Ph.D.

Chair
Milette Gaifman (Loria 557, 203.432.2687, milette.gaifman@yale.edu)

Director of Graduate Studies
Nicola Suthor (Loria 655, 203.432.7210, nicola.suthor@yale.edu)

Professors Carol Armstrong, Tim Barringer, Marisa Bass, Edward Cooke, Jr., Milette Gaifman, Jacqueline Jung, Pamela Lee, Kishwar Rizvi, Nicola Suthor, Mimi Hall Yiengpruksawan

Associate Professors Craig Buckley, Jennifer Raab

Assistant Professors Nana Adusei-Poku, Alexander Ekserdjian, Joanna Fiduccia, Morgan Ng, Quincy Ngan, Catalina Ospina

FIELDS OF STUDY

African art; African American art; American art; Asian art; British art; Byzantine art and architecture; Caribbean art; colonial Latin American art; contemporary art; eighteenth-century art; film and media; Greek and Roman art and architecture; history of photography; Native North American Art; Islamic art and architecture; Italian Early Modern Renaissance art and architecture; material culture and decorative arts; medieval European art and architecture; modern architecture; modern art; Netherlandish, Dutch, and Flemish art; nineteenth-century art; Northern Renaissance art; Pre-Hispanic art; seventeenth-century-European art and architecture; Slavic art.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

All students must pass examinations in at least two languages pertinent to their field of study, to be determined and by agreement with the adviser and director of graduate studies (DGS). One examination must be passed during the first year of study, the other not later than the beginning of the third term. During the first two years of study, students typically take twelve term courses. In March of the second year, students submit a qualifying paper that should demonstrate the candidate's ability successfully to complete a Ph.D. dissertation in art history. During the fall term of the third year, students are expected to take the qualifying examination. Candidates must demonstrate knowledge of their field and related areas, as well as a good grounding in method and bibliography. By the end of the second term of the third year, students are expected to have established a dissertation topic. A prospectus outlining the topic must be approved by a committee at a colloquium by the end of the third year. Students are admitted to candidacy for the Ph.D. upon completion of all predissertation requirements, including the prospectus and qualifying examination. Admission to candidacy must take place by the end of the third year.

The faculty considers teaching to be an important part of the professional preparation of graduate students. Students are required to complete four terms of teaching. This requirement is fulfilled in the second and third years. Students may also serve as a

graduate research assistant at either the Yale University Art Gallery or the Yale Center for British Art. This can be accepted in lieu of one or two terms of teaching, but students may accept a graduate research assistant position at any time after the end of their first year. Application for these R.A. positions is competitive.

COMBINED PH.D. PROGRAMS

History of Art and Black Studies

The Department of the History of Art offers, in conjunction with the Department of Black Studies, a combined Ph.D. in history of art and Black studies. Students in the combined-degree program must take five courses in Black studies as part of the required twelve courses and are subject to the language requirement for the Ph.D. in history of art. The dissertation prospectus and the dissertation itself must be approved by both History of Art and Black Studies. For further details, see Black Studies.

History of Art and Early Modern Studies

The Department of the History of Art offers, in conjunction with the Early Modern Studies Program, a combined Ph.D. in the History of Art and Early Modern Studies. For further details, see Early Modern Studies.

History of Art and English

The Department of the History of Art also offers, in conjunction with the Department of English Language and Literature, a combined Ph.D. degree in History of Art and English Language and Literature. The requirements are designed to emphasize the interdisciplinarity of the combined degree program.

Coursework In years one and two, a student in the combined program will complete sixteen courses: ten seminars in English, including The Teaching of English (ENGL 9090) and one course in at least three out of four designated historical periods (Medieval, Renaissance, eighteenth–nineteenth century, twentieth–twenty-first century), and six in history of art, including HSAR 5500 and one course outside the student's core area. Up to two cross-listed seminars may count toward the number in both units, reducing the total number of courses to fourteen.

Languages Two languages pertinent to the student's field of study, to be determined and by agreement with the advisers and directors of graduate studies. Normally the language requirement will be satisfied by passing a translation exam administered by one of Yale's language departments. One examination must be passed during the first year of study, the other by the end of the third year.

Qualifying Paper History of Art requires a qualifying paper in the spring term of the second year. The paper must demonstrate original research, a logical conceptual structure, stylistic lucidity, and the ability to successfully complete a Ph.D. dissertation. The qualifying paper will be evaluated by two professors from History of Art and one professor from English.

Qualifying Examination *Written exam:* addressing a question or questions having to do with a broad state-of-the-field or historiographic topic. Three hours, closed book, written by hand or on a non-networked computer. *Oral exam:* given one week after the written exam, covering four fields, including two in English (question periods of

twenty-five minutes each, covering thirty texts each, representing two distinct fields of literary history) and two in history of art (twenty-five minutes each, fields to be agreed on in advance with advisers and DGS). Exam lists will be developed by the student in consultation with faculty examiners.

Teaching Two years of teaching—one course per term in years three and four—are required: two in English (up to two sections per course) and two in History of Art.

Prospectus The dissertation prospectus must be approved by both English and History of Art. The colloquium will take place in the spring term of the third year of study. The committee will include at least one faculty member from each department. As is implied by its title, the colloquium is not an examination, but a meeting during which the student can present ideas to a faculty committee and receive advice from its members. The colloquium should be jointly chaired by the directors of graduate studies of both departments.

First Chapter Reading Students will participate in a first chapter reading (also known as a first chapter conference) normally within a year of advancing to candidacy (spring term of year four). The dissertation committee, including faculty members from both programs, will discuss the progress of the student's work in a seminar-style format.

Dissertation Defense The hour-long defense is a serious intellectual conversation between the student and the committee. Present at the defense will be the student's advisers, committee, and the directors of graduate studies in both English and History of Art; others may be invited to comment after the committee's questioning is completed.

History of Art and Film and Media Studies

The Department of the History of Art offers, in conjunction with the Film and Media Studies Program, a combined Ph.D. in the History of Art and Film and Media Studies. Students are required to meet all departmental requirements, but many courses may count toward completing both degrees at the discretion of the directors of graduate studies in History of Art and Film and Media Studies. For further details, see Film and Media Studies.

THE CENTER FOR THE STUDY OF AMERICAN ART AND MATERIAL CULTURE

The Center for the Study of American Art and Material Culture provides a programmatic link among the Yale faculty, museum professionals, and graduate students who maintain a scholarly interest in the study, analysis, and interpretation of American art and material culture. It brings together colleagues from a variety of disciplines—from History of Art and American Studies to Anthropology, Archaeological Studies, and Earth and Planetary Sciences—and from some of Yale's remarkable museum collections, from the Yale University Art Gallery and Peabody Museum to the Beinecke Library. Center activities will focus upon one particular theme each year and will include weekly lunch meetings in which a member makes a short presentation centered on an artifact or group of artifacts followed by lively discussion about methodology, interpretation, and context and an annual three-day Yale-Smithsonian Seminar on Material Culture.

MASTER'S DEGREES

M.Phil. See Degree Requirements under Policies and Regulations.

M.A. Students who withdraw from the Ph.D. program may be eligible to receive the M.A. degree if they have met the requirements and have not already received the M.Phil. degree. For the M.A., students must successfully complete eight term courses and have proficiency in one required foreign language. Candidates in combined programs will be awarded the M.A. only when the master's degree requirements for both programs have been met.

Program materials are available online at http://arthistory.yale.edu.

COURSES

HSAR 5500a, First-Year Colloquium Pamela Lee
The focus of the first-year colloquium is to analyze and critique the history of art history and its methodology from a variety of disciplinary perspectives. The seminar discusses foundational texts as well as new methods relevant to the study of the history of art and architecture today, notably those concerned with issues of race, gender, and representation. It also engages with debates about museums and the ethics of collecting and display. The seminar is structured around selected readings and includes workshops with guest speakers. It also includes an option to conduct in-person research in the Yale University Art Gallery.

HSAR 5506a, Teaching Art History Marisa Bass
Directed seminar on pedagogy focused on the genre of the introductory lecture course in the history of art. Topics include how to teach visual analysis and close looking, how to encourage participation, grading and giving written feedback, and addressing student concerns and contingencies. By invitation of the instructor only.

HSAR 6526a / AMST 6636a, Art and Extraction Jennifer Raab
This graduate seminar examines the relationship of art with extraction: as visual representation and material condition, as shaping political consensus or giving form to dissent, as imagining land and geological time, and as naturalizing—or revealing—the violences of settler-colonialism and racial capitalism. We think about gold, silver, oil, and water, about mines, mills, rocks, and rivers, about empire and enslavement, about golden myth and toxic dust. Classes often revolve around works of art and visual culture held in Yale collections and museums. Instructor permission required.

HSAR 6529b / AMST 6630b / RLST 8190b, Museums and Religion: The Politics of Preservation and Display Sally Promey
This interdisciplinary seminar focuses on the tangled relations of religion and museums, historically and in the present. What does it mean to "exhibit religion" in the institutional context of the museum? What practices of display might one encounter for this subject? What kinds of museums most frequently invite religious display? How is religion suited (or not) for museum exhibition and museum education? Enrollment is by permission of the instructor; qualified undergraduates are not only welcome but also encouraged to join us. There are no set prerequisites, but, assuming available seats, permission is granted on the basis of response to three questions: Why do you wish to take this course? What relevant educational or professional background/experience do

you bring to the course? How does the course help you to meet your own intellectual, artistic, or career aspirations?

HSAR 6553a, Embodied Artisanal Knowledge Edward Cooke
The development and transmission of knowledge during the early modern European world has lately been a dynamic subject of scholarly inquiry. Much of this work has focused upon the work of royal academies' explorations of natural philosophy and the mechanical arts. This seminar seeks to move beyond that narrow geographic focus and descriptive taxonomies to consider embodied artisanal knowledge throughout the world in the period from 1500 to 1800. As Tim Ingold reminds us, embodied knowledge is a skilled, socially generated practice distinct from the innate talents of mechanical execution. It is a cognitive skill that prizes resourcefulness; efficiency of effort; and informed, intensive use of tools. This tacit knowledge, the intellect of the hand, is experienced and felt rather than written about and illustrated. Making things depends upon constant attention to the transmission of ideas from brain to hand and from tool to material, with feedback channeled back through the tool to the body and mind of the maker. This seminar combines reading, object-driven inquiry, and hands-on exercises to explore the role of materials, techniques, and human agency in the making of objects. Students expand their own approaches to the study of artisans and objects from many periods and places.

HSAR 6573a, Advanced Topics in Modernism Joanna Fiduccia
Reading seminar on the affordances and limitations of the monograph for the study of modernism today. What is the relationship between the shape of the book and the shape of arguments about modern art? What critical possibilities have been offered in recent decades by alternative book structures, such as the "anti-monograph"? What other models for reading can be ventured? In addition to pursuing answers to these questions, we cultivate a practice for reading and recalling what we have read, as well as what we have thought while reading. This course emphasizes recent scholarship that brings an interdisciplinary and/or trans-regional approach to modern art.

HSAR 6594a / EAST 6423a, Chinese Paintings at the YUAG Quincy Ngan
This seminar explores the issue of authenticity in thirteenth through twentieth century Chinese paintings at the Yale University Art Gallery. Students become familiar with the different schools of connoisseurship and the major debates surrounding authenticity in the field of Chinese painting. Students learn about the methods for authenticating an attribution, as well as the rationale behind the dating provided by the gallery. Calligraphical inscriptions and seals on the works, as well as their physical condition, related conservation reports, and provenance are consulted as well. This class makes frequent visits to the gallery. Reading ability of Chinese is not required.

HSAR 6720a / AMST 8805a / RLST 6990a / WGSS 7779a, Sensational Materialities: Sensory Cultures in History, Theory, and Method Sally Promey
This interdisciplinary seminar explores the sensory and material histories of (often religious) images, objects, buildings, and performances as well as the potential for the senses to spark contention in material practice. While course content focuses on United States things and religions (given the professor's areas of expertise and academic appointments), the course also considers broader geographical and categorical parameters so as to invite intellectual engagement with the most challenging and decisive developments in relevant fields, including recent literatures on material agencies. The goal is to investigate possibilities for scholarly examination of a robust

human sensorium of sound, taste, touch, scent, and sight—and even "sixth senses"—the points where the senses meet material things (and vice versa) in life and practice. Topics include the cultural construction of the senses and sensory hierarchies; investigation of the sensory capacities of things; and specific episodes of sensory contention in and among various religious traditions. In addition, the course invites thinking beyond the "Western" five senses to other locations and historical possibilities for identifying the dynamics of sensing human bodies in religious practices, experience, and ideas. Course is by permission of instructor; qualified undergraduates are welcome. In order to request permission, please email the professor (sally.promey@yale.edu) with responses to the following questions: (1) Why are you interested in taking this seminar?; (2) what educational, intellectual, artistic, or other experiences do you bring to the seminar's subjects?; (3) how does the content of this course relate to your own career and/or personal aspirations?

HSAR 6841a and HSAR 6842b / ANTH 8897a and ANTH 8898b / HIST 5804a and HIST 5805b / HSHM 7691a and HSHM 7692b, Topics in the Environmental Humanities Paul Sabin

This is the required workshop for the Graduate Certificate in Environmental Humanities. The workshop meets six times per term to explore concepts, methods, and pedagogy in the environmental humanities, and to share student and faculty research. Each student pursuing the Graduate Certificate in Environmental Humanities must complete both a fall term and a spring term of the workshop, but the two terms of student participation need not be consecutive. The fall term each year emphasizes key concepts and major intellectual currents. The spring term each year emphasizes pedagogy, methods, and public practice. Specific topics vary each year. Students who have previously enrolled in the course may audit the course in a subsequent year. This course does not count toward the coursework requirement in history. Open only to students pursuing the Graduate Certificate in Environmental Humanities. ½ Course cr per term

HSAR 9512a, Directed Research Staff

By arrangement with faculty.

History of Science and Medicine

Humanities Quadrangle, 203.432.1365
http://hshm.yale.edu
M.A., M.Phil., Ph.D.

Chair
Bill Rankin

Director of Graduate Studies
Naomi Rogers

Faculty Sakena Abedin, Elaine Ayers, Paola Bertucci, Deborah Coen, Ivano Dal Prete, Megann Licskai, Gourav Krishna Nandi, Ayah Nuriddin, Nana Quarshie, Joanna Radin, Marco Ramos, William Rankin, Carolyn Roberts, Naomi Rogers, Deborah Streahle, John Harley Warner

Affiliated Faculty Rene Almeling (*Sociology*), Alexi Baker (*Collections Manager, HSI*), Marisa Bass (*History of Art*) Melissa Grafe (*Librarian for Medical History*), Greta LaFleur (*American Studies*), Alka Menon (*Sociology*), Lisa Messeri (*Anthropology*), John Durham Peters (*English*; *Film and Media Studies*), Jason Schwartz (*Public Health*), Kalindi Vora (*Women's, Gender, and Sexuality Studies*)

The Graduate Program in the History of Science and Medicine is a semi-autonomous graduate track within the Department of History. The program's students are awarded degrees in History, with a concentration in the History of Science and Medicine.

FIELDS OF STUDY

All subjects and periods in the history of science and history of medicine, especially the modern era. Special fields represented include American and European science and medicine; disease, therapeutics, psychiatry, drug abuse, and public health; science and national security; science and law, science and religion, life sciences, human genetics, eugenics, biotechnology, gender, race, and science/medicine; bioethics and medical research; environmental sciences; human and social sciences; physical and earth sciences.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Courses

Students will ordinarily take fourteen courses by the end of the third year. In their first two years, all students will normally take the three core Problems seminars: Problems in the History of Medicine and Public Health (HSHM 7010 or HSHM 7030), Problems in the History of Science (HSHM 7020), and Problems in Science Studies (HSHM 7100). These courses are committed to exploring histories of medicine and science alongside the cultural, political, and social forces that shape them. Issues of race, gender, sexuality, disability, class, and religion are integrated into discussions of medical and scientific knowledge production and praxis in Western and non-Western contexts. In addition, students are expected to take the HSHM Program seminar (HSHM 7900), which counts as one half-course per term) during their third through sixth semesters, for a total of two course credits. These courses meet every other week and teach skills

related to research and professional development that includes careers in and beyond academia.

Students are also required to take four additional graduate seminars with an HSHM course number. The remaining five courses can be taken in HSHM, history, or any other field of demonstrated relevance to the student's scholarly objectives. Of the fourteen total courses, at least three must be seminars that result in an original research paper; at least two of these papers must be written in HSHM seminars. Students may ordinarily use up to two independent reading, independent research, or pedagogical seminars towards their course requirements. The use of additional independent credits requires approval.

Graduate school grading at Yale follows a qualitative rubric of Honors, High Pass, or Pass. During the first two years of study, students must achieve Honors in at least two courses in the first year and Honors in at least four courses by the end of the second year, with a High Pass average overall. At the end of each term, the director of graduate studies (DGS) will ask faculty members whether they have serious concerns about the academic progress of any first- or second-year students in the Ph.D. program. Faculty members who have such concerns will provide written feedback to the DGS at the DGS's request. The DGS will use discretion in ensuring that feedback is provided in a clear and effective manner to any students about whom there are concerns.

Students who enter having previously completed graduate work may obtain up to three course credits toward the completion of the total course requirement, the number being contingent on the extent and nature of the previous work and its fit with intended course of study at Yale.

Languages

All students must show proficiency in two languages relevant to the student's research interests and approved by the DGS. Over the years, our graduate students have demonstrated proficiency in a wide range of languages, including American Sign Language, Bulgarian, French, German, Hebrew, Italian, Japanese, Korean, Latin, Mandarin Chinese, Norwegian, Russian, Spanish, and Swedish.

Students may fulfill the requirement in a variety of ways, including demonstrated command of a native language other than English, graduation from an approved foreign university where teaching is conducted in a language other than English, passing an approved language course for credit, or passing a language test administered by the faculty or by one of Yale's language departments. Language tests are administered by their respective departments (such as German, Italian, French, East Asian Languages and Literatures). Students should consult the DGS for additional details and options for uncommon languages.

Yale offers classes in a variety of languages, from introductory to advanced levels, as well as special summer courses for targeted reading proficiency. There are also opportunities to study languages outside of Yale's curriculum, including funding for summer language study, and Directed Independent Language Study (DILS) for individuals who wish to study a language not offered by Yale. For more information on these programs and foreign language tutoring at Yale, please visit the Center for Language Study's website, http://cls.yale.edu.

Students may petition to substitute a specific research skill for one of their languages. Proposals require discussion of how the skill will be used in the student's research and a plan for positive demonstration of proficiency.

Second-Year Review

At the end of the academic year, the HSHM faculty will hold a special meeting to review each first- and second-year student in the program. The purpose of the meeting is to assess students' academic progress. In order for second years to proceed to the third year, they must demonstrate through written work, classroom performance, and participation in departmental activities that they have the ability to: (a) speak and write clearly; (b) conduct independent research at a high level; and (c) develop coherent scholarly arguments. A faculty vote will be taken at the conclusion of the review meeting to decide whether each second-year student may continue in the program. If a majority of faculty present and voting determine that a student may not continue, the student will be informed in writing and withdrawn from the program.

Qualifying Examination

Prior to beginning work on the dissertation, all students are expected to develop a broad general knowledge of the discipline. This knowledge will be acquired through a combination of course work, regular participation in HSHM colloquia and workshops, and dedicated preparation for the qualifying oral examination.

The qualifying examination has two main goals. First, it is a preparatory step toward the dissertation. Students will master the analytical vocabulary of the discipline and engage critically with key historiographic and theoretical questions. This will prepare them to select a research topic of scholarly significance and to articulate its import effectively. Second, the qualifying examination will prepare students for teaching. Students will learn to communicate a set of historical themes and narratives confidently and fluently.

Students will normally spend the summer following their second year preparing for the oral qualifying examination, which will be taken in the third year, preferably during the first half.

The qualifying examination will normally consist of four fields, each of which will be examined by a different faculty member: two fields in the history of science and/or history of medicine; one field in an area of history outside of medicine and/or science; and one field of special interest, the content and boundaries of which will be established in consultation with the student's adviser.

Possibilities for the field of special interest include a second field in history outside of history of science or medicine, a field with a scientific or medical focus (such as bioethics, health policy, public health, medical anthropology, or medical sociology), or a field at the intersection of science, medicine, and other subjects (such as law, national security, religion, culture, biotechnology, gender, race, literature, the environment, and so on).

The examination itself will be an oral exam, with each field examined for thirty minutes. Ahead of the exam students will also submit, for each field, a written syllabus for an undergraduate course. With approval, students may submit other written

materials instead of a syllabus; examples could include a teaching statement, the text of a fifty-minute undergraduate lecture, a review essay, or an exhibit proposal. In rare cases students may also propose alternatives to the oral component, given sufficiently compelling intellectual or career factors.

In preparation for the qualifying examination, the program's faculty work closely with students to facilitate the successful passage of the exam. A student who does fail the qualifying examination will be permitted to retake it. A student who fails a second time will be asked to withdraw from the program.

Advising

During their first term in the program, all students will be advised by the DGS. During the second term and thereafter, each student will be advised by a faculty member of the student's choosing. The adviser will provide guidance in selecting courses and preparing for the qualifying examination. The adviser may also offer help with the development of ideas for the dissertation, but students are free to choose someone else as the dissertation supervisor when the time comes to do so. Students are encouraged to discuss their interests and program of study with other members of the faculty.

Dissertation Prospectus

Students are encouraged to begin thinking about their dissertation topics during the second year. They are required to prepare a dissertation prospectus as soon as possible following the qualifying examination and to defend the prospectus orally before being admitted to full candidacy for the doctoral degree. The prospectus colloquium is typically held in the second term of the third year, with advancement to candidacy before the start of the fourth year.

For more information, please see the program's Guide to Prospectus and Prospectus Colloquium at https://hshm.yale.edu/sites/default/files/files/prospectus_guide.pdf.

Committee Constitution Requirement

Each Ph.D. student must have a dissertation committee in order to register for the fourth year of study. Students without an approved committee and dissertation adviser will normally be withdrawn from their program. The graduate school requires a committee of three, four, or five faculty members, at least two of whom must have an appointment in the graduate school, including the principal adviser. Others may come from beyond the graduate school or from beyond Yale, depending on the student's goals and the particulars of the project. HSHM committees will ordinarily include at least two HSHM faculty members.

Teaching

Teaching is an important part of the professional preparation of doctoral students in the History of Science and Medicine. Students are encouraged to participate in programs to develop their teaching skills, including the Certificate for College Teaching Preparation, which is a comprehensive training program designed to enhance proficiency in classroom instruction.

Typically, during the third and fourth years of study, students will work as teaching fellows, which usually means that they will lead small-group discussion sections for

undergraduate courses and grade their students' exams and papers. On occasion, however, students may work as teaching fellows in the second term of the second year, particularly if they have received course credit for previous graduate studies, or if they choose to defer the completion of their required coursework to the first semester of the third year. Students usually work as teaching fellows for courses in the History of Science and Medicine, but they may also have the opportunity to be teaching fellows in History or other departments.

At least two terms of teaching are required for doctoral students to graduate from the Program in the History of Science and Medicine; four terms are required for students on Yale-supported fellowships, although students may elect to substitute one or two of these terms with research assistantships at the Yale Center for British Art, the Yale University Art Gallery, or other sites across campus. For more information, please contact the Office of Financial Aid.

Chapter Conference and Dissertation Completion

In the fourth or fifth year, and preferably no later than the fall term of the fifth year, students are required to submit one chapter of the dissertation (not necessarily the first chapter) to the dissertation committee. The committee will then meet as a group with the student to discuss the chapter and the student's progress on the dissertation more generally. This conference is meant to be an extension of the conversation begun in the prospectus colloquium, with the aim of providing feedback on the student's research, argument, and style at this early stage of the dissertation writing process. No less than one month before students plan to submit their dissertations, a relatively polished full draft of the dissertation should be discussed with the student by the dissertation committee in a dissertation defense of one to two hours. This will give the students additional advice and counsel on completing the dissertation or on turning it into a book, as appropriate. Students are required to submit the draft to their committee in sufficient time for the committee to be able to read it. This defense is designed to give students advice on the overall arguments and the final shape of the dissertation or book and to leave time for adjustments coming out of the discussion.

Please also see GSAS Policies and Regulations.

M.D.-PH.D. AND J.D./PH.D. JOINT-DEGREE PROGRAMS

Students may pursue a doctorate in History of Science and Medicine jointly with a degree in Medicine or Law. Standard graduate financial support is provided for the doctoral phase of work toward such a joint degree. Candidates for the joint degree in Law must apply for admission to both the Law School and the graduate school. Information about the joint-degree program with Medicine can be obtained from the website of the Yale School of Medicine (http://medicine.yale.edu/mdphd) and from the website of the Section of the History of Medicine (http://medicine.yale.edu/histmed).

MASTER'S DEGREES

M.Phil. and M.A. (en route to the Ph.D.) Master's degrees are normally awarded to Ph.D. students as part of their advancement to candidacy.

Terminal M.A. For the terminal master's degree students must pass seven term courses, four of which must be in HSHM. Coursework will normally include at least two "Problems" graduate seminars and two additional graduate seminars in the History of Science and Medicine. The remaining courses are to be chosen in consultation with the DGS or a faculty adviser. Honors grades are required in two courses, with a High Pass average overall. Financial aid is not available for this M.A. program.

More information is available on the program's website, http://hshm.yale.edu.

COURSES

HSHM 5250a or b / HIST 5250a or b, Field Studies Staff
This course does not count toward the coursework requirements for the Ph.D. or M.A.
½ Course cr

HSHM 7010a / HIST 8931a, Problems in the History of Medicine and Public Health John Warner
An examination of the variety of approaches to the social and cultural history of medicine and public health. Readings are drawn from recent literature in the field, sampling writings on health care, illness experiences, and medical cultures in Asia, Latin America, Europe, and the United States from antiquity through the twenty-first century. Topics include the role of gender, class, ethnicity, race, religion, and region in the experience of sickness and healing; the intersection of lay and professional understandings of the body; and the role of the marketplace in shaping cultural authority, professional identities, and patient expectations.

HSHM 7020b / HIST 8911b, Problems in the History of Science Ayah Nuriddin
Surveys current methodologies through key theoretical and critical works. Students encounter major twentieth-century methodological moments that have left lasting imprints on the field: positivism and anti-positivism, the sociology of knowledge, actor-network theory, and historical epistemology, as well as newer approaches focusing on space, infrastructure, translation, and exchange. We also consider central conceptual problems for the field, such as the demarcation of science from pseudoscience; the definition of modernity and the narrative of the Scientific Revolution; vernacular science, the colonial archive, and non-textual sources.

HSHM 7100a / HIST 8910a, Problems in Science Studies Marco Ramos
Exploration of the methods and debates in the social studies of science, technology, and medicine. This course covers the history of the field and its current intellectual, social, and political positioning. It provides critical tools—including feminist, postcolonial, and new materialist perspectives—to address the relationships among science, technology, medicine, and society.

HSHM 7130a / HIST 8912a, Geography and History Bill Rankin
A research seminar focused on methodological questions of geography and geographic analysis in historical scholarship. We consider approaches ranging from the Annales School of the early twentieth century to contemporary research in environmental history, history of science, urban history, and more. We also explore interdisciplinary work in social theory, historical geography, and anthropology and grapple with the promise (and drawbacks) of GIS. Students may write their research papers on any time period or geographic region, and no previous experience with geography or GIS is necessary. Open to undergraduates with permission of the instructor.

HSHM 7160b / EMST 8160b / HIST 8942b, Early Modern Science and Medicine Paola Bertucci

The course focuses on recent works in the history of science and medicine in the early modern world. We discuss how interdisciplinary approaches—including economic and urban history, sociology and anthropology of science, gender studies, art and colonial history—have challenged the classic historiographical category of "the Scientific Revolution." We also discuss the avenues for research that new approaches to early modern science and medicine have opened up, placing special emphasis on the circulation of knowledge, practices of collecting, and visual and material culture.

HSHM 7360b / HIST 8932b / WGSS 7730b, Health Politics, Body Politics Naomi Rogers

A reading seminar on struggles to control, pathologize, and normalize human bodies, with a particular focus on science, medicine, and the state, both in North America and in a broader global health context. Topics include disease, race, and politics; repression and regulation of birth control; the politics of adoption; domestic and global population control; feminist health movements; and the pathologizing and identity politics of disabled people.

HSHM 7520a / HIST 8916a, Historicizing the Atmosphere Deborah Coen

Recent scholarship brings the atmosphere from the background to the foreground of history. Inspired in part by present-day problems of climate change, air pollution, airborne viruses, and police brutality, humanities scholars are teasing out the historical specificity of experiences of the atmosphere. A focus on the atmosphere allows historians to make connections between local, embodied practices and planetary processes. We explore ways to periodize the atmosphere's history, from its invention in the seventeenth century to its weaponization in the twentieth. While some scholars in the humanities are working in partnership with the natural sciences, others present their work as complements to or critiques of science. We consider how scientific and cultural analyses of the atmosphere can build on each other as well as the tensions between them. Authors include Leo Spitzer, Peter Sloterdijk, Shigehisa Kuriyama, Christina Sharpe, Timothy Choi, and Kimberly Bain. Students have the option of a creative final project or a historical research paper.

HSHM 7610b / AFAM 7152b / AMST 8867b / HIST 8902b, Researching and Writing Medicine, Health, and Empire Carolyn Roberts

This small graduate seminar is for students currently engaged in research and writing projects that touch on issues related to health, medicine, science, or the body in the context of slavery, colonialism, or neocolonialism. Students will explore their relationship to the craft of writing, their identity as "authors," the politics of the archive, the methodological and evidentiary challenges in their work, and tools that will level up their research organization and management skills. The course provides graduate students with a balance of support and independence as they further their research and writing projects. Graduate students in any discipline are warmly invited to participate in a compassion-based research community that prioritizes values of deep listening, presence, and care

HSHM 7691a and HSHM 7692b / ANTH 8897a and ANTH 8898b / HIST 5804a and HIST 5805b / HSAR 6841a and HSAR 6842b, Topics in the Environmental Humanities Paul Sabin

This is the required workshop for the Graduate Certificate in Environmental Humanities. The workshop meets six times per term to explore concepts, methods, and pedagogy in the environmental humanities, and to share student and faculty research. Each student pursuing the Graduate Certificate in Environmental Humanities must complete both a fall term and a spring term of the workshop, but the two terms of student participation need not be consecutive. The fall term each year emphasizes key concepts and major intellectual currents. The spring term each year emphasizes pedagogy, methods, and public practice. Specific topics vary each year. Students who have previously enrolled in the course may audit the course in a subsequent year. This course does not count toward the coursework requirement in history. Open only to students pursuing the Graduate Certificate in Environmental Humanities. ½ Course cr per term

HSHM 7710b / AFAM 7119b / HIST 8900b, Researching and Writing Histories of Health, Medicine, and Science Carolyn Roberts

This small graduate seminar is for students currently researching and writing histories of health, science, and medicine. Students learn about slow scholarship, the politics of the archive, and research organization and management and explore the craft of writing. Preference is given to graduate students in history, the history of science and medicine, and African American studies.

HSHM 7900a or b, HSHM Program Seminar Naomi Rogers

The HSHM Program Seminar helps students navigate the requirements of the Ph.D. program in HSHM, including but not limited to the prospectus, teaching, conference presentations, the "hidden curriculum," research and publication strategies, career planning, and other topics. Along with discussion of skills specific to HSHM, the course provides opportunities for students to practice these skills in a workshop format. Some sessions will include guest speakers on topics such as non-academic careers and the publishing world. The seminar is a requirement for students in their second and third years of the Ph.D. in HSHM and is an elective for students in other years. ½ Course cr

HSHM 7920a / AMST 6619a / ER&M 6520 / WGSS 6620a, Enduring Conditions: Chronic Illness, Disability, Care, and Access Kalindi Vora

This interdisciplinary course brings together scholarship on access and care that bridges concerns in the fields of disability studies and humanistic approaches to chronic illness. Scholarly texts are drawn from the fields of critical race and ethnic studies, gender and sexuality studies, anthropology and sociology of medicine, history, and feminist science and technology studies (fSTS). Seminar participants also engage with the arts and media as critical sites for understanding culture work bringing together knowledge in disability and chronic illness spaces. To embrace community-based research and knowledge sharing, the course features regular guest lectures from grassroots disability justice organizers and culture workers. The course is offered in a hybrid format. To consider what disability studies and work on chronic illness can build together, we explore the work of Moya Bailey, Aimi Hamraie, Jina B. Kim, Sami Schalk, Akemi Nishida, Ryan Cartwright, and Arthur Kleinman, among others. Permission of instructor is required. Undergraduates may also enroll with permission of instructor.

HSHM 9200a or b, Independent Reading Staff
By arrangement with faculty.

HSHM 9300a or b, Independent Research Staff
By arrangement with faculty.

HSHM 9970a or b / HIST 9997a or b, Pedagogy Seminar Staff
Faculty members instruct their Teaching Fellows on the pedagogical methods for teaching specific subject matter. o Course cr

Immunobiology

Anlyan Center (TAC) S625, 203.785.3857
http://immunobiology.yale.edu
M.S., M.Phil., Ph.D.

Chair
David Schatz

Director of Graduate Studies
Carla Rothlin (TAC 625A, 203.737.4679, carla.rothlin@yale.edu)

Professors Jeffrey Bender (*Internal Medicine*), Marcus Bosenberg (*Dermatology*), Lieping Chen, Joseph Craft (*Internal Medicine*), Peter Cresswell, Vishwa Dixit (*Comparative Medicine*), Richard Flavell, David Hafler (*Neurology*), Kevan Herold, Andres Hildago, Akiko Iwasaki, Paula Kavathas (*Laboratory Medicine*), Steven Kleinstein (*Pathology*), John MacMicking (*Microbial Pathogenesis*), Ruslan Medzhitov, Markus Müschen (*Hematology*), Jordan Pober, Carla Rothlin, Craig Roy (*Microbial Pathogenesis*), Lauren Sansing (*Neurology*), David Schatz, John Tsang

Associate Professors Ellen Foxman (*Laboratory Medicine*), Ann Haberman, Daniel Jane-Wit (*Internal Medicine*), Nikhil Joshi, Liza Konnikova (*Medicine*), Carrie Lucas, Kevin O'Connor (*Neurology*), Noah Palm, João Pereira, Andrew Wang (*Rheumatology*), Craig Wilen (*Laboratory Medicine*)

Assistant Professors Etienne Caron, Grace Chen, Wei Hu, Jeffrey Ishizuka (*Medical Oncology*), Carolina Lucas, David Martinez, Andrew James Martins

FIELDS OF STUDY

Immunology is the study of the immune system that confers protection against infectious diseases. This complex system is also involved in the rejection of grafted tissues, in allergy, and in autoimmunity. The Department of Immunobiology is a multidisciplinary group of investigators committed to understanding the cellular, genetic, and molecular basis of these processes. The department is based on the understanding that the solution to complex biological problems requires the integration of individuals with a common goal but differing expertise. Research focuses on the molecular, cellular, and genetic underpinnings of immune system function and development, on host-pathogen interactions, and on a variety of autoimmune disorders. In addition to the growing need to apply basic science research toward human disease, we have developed a Human and Translational Immunology (HTI) section to improve our understanding and treatment of human immunological disorders. The general research interests of the Immunology track span almost all aspects of the immune system and its role in disease prevention.

RESEARCH AREAS

Fundamental Mechanisms of Immunity Research in the department examines the fundamentals of the immune system at multiple levels: development, activation, regulation, and evolution. Studies of lymphocyte and innate immune cell development examine the receptors and signals that control lineage commitment, cell maturation, and cell death; the establishment of the proper environments for cellular development; and the mechanisms by which antibody and T cell receptor genes are assembled and

diversified. A critical first step in an effective immune response is the activation of cells of the innate immune system, including monocytes, macrophages, dendritic cells, and neutrophils. Research examines the receptors and signaling molecules that control these processes, the mechanism by which cells process and present antigen, and the recognition of this antigen by T cell receptors on T lymphocytes. Upon activation, T and B cells differentiate and acquire critical effector functions including the production of cytotoxic anti-pathogen molecules and antibodies. Studies in the department examine the tissue spatial context and cellular interactions that influence effector lineage fate decisions, cytoplasmic signal transduction molecules, nuclear transcription factors, and mechanisms controlling gene expression during differentiation. Finally, resolution of the immune response (leading to scarring or healing) and the evolution of adaptive immunity are under study.

The Human Immune System The immune system has evolved to deal with many different challenges, some of which can vary widely among vertebrate species, and thus while many basic mechanisms may be shared between humans and various animal models, the human immune system has evolved to differ in important ways from that of commonly used experimental rodents. Furthermore, human diseases, especially chronic disorders, are also significantly more complex than commonly used disease models, and the approaches to studying human immunity, for ethical reasons, must often be fundamentally different from those used in experimental systems. New immunotherapies, especially those based on the use of biologicals, have created an opportunity to ethically investigate human immunology and improve the value of clinical trials. The Human and Translational Immunology (HTI) section of the Immunobiology department studies both the immune systems of healthy individuals and the roles that immunology plays in a variety of human disease and analyzes the alterations that therapies may have on the immune response. HTI investigators also develop new approaches for human investigation and create new experimental models that better replicate human immunity.

Immunology of Cancer The past several years have witnessed a revolution in cancer treatment based on the paradigm of activating a patient's own immune system to target their cancer. Cancer immunotherapy relies on the immune system's ability to not only recognize "non-self," but "altered self," detecting the remarkably subtle differences between cancer cells and healthy tissues. Moreover, many therapies rely on preexisting immune cells in the tumor microenvironment for efficacy, highlighting the potential of natural immunosurveillance mechanisms to destroy cancer. In close collaboration with the Yale Cancer Center, ongoing work in the Department of Immunobiology focuses on seeking to understand the basic mechanisms of how innate and adaptive immune responses are generated against tumors, how tumor clearance is achieved, and how the immune system can be manipulated to enhance immunotherapy.

Disorders of the Immune System Adaptive immune responses provide powerful long-lived protection from pathogens, but when misdirected, T and B cell responses can cause significant injury and disease. The mechanisms controlling inappropriate adaptive immunity to self-targets/autoantigens (autoimmunity), allergens (allergy), or transplanted tissues (alloimmunity) are being addressed by faculty in our department. Diabetes, multiple sclerosis, lupus, and rheumatoid arthritis are just some of the autoimmune diseases under study. Why and how allergens are targeted by the immune system in diseases like food allergy and asthma are questions being actively studied.

Vascular graft and red blood cell rejection are examples of alloimmune responses under investigation in our department.

Host-Microbe Interactions The immune system evolved to manage our constant exposure to diverse microbial stimuli, ranging from the smallest viruses to fifty-foot-long tapeworms. Researchers in the Department of Immunobiology investigate the full spectrum of possible host-microbe interactions, including antagonistic interactions with parasitic viruses, bacteria, and helminths, as well as mutualistic interactions with the trillions of microbes that live in and on us (our microbiota).

Inflammation Biology Inflammation is a protective response including infection and injury as well as other causes of loss of tissue homeostasis. Although primarily orchestrated by the immune system, the inflammatory response can affect virtually any physiological process, from cardiovascular and digestive functions to growth, reproduction, and behavior. However, because inflammation operates at the expense of some normal physiological processes, it can also be a source of a variety of pathological sequela. Indeed, most human diseases are now known to be associated with inflammation. Research in our department addresses multiple aspects of inflammation biology, ranging from detailed molecular mechanisms underlying the response, to human diseases.

Computational Immunology Computational immunology (or systems immunology) involves the development and application of bioinformatics methods, mathematical models, and statistical techniques for the study of immune system biology. The immune system is composed of dozens of different cell types and hundreds of intersecting molecular pathways and signals. Systems approaches can be used to predict how the immune system will respond to a particular infection or vaccination. Or it can help understand how best to design an immunotherapy: will it help ease disease, and what might the side effects be? In addition, computational approaches are increasingly vital to understanding the implications of the wealth of gene expression and epigenomics data being gathered from immune cells. Yale has a diverse research program in computational immunology that brings together expertise from a variety of scientific disciplines to bear on research projects in vaccine response, host-pathogen dynamics, cell-fate choices, immune genomics, informatics, and many other topics. Students interested in computational immunology can be co-mentored by faculty from the Immunology track and the Computational Biology and Bioinformatics tracks.

FACILITIES

More than forty laboratories are actively involved in research in immunology. Many share adjoining or nearby laboratory space in the Anlyan Center (TAC) and include faculty who are funded by the Howard Hughes Medical Institute. The Department of Immunobiology provides one of the largest integrated training programs in immunology in the country, led by a faculty with a reputation for excellence in research. The department maintains a wide variety of major equipment. In addition, investigators have access to a wide variety of cutting-edge equipment on campus in open-access core facilities for flow cytometry, mass cytometry, EM, and imaging including light-sheet microscopy and intravital two-photon LSM.

PROGRAM ENTRY

Most students enter the Immunobiology graduate program through the Immunology track of the interdepartmental graduate program in Biological and Biomedical Sciences (BBS), http://bbs.yale.edu. Other types of students enter from the M.D./Ph.D. program (see below), the MRSP (see below), or another BBS track, with approval of the Immunobiology director of graduate studies (DGS) and the faculty adviser.

The faculty and students of the BBS program are organized into interest-based tracks. Immunology, being one of eight tracks, encourages individualized attention to maximize scientific interactions. There is complete freedom to work with any of the 350 faculty members affiliated within any of the tracks and to take courses offered by any of the BBS departments or programs. Students are encouraged to supplement core courses in molecular and cellular immunology with additional courses selected from the wide range available in cell biology, molecular biology, developmental biology, biochemistry, genetics, pharmacology, molecular medicine, neuroscience, and bioinformatics. Research seminars and informal interactions with other graduate students, postdoctoral fellows, and faculty also form an important part of graduate education.

The Section of Human and Translational Immunology (HTI) is a component of the Immunobiology department and is located at 10 Amistad Street and 300 George Street. Its mission is to accelerate the application of new developments in the field of immunology to the treatment of human diseases. HTI faculty study the immunologic aspects of a very broad range of human diseases, encompassing investigations in the fields of cancer; transplantation of solid organs and stem cells; autoimmune diseases; and neurologic disease.

The Medical Research Scholars Program (MRSP) is open to students who have already been accepted into the BBS program. A separate application is also required, and is to be submitted to the BBS. A total of eight students each year (four first-years and four second-years) will be enrolled as Medical Research Scholars. They remain in their BBS tracks or departments but participate in the additional MRSP curriculum. The program bridges barriers between traditional predoctoral and medical training by providing Yale Ph.D. students with both medically oriented course work and a mentored clinical experience. This combination of medical knowledge and face-to-face interaction with patients and their doctors provides a new perspective to Ph.D. students and enhances the rigorous training in basic science already provided.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Students are required to take six courses for a grade in the graduate school.

Required graded courses for first- and second-year students are:

1. IBIO 5300, Biology of the Immune System (Students have the option of passing out of IBIO 5300 by taking the final exam from the previous year.)
2. IBIO 5310, Advanced Immunology
3. Two Immunobiology seminar courses taken from this series: IBIO 5320, IBIO 5360, IBIO 5370, IBIO 5380, IBIO 5390 (The second seminar course can be audited if a student has grades in six other science courses and has already taken one seminar course for credit.)

Required credit-only, nongraded courses for first-year students are:

1. IBIO 6000, Introduction to Research (Immunology-track first years only)
2. IBIO 6110, IBIO 6120, IBIO 6130, Research Rotations (short research projects are taken under the guidance of three Yale professors) (Immunology-track first years only)
3. IBIO 6010, Fundamentals of Research: Responsible Conduct of Research

Fourth-year students are required to take IBIO 5503, a refresher training course in the responsible conduct of research.

Additional courses are determined based on the individual needs of the student, and include courses in biochemistry, cell biology, genetics, molecular biology of prokaryotes, molecular biology of eukaryotes, animal viruses, the structure of nucleic acids and proteins, microbiology, and disease mechanisms. Students choose courses after consulting the DGS and the thesis adviser.

Honors The graduate school uses grades of Honors, High Pass, Pass, or Fail. Students are required to earn a grade of Honors in at least two courses in the first two years, and are expected to maintain a High Pass average. There is no foreign language requirement.

Teaching Students are required to serve as a science TA (teaching assistant) for two terms before the end of their sixth term. Teaching protocol and rules are as follows:

1. Teaching two term-long science courses is required as a fulfillment of the Ph.D.
2. First-year students do not teach.
3. Teaching opportunities are first given to students who need teaching credit.
4. Teaching for additional income is available when openings exist after those selected for credit are hired; approval signatures from the adviser and DGS are required.
5. The maximum teaching allowed is one course per term.

A one-day seminar entitled "Teaching at Yale" is offered by the Yale Poorvu Center for Teaching and Learning at the start of each term. Attending this seminar is recommended prior to teaching.

Prospectus and Qualifying Exam In the second year, early in the fourth term, or in certain circumstances, in the third term, students make a thirty-minute presentation to their Prospectus Committee of their proposed research and initial results. The committee assigns four or five broad areas of biology and immunology that are of particular relevance to the proposed research and on which the student will be examined in the qualifying exam. During the next several weeks, students prepare a formal research proposal (in NIH grant format) concerning the proposed thesis research and study for the exam. The exam is held within two months. It is an oral exam covering all aspects of immunology generally, with a focus on the assigned areas mentioned above. The student is questioned on aspects of the thesis proposal.

Admission to Candidacy Requirements for admission to candidacy, which usually takes place after six terms of residence, are: completion of course requirements, one of the two teaching requirements, the qualifying exam, and the third-year committee meeting—at the one year anniversary of the qualifying exam—with a signed

certification form from the adviser and committee members verifying that the student has made good progress.

Progress in thesis research in the third and later years is monitored carefully by the student's thesis committee (composed of the adviser and three or four other faculty). See below.

REQUIREMENTS FOR M.D.-PH.D. STUDENTS MAJORING IN IMMUNOBIOLOGY

Six courses for a grade. Out of the six courses the following are mandatory:

1. IBIO 5300, Biology of the Immune System (Students have the option of passing out of IBIO 5300 by taking the final exam from the previous year.)
2. IBIO 5310, Advanced Immunology
3. Two Immunobiology seminar courses taken from this series: IBIO 5320, IBIO 5360, IBIO 5370, IBIO 5380, IBIO 5390 (The second seminar course can be audited if a student has grades in six other courses and has already taken one seminar course for credit.)

Two grades of Honors: Yale University graduate courses taken for a grade at the School of Medicine may be counted toward the Honors fulfillment and the six total required courses. Verification must be provided to the DGS.

One term of teaching: Previously taught courses in the School of Medicine may count toward this requirement. To request credit for previous teaching experience, a note from the course director describing the teaching experience (duration of the teaching experience, frequency of class meetings, number of students taught, materials covered, dates, and for whom) should be provided to the Immunobiology DGS.

Responsible Conduct of Research, Refresher Course: Fourth-year students are required to take a refresher training course in the responsible conduct of research. M.D.-Ph.D. students can fulfill this NIH requirement through Immunobiology (IBIO 5503) or through the M.D.-Ph.D. program.

Annual thesis committee meetings: Each student is required to have a thesis committee meeting at least every twelve months, and more frequently if the student or committee feels that it would be appropriate or helpful. The thesis supervisor (the student's PI) then submits a thesis committee report form to the DGS summarizing the student's progress.

M.D.-Ph.D. students are *not* required to take:

1. IBIO 6000, Introduction to Research
2. IBIO 6110, IBIO 6120, IBIO 6130, Research Rotations
3. IBIO 6010, Fundamentals of Research: Responsible Conduct of Research. A note from the DGS of the M.D.-Ph.D. program must be forwarded to the Immunobiology DGS stating that the student has taken a course in Research Conduct and Ethics, or its equivalent in the School of Medicine. *Include dates, titles, and faculty*. If the student has not taken this course, then registration in this class is required.

MASTER'S DEGREES

M.Phil. A student is entitled to the M.Phil. degree once all academic and prospectus requirements, and one of the two teaching requirements, have been met. Also required is a third-year committee meeting at which the members sign an approval form stating that the student is making good progress toward the student's research.

M.S. Students who withdraw from the Ph.D. program may be eligible to receive the M.S. degree if they have met the requirements and have not already received the M.Phil. degree. For the M.S., students must successfully complete at least one year of resident graduate study at Yale with the quality of work judged satisfactory by the Department of Immunobiology faculty, as well as ten courses with an average grade of High Pass.

For additional information on the Program in Biological and Biomedical Sciences see http://bbs.yale.edu.

COURSES

For a complete listing of immunology-related courses, https://medicine.yale.edu/immuno/graduate-program/curriculum/

IBIO 5300a / MBIO 530 / MCDB 5300a, Biology of the Immune System Nikhil Joshi and Grace Chen

The development of the immune system. Cellular and molecular mechanisms of immune recognition. Effector responses against pathogens. Immunologic memory and vaccines. Human diseases including allergy, autoimmunity, cancer, immunodeficiency, HIV/AIDS.

IBIO 5360a, Immunobiology Seminar: Translational Immunology Kevin O'Connor and Esen Sefik

This course is designed to introduce immunobiology Ph.D. students to translational research and medicine. Each weekly seminar focuses on a specific disease with a significant immunological component. In-class sessions consist of highly interactive, didactic sections covering patient experiences, disease phenotypes, underlying immunobiology and pathology, and mechanisms of treatment approaches, including their limitations. Considerable student participation is required. Students are required to read and critically review assigned reading related to the weekly seminar topics. They discuss these papers in class, evaluating the methodologies, results, and conclusions, and identifying gaps in knowledge and potential areas for further research. Discussions are led by principal investigators specializing in human translational immunology, with particular input from clinician-scientists who treat patients in associated clinics. Students are presented with real-world case studies that illustrate the complexities and challenges of translational research and clinical practice. Examples of topics include: T and B cell contributions to the underlying pathophysiology of multiple sclerosis, type 1 diabetes, systemic lupus erythematosus, myasthenia gravis, other autoimmune diseases, early-life immunity, immune responses to acute brain injury, inherited immune disorders, paradigms governing how anti-tumor immune responses are promoted or suppressed, current approaches in immunotherapy-based clinical trials, and immune responses to infection and vaccination. To promote critical thinking and the identification of new challenges and scientific questions in translational immunology, students are given weekly assignments. These assignments challenge students to think

creatively about solutions to problems that hinder progress in understanding disease mechanisms and developing therapeutics. A term assignment, in the form of a research proposal, focuses on an independent study of a translational immunobiology problem chosen by each student. This assignment must differ from their thesis research. The combination of medical knowledge and interaction with translational and clinician-scientists provides a new perspective for IBIO Ph.D. students, broadening their basic science training. Exposure to the practice of medicine enables immunobiology (and other) graduate students to work more confidently at the interface of research and medicine, fostering collaborations with clinical investigators. Prerequisites: IBIO 5310 or a similar introductory course that provides a solid foundation in fundamental immunology is strongly recommended. This prerequisite is waived for highly motivated students.

IBIO 6000a, Introduction to Research: Faculty Research Presentations Carla Rothlin
Introduction to the research interests of the faculty. Required of all first-year Immunology/BBS students. Pass/Fail.

IBIO 6110a, Research Rotation 1 Carla Rothlin
Intensive experience in the design and execution of experiments in immunology or other areas of biology. Students design a focused research project in consultation with a faculty mentor and execute the designed experiments in the mentor's laboratory. Students are expected to read relevant background papers from the literature, design and perform experiments, interpret the resulting data, and propose follow-up experiments. Students are also expected to attend the mentor's weekly lab meeting(s) as well as weekly Immunobiology departmental seminars and Research in Progress seminars. The course concludes with the student giving a brief presentation of the work performed at Rotation Talks, attended by other first-year immunology-track graduate students. Evaluation is by the mentor; students also evaluate the rotation experience. Students must turn in a prioritized list of four possible mentors to the office of the DGS at least one week prior to the beginning of the course. Mentors are assigned by the DGS. Graded Satisfactory/Unsatisfactory. Minimum of twenty hours per week. Required of all first-year Immunology/BBS students.

IBIO 6120a, Research Rotation 2 Carla Rothlin
Intensive experience in the design and execution of experiments in immunology or other areas of biology. Students design a focused research project in consultation with a faculty mentor and execute the designed experiments in the mentor's laboratory. Students are expected to read relevant background papers from the literature, design and perform experiments, interpret the resulting data, and propose follow-up experiments. Students are also expected to attend the mentor's weekly lab meeting(s) as well as weekly Immunobiology departmental seminars and Research in Progress seminars. The course concludes with the student giving a brief presentation of the work performed at Rotation Talks, attended by other first-year immunology-track graduate students. Evaluation is by the mentor; students also evaluate the rotation experience. Students must turn in a prioritized list of four possible mentors to Barbara Cotton in the office of the director of graduate studies at least one week prior to the beginning of the course. Mentors are assigned by the DGS. Graded Pass/Fail. 1 course credit; minimum of 20 hours/week. Required of all first-year Immunology/BBS students.

Interdepartmental Neuroscience Program

Hope Memorial Building 212, 203.785.5932
http://medicine.yale.edu/inp
M.S., M.Phil., Ph.D.

Director of Graduate Studies
Marina Picciotto (*Psychiatry*; *Pharmacology*; *Neuroscience*)
marina.picciotto@yale.edu

Professors Amy Arnsten (*Neuroscience*; *Psychology*), Anton Bennett (*Pharmacology*; *Comparative Medicine*), Hilary Blumberg (*Psychiatry*; *Child Study Center*; *Radiology and Biomedical Imaging*), Hal Blumenfeld (*Neurology*; *Neuroscience*; *Neurosurgery*), Angélique Bordey (*Neurosurgery*; *Cellular and Molecular Physiology*), Kristen Brennand (*Psychiatry*; *Genetics*), Tyrone Cannon (*Psychology*; *Psychiatry*), Jessica Cardin (*Neuroscience*), John Carlson (*Molecular, Cellular, and Developmental Biology*), Sreeganga Chandra (*Neurology*; *Neuroscience*), Marvin Chun (*Psychology*; *Neuroscience*), Lawrence Cohen (*Cellular and Molecular Physiology*), Daniel Colón-Ramos (*Cell Biology*; *Neuroscience*), R. Todd Constable (*Radiology and Biomedical Imaging*; *Neurosurgery*), Kelly Cosgrove (*Psychiatry*; *Radiology and Biomedical Imaging*; *Neuroscience*), Michael Crair (*Neuroscience*; *Ophthalmology and Visual Science*), Pietro De Camilli (*Cell Biology*; *Neuroscience*), Jonathan Demb (*Ophthalmology and Visual Science*; *Cellular and Molecular Physiology*), Ralph DiLeone (*Psychiatry*; *Neuroscience*), Barbara Ehrlich (*Pharmacology*; *Cellular and Molecular Physiology*), Thierry Emonet (*Molecular, Cellular, and Developmental Biology*; *Physics*), Paul Forscher (*Molecular, Cellular, and Developmental Biology*), Elena Gracheva (*Cellular and Molecular Physiology*; *Neuroscience*), Charles Greer (*Neurosurgery*; *Neuroscience*), Jeffrey Gruen (*Pediatrics*; *Genetics*), Jaime Grutzendler (*Neurology*; *Neuroscience*), Murat Gunel (*Neurosurgery*; *Genetics*; *Neuroscience*), David Hafler (*Neurology*; *Immunobiology*), Joy Hirsch (*Psychiatry*; *Comparative Medicine*; *Neuroscience*), Tamas Horvath (*Comparative Medicine*; *Neuroscience*; *Obstetrics, Gynecology, and Reproductive Sciences*), Arthur Horwich (*Genetics*; *Pediatrics*), Jonathon Howard (*Molecular Biophysics and Biochemistry*; *Physics*), Fahmeed Hyder (*Radiology and Biomedical Imaging*; *Biomedical Engineering*), Yong-Hui Jiang (*Genetics*), Elizabeth Jonas (*Internal Medicine*; *Neuroscience*), Leonard Kaczmarek (*Pharmacology*; *Cellular and Molecular Physiology*), Haig Keshishian (*Molecular, Cellular, and Developmental Biology*), Jeffery Kocsis (*Neurology*; *Neuroscience*), Michael Koelle (*Molecular Biophysics and Biochemistry*), Anthony Koleske (*Molecular Biophysics and Biochemistry*; *Neuroscience*), John Krystal (*Psychiatry*; *Neuroscience*), Robert LaMotte (*Anesthesiology*; *Neuroscience*), Chiang-shan Ray Li (*Psychiatry*; *Neuroscience*), Angeliki Louvi (*Neurosurgery*; *Neuroscience*), Gregory McCarthy (*Psychology*), James McPartland (*Child Study Center*; *Psychology*), Mark Mooseker (*Molecular, Cellular, and Developmental Biology*; *Cell Biology*), Evan Morris (*Radiology and Biomedical Imaging*; *Biomedical Engineering*; *Psychiatry*), Angus Nairn (*Psychiatry*; *Pharmacology*), Michael Nitabach (*Cellular and Molecular Physiology*; *Genetics*), Vincent Pieribone (*Cellular and Molecular Physiology*; *Neuroscience*), Christopher Pittenger (*Psychiatry*; *Child Study Center*), Marc Potenza (*Psychiatry*; *Child Study Center*; *Neuroscience*), Pasko Rakic (*Neuroscience*; *Neurology*), Carla Rothlin (*Immunobiology*; *Pharmacology*), Gary Rudnick (*Pharmacology*), W. Mark Saltzman (*Biomedical Engineering*; *Cellular and Molecular Physiology*; *Chemical and Environmental Engineering*),

Laurie Santos (*Psychology*), Joseph Santos-Sacchi (*Surgery*; *Cellular and Molecular Physiology*; *Neuroscience*), Nenad Sestan (*Neuroscience*; *Comparative Medicine*; *Genetics*; *Psychiatry*), Fred Sigworth (*Cellular and Molecular Physiology*; *Biomedical Engineering*), Dana Small (*Psychiatry*; *Psychology*), Stephen Strittmatter (*Neurology*; *Neuroscience*), Jane Taylor (*Psychiatry*; *Psychology*), Susumu Tomita (*Cellular and Molecular Physiology*; *Neuroscience*), Nicholas Turk-Browne (*Psychology*), Flora Vaccarino (*Child Study Center*; *Neuroscience*), Christopher van Dyck (*Psychiatry*; *Neuroscience*; *Neurology*), Stephen Waxman (*Neurology*; *Pharmacology*; *Neuroscience*), David Zenisek (*Cellular and Molecular Physiology*; *Ophthalmology and Visual Science*), Z. Jimmy Zhou (*Ophthalmology and Visual Science*; *Cellular and Molecular Physiology*; *Neuroscience*), Steven Zucker (*Computer Science*; *Biomedical Engineering*)

Associate Professors Nii Addy (*Psychiatry*; *Cellular and Molecular Physiology*), Meenakshi Alreja (*Psychiatry*; *Neuroscience*), Alan Anticevic (*Psychiatry*; *Psychology*), Sviatoslav Bagriantsev (*Cellular and Molecular Physiology*), Abhishek Bhattacharjee (*Computer Science*), Thomas Biederer (*Neurology*; *Neuroscience*), William Cafferty (*Neurology*; *Neuroscience*), Rui Chang (*Cellular and Molecular Physiology*; *Neuroscience*), Steve Chang (*Psychology*; *Neuroscience*), Damon Clark (*Molecular, Cellular, and Developmental Biology*; *Physics*), Philip Corlett (*Psychiatry*; *Psychology*), Marcelo de Oliveira Dietrich (*Comparative Medicine*; *Neuroscience*), George Dragoi (*Psychiatry*; *Neuroscience*), Tore Eid (*Laboratory Medicine*; *Neurosurgery*), Irina Esterlis (*Psychiatry*; *Psychology*), Sourav Ghosh (*Neurology*; *Pharmacology*), Pallavi Gopal (*Pathology*), Junjie Guo (*Neuroscience*), Marc Hammarlund (*Genetics*; *Neuroscience*), Michelle Hampson (*Radiology and Biomedical Imaging*; *Psychiatry*; *Child Study Center*), Michael Higley (*Neuroscience*), Avram Holmes (*Psychology*), Erdem Karatekin (*Cellular and Molecular Physiology*; *Molecular Biophysics and Biochemistry*), In-Jung Kim (*Ophthalmology and Visual Science*; *Neuroscience*), Hedy Kober (*Psychiatry*; *Psychology*), Smita Krishnaswamy (*Genetics*; *Computer Science*), Ifat Levy (*Comparative Medicine*; *Psychology*; *Neuroscience*), Janghoo Lim (*Genetics*; *Neuroscience*), John Murray (*Psychiatry*; *Neuroscience; Physics*), Dhasakumar Navaratnam (*Neurology*; *Neuroscience*), Timothy Newhouse (*Chemistry*), In-Hyun Park (*Genetics*), Maria Piñango (*Linguistics*), Helena Rutherford (*Child Study Center*; *Psychology*), Dustin Scheinost (*Radiology and Biomedical Imaging*; *Child Study Center*; *Statistics and Data Science*), Justus Verhagen (*Neuroscience*), Shaul Yogev (*Neuroscience*), Weimin Zhong (*Molecular, Cellular, and Developmental Biology*), Jiangbing Zhou (*Neurosurgery*; *Biomedical Engineering*)

Assistant Professors Moitrayee Bhattacharyya (*Pharmacology*), Joel Butterwick (*Pharmacology*), Alicia Che (*Psychiatry*), Youngsun Cho (*Psychiatry*; *Child Study Center*), Eyiyemisi Damisah (*Neurosurgery*; *Neuroscience*), Carolyn Fredericks (*Neurology*), Dylan Gee (*Psychology*), Jason Gerrard (*Neurosurgery*; *Neuroscience*), Matthew Girgenti (*Psychiatry*), Elizabeth Goldfarb (*Psychiatry*; *Psychology*), Abha Gupta (*Pediatrics*; *Neuroscience*), Brian Hafler (*Ophthalmology and Visual Science*; *Pathology*), Ellen Hoffman (*Child Study Center*; *Neuroscience*), Monika Jadi (*Psychiatry*; *Neuroscience*), James Jeanne (*Neuroscience*), Al Kaye (*Psychiatry*), Liang Liang (*Neuroscience*), Samuel McDougle (*Psychology*), Anirvan Nandy (*Neuroscience*), Michael O'Donnell (*Molecular, Cellular, and Developmental Biology*), Candie Paulsen (*Molecular Biophysics and Biochemistry*), Albert Powers (*Psychiatry*; *Psychology*), Hyojung Seo (*Psychiatry*; *Neuroscience*), David van Dijk (*Internal Medicine*; *Computer Science*), Ilker Yildirim (*Psychology*)

FIELDS OF STUDY

The Interdepartmental Neuroscience Program (INP) offers flexible but structured interdisciplinary training for independent research and teaching in neuroscience. The goal of the program is to ensure that degree candidates obtain a solid understanding of cellular and molecular neurobiology, physiology and biophysics, neural development, systems and behavior, and neural computation. In addition to coursework, graduate students participate in student research talks, as well as mentoring and outreach activities.

To enter the Interdepartmental Neuroscience Ph.D. program, students apply to the Neuroscience track within the Biological and Biomedical Sciences (BBS), https://medicine.yale.edu/bbs.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Each entering student is assigned a pre-thesis faculty adviser who is responsible for establishing the student's initial course of study and for monitoring the student's progress. This adviser will subsequently be modified to a faculty committee with expertise in the student's emerging area of interest.

Although each student's precise course requirements are set individually to take account of background and educational goals, the course of study is based on a model curriculum beginning with four core required courses: Bioethics in Neuroscience (INP 5580), Principles of Neuroscience (INP 5701), Foundations of Cellular and Molecular Neurobiology (INP 5702), and Foundations of Systems Neuroscience (INP 5703), all completed in the first year of enrollment.

During the second or third year of enrollment, students are required to take one course on quantitative techniques (including, but not limited to, INP 7560, PSYC 2100, PSYC 5580, INP 7562, INP 7575, INP 7599, PSYC 2610) as well as one elective course selected from a broad set of neuroscience-related courses. Collectively, these courses are designed to ensure broad competence in modern neuroscience.

Additional degree requirements are successful completion of both terms of Lab Rotations for First-Year Students (INP 6511, INP 6512), which includes rotating in at least three labs; both terms of Second-Year Thesis Research (INP 6513, INP 6514); and RCR Bioethics Refresher course (INP 5503) completed during the fourth year of enrollment.

The graduate school uses grades of Honors, High Pass, Pass, and Fail and requires two course grades of Honors during the first two years of study. Students are expected to maintain at least a High Pass average.

In accordance with the expectations of the BBS program, Ph.D. students are also expected to participate in two terms (or the equivalent) of teaching.

Admission to candidacy requires passing a qualifying examination, normally given during the second year, and submission of a dissertation prospectus (NIH NRSA grant format) before the end of the third year. After admission to candidacy, thesis committee meetings are required at six-month intervals.

Also required for graduation are the completion and satisfactory defense of the thesis.

Requirements for M.D.-Ph.D. students are the same as for Ph.D. students with the following differences: one term as a Teaching Fellow; two laboratory rotations while in the medical school prior to degree-program track affiliation; and three courses (Principles of Neuroscience, INP 5701; Structural and Functional Organization of the Human Nervous System, INP 9510; one elective graduate-level course).

MASTER'S DEGREES

M.Phil. See Degree Requirements under Policies and Regulations.

M.S. Awarded only to students who are not continuing for the Ph.D. degree, but have successfully completed all of the requirements other than the thesis prospectus and defense. This includes a passing grade in the required and elective courses, a minimum of two Honors grades, passing a qualifying examination, and successful completion of both terms of Lab Rotation for First-Year Students (INP 6511, INP 6512) and both terms of Second-Year Thesis Research (INP 6513, INP 6514). Students are not admitted for this degree. Students who are eligible for or who have already received the M.Phil. will not be awarded the M.S.

Program information is available at http://medicine.yale.edu/inp.

COURSES

INP 562b / AMTH 765b / CB&B 5620b / ENAS 5620b / INP 7562b / MB&B 5620b / PHYS 5620b, Modeling Biological Systems II Thierry Emonet, Jing Yan, and Damon Clark

This course covers advanced topics in computational biology. How do cells compute, how do they count and tell time, how do they oscillate and generate spatial patterns? Topics include time-dependent dynamics in regulatory, signal-transduction, and neuronal networks; fluctuations, growth, and form; mechanics of cell shape and motion; spatially heterogeneous processes; diffusion. This year, the course spends roughly half its time on mechanical systems at the cellular and tissue level, and half on models of neurons and neural systems in computational neuroscience. Prerequisite: a 200-level biology course or permission of the instructor.

INP 5701a, Principles of Neuroscience William Cafferty, Ifat Levy, and Junjie Guo

General neuroscience seminar: lectures, readings, and discussion of selected topics in neuroscience. Emphasis is on how approaches at the molecular, cellular, physiological, and organismal levels can lead to understanding of neuronal and brain function.

INP 5702a, Foundations of Cellular and Molecular Neurobiology Shaul Yogev and James Jeanne

A comprehensive overview of cellular and molecular concepts in neuroscience. Each exam (of three) covers one-third of the course (cell biology, electrophysiology, and synaptic function) and is take-home, with short answer/essay questions.

INP 6511a, Lab Rotations for First-Year Students Marina Picciotto

Required of all first-year neuroscience-track graduate students. Rotation period is one term. Grading is Satisfactory/Unsatisfactory.

INP 6513a, Second-Year Thesis Research Marina Picciotto

Required of all second-year INP graduate students. Grading is Satisfactory/Unsatisfactory.

INP 6519a, Tutorial Marina Picciotto
By arrangement with faculty and approval of DGS.

INP 7562b / AMTH 765b / CB&B 5620b / ENAS 5620b / INP 562b / MB&B 5620b / PHYS 5620b, Modeling Biological Systems II Thierry Emonet, Jing Yan, and Damon Clark
This course covers advanced topics in computational biology. How do cells compute, how do they count and tell time, how do they oscillate and generate spatial patterns? Topics include time-dependent dynamics in regulatory, signal-transduction, and neuronal networks; fluctuations, growth, and form; mechanics of cell shape and motion; spatially heterogeneous processes; diffusion. This year, the course spends roughly half its time on mechanical systems at the cellular and tissue level, and half on models of neurons and neural systems in computational neuroscience. Prerequisite: a 200-level biology course or permission of the instructor.

INP 7575a / CPSC 5750a / ECE 5750a, Computational Vision and Biological Perception Steven Zucker
An overview of computational vision with a biological emphasis. Suitable as an introduction to biological perception for computer science and engineering students, as well as an introduction to computational vision for mathematics, psychology, and physiology students.

INP 9510a, Structural and Functional Organization of the Human Nervous System Thomas Biederer
An integrative overview of the structure and function of the human brain as it pertains to major neurological and psychiatric disorders. Neuroanatomy, neurophysiology, and clinical correlations are interrelated to provide essential background in the neurosciences. Lectures in neurocytology and neuroanatomy survey neuronal organization in the human brain, with emphasis on long fiber tracts related to clinical neurology. Lectures in neurophysiology cover various aspects of neural function at the cellular and systems levels, with a strong emphasis on the mammalian nervous system. Clinical correlations consist of sessions applying basic science principles to understanding pathophysiology in the context of patients. Seven three-hour laboratory sessions are coordinated with lectures throughout the course to provide an understanding of the structural basis of function and disease. Case-based conference sections provide an opportunity to integrate and apply the information learned about the structure and function of the nervous system in the rest of the course to solving a focused clinical problem in a journal club format. Variable class schedule; contact course instructors. This course is offered to graduate and M.D./Ph.D. students only and cannot be audited.

INP 9585b / BENG 5485b, Fundamentals of Neuroimaging Fahmeed Hyder, Elizabeth Goldfarb, and Douglas Rothman
The neuroenergetic and neurochemical basis of several dominant neuroimaging methods, including fMRI. Topics range from technical aspects of different methods to interpretation of the neuroimaging results. Controversies and/or challenges for application of fMRI and related methods in medicine are identified.

INP 9640a, Current Topics in Neuroscience Junjie Guo
In this course, students select three modular "mini-courses" from a list of mini-courses spanning a wide range of topics and techniques in molecular, cellular, systems, and

behavioral neuroscience. Prerequisites: INP 5702 and INP 5703 or INP 9720, MCDB 7200, or MCDB 3200.

International and Development Economics

Economic Growth Center
27 Hillhouse Avenue, 203.432.3610
https://economics.yale.edu/ide-ma-program
M.A.

Director of Graduate Studies
Michael Boozer

Program Co-Directors
Michael Boozer
Ana Cecilia Fieler

The Department of Economics offers a one-year program of study in International and Development Economics, leading to the Master of Arts degree. IDE students are diverse in terms of their nationalities and their career paths. Many of our students now come directly from their undergraduate school or a few years of work experience, although we do not exclude any candidate on the basis of work experience or country of origin. After completion of the program, IDE students have gone into various paths, including working in research for academic and nonacademic agencies such as the World Bank, the United Nations, and the Poverty Action Lab. Other students have gone on to further academic work such as law school and to Ph.D. programs in economics, environmental sciences, public health, and similar programs. Many students have returned to their home countries to work for their government or for funding agencies there.

Some students entering the program are required to complete the summer program in English and Mathematics for Economists offered by Yale University. This requirement may be waived for applicants demonstrating exceptional training in economic analysis and a good command of English.

Yale fellowship funds are not available for the IDE program, and students are required to produce certification of the necessary funding prior to enrollment.

The course program requires the completion of eight graduate-level courses, five of which make up the core elements of the IDE program and are required; the remaining three are graduate electives. The required courses are ECON 5545, Microeconomics; ECON 5546, Growth and Macroeconomics; ECON 5558, Econometrics; ECON 5559, Development Econometrics; and one of the following: ECON 7732, Advanced Economic Development, or ECON 5547, Social Networks and Economic Development. These required courses are designed to provide a rigorous understanding of the economic theory necessary for economic policy analysis. In special circumstances, in consultation with the DGS, students may receive credit toward the degree for undergraduate language or mathematics classes. An option of a second year of nondegree elective study is available via the special student registration status.

Joint-program options for study with the School of the Environment (YSE) and the School of Public Health (YSPH) are also available. Application to YSE or YSPH must be made simultaneously with the application to the IDE program. Admission to these

joint programs is determined by the participating professional school and must be obtained prior to beginning the program. Joint-degree students earn the Master of Arts degree in IDE and the Master of Environmental Studies (YSE) or Master of Public Health (YSPH) degree.

Prospective applicants are encouraged to visit the IDE program website at https://economics.yale.edu/ide-ma-program. Send questions regarding the program to the senior administrative assistant, International and Development Economics Program, Yale University, PO Box 208269, New Haven CT 06520-8269; email, ide@yale.edu.

Investigative Medicine

2 Church Street South, Suite 113
http://medicine.yale.edu/investigativemedicine
Ph.D

Program Director and Director of Graduate Studies
Joseph Craft (joseph.craft@yale.edu)

Deputy Program Director
Eugene Shapiro (eugene.shapiro@yale.edu)

Professors Karen Anderson (*Pharmacology*), Joseph Craft (*Internal Medicine*; *Immunobiology*), James Dzuria (*Emergency Medicine*), David Fiellin (*Internal Medicine*; *Epidemiology*), Thomas Gill (*Internal Medicine*; *Epidemiology*), Fred Gorelick (*Internal Medicine*; *Cell Biology*), Jeffrey Gruen (*Pediatrics*; *Genetics*), Harlan Krumholz (*Internal Medicine*; *Epidemiology*), Eugene Shapiro (*Pediatrics*; *Epidemiology*), George Tellides (*Surgery*), Mary Tinetti (*Internal Medicine*)

FIELDS OF STUDY

The Investigative Medicine program offers training for physicians in clinical departments who are interested in careers in clinical research. The program is designed to develop the broad knowledge base, analytical skills, creative thinking, and hand-on experience demanded of clinical researchers devoted to disease-oriented and patient-oriented investigation. The program provides the student with individualized experience encompassing formal course work and experience leading to a Ph.D. thesis under the supervision and mentorship of a graduate school faculty member. Students can undertake thesis work in a variety of disciplines. These include but are not limited to:

1. Evaluating risk factors and interventions for disease using modern concepts in quantitative methods and clinical study design,
2. Investigating the biochemical, physiological, and/or genetic basis of disease in a translational setting and/or laboratory.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

The course requirements for the doctorate program in investigative medicine are completion of six required courses plus two electives, either in laboratory-based patient-oriented research or clinically-based patient-oriented research. Most required courses are to be completed by the end of the first year of study. Before registering for a second year of study, students must have completed IMED 5630, Ethical Issues in Biomedical Research. Electives are often taken in the second year with the expectation that the courses will be completed by the end of the second year of study. To be admitted to candidacy, students must pass both a written and oral comprehensive qualifying exam (the prospectus examination) and submit a thesis prospectus that has been approved by their qualifying committee. To be eligible for the comprehensive qualifying exam, students must achieve a grade of Honors in two courses, have a minimum grade average of a High Pass, and have completed at least six courses. The remaining degree requirements include completion of the dissertation, writing of the dissertation, and its oral defense. It is expected that students will complete

the program in three to five years. There is no foreign language requirement. The minimum required curriculum for each program of study is as follows:

Course Requirements

LABORATORY-BASED PATIENT-ORIENTED RESEARCH

IMED 5625	Principles of Clinical Research	1
IMED 5630	Ethical Issues in Biomedical Research	1
IMED 5645	Introduction to Biostatistics in Clinical Investigation	1
IMED 6635	Directed Reading in Investigative Medicine	1
IMED 6680	Topics in Human Investigation	1
IMED 9665	Writing Your K- or R-Type Grant Proposal	1

Two discipline-based electives. Director of graduate studies approval required.

CLINICAL-BASED PATIENT-ORIENTED RESEARCH

IMED 5630	Ethical Issues in Biomedical Research	1
IMED 5661	Methods in Clinical Research, Part I	1
IMED 5662	Methods in Clinical Research, Part II	1
IMED 6635	Directed Reading in Investigative Medicine	1
IMED 6680	Topics in Human Investigation	1
IMED 9665	Writing Your K- or R-Type Grant Proposal	1

Two discipline-based electives. Director of graduate studies approval required.

For more information on the admissions process and course details please visit the Investigative Medicine Program website, https://medicine.yale.edu/investigativemedicine.

COURSES

IMED 5630a, Ethical Issues in Biomedical Research Lauren Ferrante
This term-long course addresses topics central to biomedical research, including the ethics of clinical investigation, conflicts of interest, misconduct in research, data acquisition, and protection of human subjects. Practical sessions cover topics such as collaborations with industry, publication and peer review, responsible authorship, and mentoring relationships. Satisfactory completion of this course fulfills the NIH requirement for training in the responsible conduct of research. Permission of instructor required.

IMED 5661a, Methods in Clinical Research, Part I Eugene Shapiro
This yearlong course (taken in concert with IMED 662), presented by the National Clinical Scholars Program, presents in depth the methodologies used in patient-oriented research, including methods in biostatistics, clinical epidemiology, health services research, community-based participatory research, and health policy. Permission of instructor required. Permission of instructor required.

IMED 6635a, Directed Reading in Investigative Medicine Joseph Craft
An independent study course for first-year students in the Investigative Medicine program. Topics are chosen by the student, and reading lists are provided by faculty

for weekly meetings to discuss articles. Four sessions are required: dates/times by arrangement. Permission of instructor required. Consent of instructor required.

IMED 9665a, Writing Your K- or R-Type Grant Proposal Eugene Shapiro
In this term-long course, students gain intensive, practical experience in evaluating and preparing grant proposals, including introduction to NIH study section format. The course gives new clinical investigators the essential tools to design and initiate their own proposals for obtaining grants to do research and to develop their own careers. The course is intended for students who plan to submit grant proposals (for either a K-type career development award or an R-type investigator-initiated award). Attendance and active participation are required. Permission of instructor required. (There may be spaces to audit the course.)

Italian Studies

Humanities Quadrangle, 203.432.0595
http://italian.yale.edu
M.A., M.Phil., Ph.D.

Chair
Jane Tylus

Director of Graduate Studies
Millicent Marcus (HQ 524, 203.432.0599)

Professors Millicent Marcus, Jane Tylus, Heather Webb

Professor in the Practice Amara Lakhous

Assistant Professor Serena Bassi, Alessandro Giammei

Senior Lecturer Pierpaolo Antonello

Senior Lector II Anna Iacovella

Senior Lectors I Michael Farina, Simona Lorenzini, Deborah Pellegrino

Affiliated Faculty Paola Bertucci, (*History of Science, Medicine, and Public Health*), Howard Bloch (*French*), Jessica Brantley (*English*), Francesco Casetti (*Film and Media Studies*), Joanna Fiduccia (*History of Art*), Jacqueline Jung (*History of Art*), Laurence Kanter (*Yale University Art Gallery*), Gundula Kreuzer (*Music*), Morgan Ng (*History of Art*), Jessica Peritz (*Music*), David Quint (*English*; *Comparative Literature*), Ayesha Ramachandran (*Comparative Literature*), Kevin Repp (*Beinecke Library*), Lucia Rubinelli (*Political Science*), Pierre Saint-Amand (*French*), Gary Tomlinson (*Music*)

Visiting faculty from other universities are regularly invited to teach courses in the department.

FIELDS OF STUDY

The Italian Studies department brings together several disciplines for the study of the Italian language and its literature. Although the primary emphasis is on a knowledge of the subject throughout the major historical periods, the department welcomes applicants who seek to integrate their interests in Italian with wider methodological concerns and discourses, such as history, rhetoric and critical theories, comparison with other literatures, the figurative arts, religious and philosophical studies, medieval, Renaissance, and modern studies, and the contemporary state of Italian writing. Interdepartmental work is therefore encouraged and students are accordingly given considerable freedom in planning their individual curriculum, once they have acquired a broad general knowledge of the field through course work and supplementary independent study.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

The department recognizes that good preparation in Italian literature is unusual at the college level and so suggests that students begin as soon as possible to acquire a broad general knowledge of the field through outside reading. Candidates must demonstrate proficiency in two languages in addition to English and Italian; these

could be other Romance languages, Latin, or non-Romance languages relevant to the research interests of the individual student. Students are reminded that it is difficult to schedule beginning language courses during the academic year and are therefore encouraged to take them in the summer. (Yale Summer Session offers online language-for-reading courses as well as Latin instruction each summer, for which incoming and continuing students will receive a tuition fellowship.) All language requirements must be fulfilled before the Ph.D. qualifying examination.

Students are required to take two years of course work (normally sixteen courses), including two graduate-level term courses outside the Italian department. After consultation with the director of graduate studies (DGS), students who join the graduate program with an M.A. in hand may have up to two courses waived. Students who have had little or no experience in Italy are generally urged to do some work abroad during the course of their graduate program. At the end of the first and second years, students' progress is analyzed in an evaluative colloquium. The comprehensive qualifying examination must take place during the third year of residence. It is designed to demonstrate the student's mastery of the language and acquaintance with the literature. The examination, which is both written and oral, will be devised in consultation with a three-member committee, chosen by the student. In the term following the qualifying examination, the student will discuss, in a session with faculty members, a prospectus describing the subject and aims of the dissertation. Students are admitted to candidacy for the Ph.D. upon completion of all predissertation requirements, including the prospectus. Admission to candidacy normally occurs by the end of the sixth term.

Teaching is considered to be an important component of the doctoral program in Italian Studies. Students will be appointed as teaching fellows in the third and fourth years of study. Guidance in teaching is provided by the faculty of the department and specifically by the director of language instruction.

COMBINED PH.D. PROGRAMS

Italian and Early Modern Studies

The Department of Italian Studies also offers, in conjunction with the Early Modern Studies Program, a combined Ph.D. in Italian and Early Modern Studies. For further details, see Early Modern Studies.

Italian and Film and Media Studies

The Department of Italian Studies also offers, in conjunction with the Film and Media Studies Program, a combined Ph.D. in Italian and Film and Media Studies. For further details, see Film and Media Studies. Applicants to the combined program must indicate on their application that they are applying both to Film and Media Studies and to Italian Studies. All documentation within the application should include this information.

MASTER'S DEGREES

M.Phil. See Degree Requirements under Policies and Regulations.

M.A. Students who withdraw from the Ph.D. program may be eligible to receive the M.A. degree if they have met the requirements and have not already received the

M.Phil. degree. For the M.A., students must successfully complete two years of course work (normally sixteen courses), including two graduate-level term courses outside of Italian studies. Candidates in combined programs will be awarded the M.A. only when the master's degree requirements for both programs have been met.

Program materials are available upon request to the DGS, Italian Studies, Yale University, PO Box 208311, New Haven CT 06520-8311.

COURSES

ITAL 6570b / FREN 6700b / LING 5640b / SPAN 5000b, Principles of Language Teaching and Learning Staff

Introduction to the basic principles of second-language acquisition theory, focusing on current perspectives from applied linguistics, sociolinguistics, and psycholinguistics. Topics include language teaching methodology, communicative and task-based approaches, learner variables, intercultural competence, and models of assessment.

ITAL 6578b / ENGL 6576b / MDVL 6176, Medieval Women Mystics: Piety and Disobedience Jessica Brantley and Jane Tylus

How was female sanctity practiced in medieval Europe? How did mystical engagement, in particular, spark both piety and disobedience? How was mysticism explored in writing and the arts by women themselves—especially those women who would challenge the status quo by asserting their own direct connections to the divine? Finally, how do we "access" these medieval minds today, and to what extent do contemporary theoretical concerns about gender identity, subjectivity, and alterity enable us to grapple with the intensely personal dynamics of mystical experience? We introduce these questions—and many others—in connection to the lives and works of five medieval women, beginning with Clare of Assisi, who fled her parents' wealthy home in the middle of the night to join her radical neighbor, Francis. We consider the writings of Bridget of Sweden, Catherine of Siena, and Julian of Norwich, all formative figures in the crisis-ridden fourteenth century who unsettled the boundaries between private and public, religious and "profane." Finally, we read the *Book of Margery Kempe* as a fifteenth-century record of how the mystical experiences of female saints inspired one bourgeois woman's negotiation between her piety and her community. Historical, cultural, and religious topics to be considered include: the influence of the emerging vernaculars on religious movements and texts; the reassessment of Biblical figures such as Mary, Mary Magdalene, Judith, and Ruth; the impact of marginal, possibly heretical groups such as the Beguines; and the rise of the mendicant orders and the resulting changes to monastic and convent life. If our funding applications are successful, we take a course trip to England and Italy during spring break.

ITAL 6990a / CPLT 6640a, Taking Leave: Meditations on Art, Death, and the Afterlife from the Bible to the Twentieth Century Jane Tylus and Bruce Gordon

This seminar seeks to contextualize leave-taking within the explicitly religious and artistic contexts of Western culture. We open with readings from ancient texts from Mesopotamian, Greek, Latin, and Judaic cultures, and end with the U.S. Civil War. And in between we spend considerable time on the ways in which the advent of Christianity and, in turn, the Reformation, Counter-Reformation, and modern worlds influenced the practices and understanding of leave-taking. En route we explore how, for example, Catholicism sought to extend life into the third realm of Purgatory, why the Reformation sought to undo those imaginative excursions, and the extent

to which the different faiths of figures such as Michelangelo, Shakespeare, and John Donne produced radically different kinds of finished—and unfinished—works. As we explore the transformative potential of the goodbye in literary and religious works, we also engage with more recent discussions from theologians, theorists, and therapists about grieving, transitions, and letting go. Our objectives are: to strive to understand the important role that leave-takings play in the history of Christianity and artistic expression, especially between 1300–1850; to probe the difference between religious faiths of early modernity with respect to rituals of saying goodbye and the afterlife; to sharpen our skills as readers, spectators, and listeners of works that engage with complex questions regarding the meaning of one's life and one's lifework; and to contextualize our readings within contemporary conversations about dying, grief, and letting go. Area V and Area III.

ITAL 8594a, Canons and Counter-Canons: Modern and Contemporary Italian Prose
Serena Bassi

There's no such thing as "the great Italian novel". The modern bourgeois aesthetic form *par excellence* may be routinely described by literary theorists as emerging and seeing its major developments in Spain, Britain, France, or Russia. Italy is usually excluded from this particular invented cultural trajectory. Instead of seeing this assessment as an indictment on Italian versions of the novel form, we interpret the supposed lack as an opportunity for rethinking the novel from a marginal vantage point. We read six canonical Italian novels and six minor ones that may be read as critical responses to the better-known texts, beginning at the start of the nineteenth century and ending two centuries after with the likely winner of the 2025 *Premio Strega*. Throughout the class, we ask what may be peculiar or eccentric about the Italian novelistic tradition by focusing, in particular, on the ways in which the novel registers and encodes philosophical debate about the nature of time and history; collective and individual memory; class and social mobility; *Bildung* and selfhood. The class is held in English, but reading knowledge of Italian is required (we read all texts in Italian; many of them do not have available English translations).

ITAL 8783a / FILM 7790a, Italian Film Ecologies: Yesterday, Today, and Tomorrow
Millicent Marcus

Landscape and the natural environment have never occupied "background" status in Italian film. Given the spectacular visual presence of its terrain—thanks to the relative proximity of mountain chains and the long seacoast—and given the pivotal importance of farming and pasturage in this traditionally agrarian economy, the synergy between the human and natural worlds has played a prominent role in Italian filmmaking since the very inception of the industry. Most recently, two developments have pushed this issue to the forefront of scholarly attention: the advent of ecocriticism, which found one of its earliest and most influential champions in Serenella Iovino, and the establishment of regional film commissions, grassroots production centers that sponsored cinematic works attuned to the specificity of "the local." The course includes study of films that predate our current environmental consciousness, as well as recent films that foreground it in narrative terms. In the case of the older films, which have already attracted a great deal of critical commentary over time, we work to shift our interpretive frame in an "eco-friendly" direction (even when the films' characters are hardly friends of the environment). Among the films considered are *Le quattro volte, Il vento fa il suo giro, L'uomo che verrà, Gomorra, L'albero degli zoccoli, Riso amaro, Red*

Desert, *Christ Stopped at Eboli,* and *Il ladro di bambini*. We screen one film a week and devote our seminars to close analysis of the works in question.

ITAL 9999a, Preparing for Doctoral Exams and Prospectus Writing Serena Bassi
The aim of this seminar is to give third-year students the opportunity to work together on the three projects that will occupy them throughout Year 3: the oral comprehensive exam (for early November), the written exam on the three topics lists (for March–April), and the writing of the prospectus, to be defended in September of Year 4. Weekly meetings are run and coordinated by a faculty member in Italian, generally the graduate adviser. Each week of the first nine weeks is devoted to a specific topic on the comprehensive lists requested by the students themselves. Students are in conversation with each other, with the presiding faculty member, and with an additional guest lecturer who is an expert in the areas under discussion. Following the ninth week, there is a dry run of the oral exam. The remaining four weeks are devoted to discussing the composition of the topics lists and to the writing of the prospectus. Informal meetings may continue through the spring to discuss these issues as well. Prerequisite: completion of all other graduate course work (15 credits).

Law

Sterling Law Building, 203.432.1696
http://law.yale.edu/phd
M.A., Ph.D.

Dean
Heather Gerken

Director of Graduate Studies
Robert Post

FIELDS OF STUDY

The Ph.D. in Law program prepares students who have earned a J.D. from an American Bar Association accredited law school to enter law teaching or other careers that require a scholarly mastery of law. The program is designed to provide a broad foundation in the canonical texts and methods of legal scholarship and to support students in producing original scholarship in the form of a dissertation. The program strongly encourages, but does not require, interdisciplinary approaches to the study of law.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Each student will have a faculty advisory committee, which will help the student select appropriate courses. In their first year, students take a mandatory two-term seminar on the foundations of legal scholarship, legal theory, and methods or its equivalent as specified by the program's director of graduate studies (DGS). Each student may enroll in as many as four additional courses. These courses may be offered in the Law School or in other departments or schools at Yale University. Each student's advisory committee may waive up to four courses. The foundations seminar or its equivalent as specified by the program's DGS may not be waived and must be taken for a grade, not audited.

Each Ph.D. student must take two qualifying examinations. The first, administered before the start of the second term in the program, is a written examination based on materials studied in the first term of the foundations seminar. It will test the student's breadth of knowledge across the legal canon, including knowledge of canonical texts, methods, and principles. The second is an oral examination administered by the student's advisory committee at the beginning of the second year and no later than October 15 of that year. The oral examination tests the student's knowledge of the scholarship, theories, and methodologies relevant to the student's area of study. Both qualifying examinations are graded on a pass/fail basis. A student who fails a qualifying examination will have one opportunity to retake the examination in the following term.

After completion of the second qualifying examination, the student will assemble a faculty dissertation committee and prepare a dissertation prospectus. Upon approval of the prospectus, usually by the end of the fourth term, the student will devote the remaining time in the program to writing a dissertation, which may take the form of a traditional monograph or three publishable scholarly articles. The final dissertation must be approved by both the student's dissertation committee and the DGS.

Students in the Ph.D. in Law program are also expected to meet additional academic requirements in each year of the program, specified below and outlined in greater detail

in the Ph.D. in Law Program Manual available from the Graduate Programs Office at Yale Law School. Students who fail to meet program requirements will not be in good standing and may be withdrawn from the program.

All required written work must be judged satisfactory by the student's advisory committee, in consultation with the assistant dean for graduate programs and the DGS. A satisfactory article or chapter is one that the student's advisory committee, the assistant dean, and the DGS agree is appropriate and ready for professional presentation at an academic workshop, and one that offers the promise of meeting the standards expected by leading law reviews or academic presses.

First-year requirements include satisfactory performance in course work, including the foundations seminar (or its equivalent as specified by the DGS); passing the first qualifying examination; and completion of a first dissertation article or chapter. Students also must submit an approved reading list for the second qualifying examination to the assistant dean and the DGS no later than the final day of the spring examination period.

Second-year requirements include submission of the first dissertation article or chapter for publication no later than the first day of classes for the fall term of the second year and successful completion of the second qualifying examination by October 15 of that year. Second-year students shall complete a second satisfactory dissertation article or chapter by December 1 and complete their one-semester required teaching experience by the end of their second year in the program. Student teaching will typically be reviewed in person or via recorded media with the assistant dean and/or the dissertation committee chair. They shall submit their dissertation prospectus to the assistant dean and the DGS by June 1 of the second year.

In the third year, students are required to complete and submit a draft of their third dissertation article or chapter by August 1, and to workshop their article or chapter at the Law School no later than September 20 in preparation for the academic job market. For those who plan to graduate in May of their third year, a final and complete dissertation must be submitted to the assistant dean, the DGS, dissertation committee members, and the graduate school registrar no later than March 15.

The program is designed to be completed in three years and two summers, but students who do not expect to complete all program requirements before the conclusion of their third year in the program are invited to petition the Law School's Ph.D. Policy Committee for permission to enroll for a seventh and eighth semester in the program under Extended Registration or Dissertation Completion Status (DCS). Those enrolled under Extended Registration are full-time students and receive, as before, Yale Basic Health coverage and a Health Award to cover the cost of Yale Health hospitalization/specialty coverage, but they do not receive stipendiary support. Instead, having completed their required teaching experience, they are eligible to teach in Yale College or, in exceptional circumstances, to assist a Yale Law School faculty member in their teaching to support their living expenses. Teaching opportunities are coordinated by the graduate school's Teaching Fellow Program.

Students on DCS are less than half-time students who retain their Yale NetID in order to access electronic library resources and their Yale e-mail accounts. Students in this category are not eligible for stipendiary support nor a Health Award from the graduate

school or the Law School; they should consult with the graduate school on other services and resources that may not be available to them as less than half-time students.

Those on both "Extended Registration" and "Dissertation Completion" status are responsible for paying the Continuous Registration Fee. (Note that the graduate school provides a fellowship to cover the cost of the Continuous Registration Fee for those teaching in Yale College.)

TEACHING

As part of their training, Ph.D. students must complete one semester of teaching experience. There are a number of ways to fulfill this requirement, depending on the availability of teaching experiences from year to year. They include: (1) serving as a teaching assistant for a Law School course, (2) serving as a student organizer for a Law School reading group, (3) serving as a teaching fellow for a course in Yale College or another school at Yale, (4) co-teaching a Law School course with a faculty member, (5) teaching at another institution of higher education approved by the assistant dean and DGS, and (6) in unusual situations, teaching their own course. In all cases, students engaged in teaching will have faculty supervision and feedback from their advisers.

MASTER'S DEGREE

M.A. The M.A. degree may be granted to Ph.D. in Law students who are not completing the program, but who successfully complete the two-term foundations seminar and at least two additional courses, pass the two qualifying examinations, and submit an academic paper that is judged to be of publishable quality. Students may substitute a third course for one of the two qualifying examinations. The degree is available retroactively to students who matriculated from September 2013 onward.

Program materials are available upon request to the Graduate Programs Office, Yale Law School, 127 Wall Street, New Haven CT 06511.

COURSES

For Law School courses, see the Law School bulletin, online at https://bulletin.yale.edu/bulletin/law. For courses in other schools at Yale University, please see their respective bulletins or https://courses.yale.edu. Specific course selections will be approved by the student's advisory committee and by the DGS.

Linguistics

370 Temple Street, Rm. 204, 203.432.2450
http://ling.yale.edu
M.A., Ph.D.

Chair
Veneeta Dayal

Director of Graduate Studies
Jim Wood

Professors Claire Bowern, Veneeta Dayal, Robert Frank, Laurence Horn (*Emeritus*), Frank Keil,* Maria Piñango, Fernando Rubio (*Center for Language Study*), Zoltán Szabó,* Raffaella Zanuttini

Associate Professors Athulya Aravind, Simon Charlow, Jason Shaw, Jim Wood

Assistant Professors Tom McCoy, Natalie Weber

* A joint appointment with primary affiliation in another department.

FIELDS OF STUDY

The Department of Linguistics embraces an integrative approach to the study of language, based on the premise that an understanding of the human language faculty arises only through the combination of insights from the development of explicit formal theories with careful descriptive and experimental work. Members of the department offer courses and conduct research in which theoretical inquiry proceeds in partnership with historical and comparative studies, fieldwork, experimental work, cognitive neuroscience, and computational and mathematical modeling. Faculty expertise includes all of the major domains of linguistics (phonetics, phonology, syntax, semantics, pragmatics) and spans a wide range of languages.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Coursework

The conception of linguistics embraced by the Yale Ph.D. program requires that students receive training that is both deep in its coverage of areas of linguistic inquiry and broad in the range of methodological approaches. The course work requirements are designed to accomplish these complementary goals. This course work includes a set of courses designed to expose students to core ideas, together with courses equipping students with a range of methodologies in linguistic research.

During their first two terms, students must take LING 5190, Perspectives on Grammar. This course is taken SAT/UNSAT. A minimum of thirteen other courses are required: four foundational courses, three methodology courses, three advanced seminars, and three linguistics elective classes. No single course can simultaneously satisfy a requirement in two distinct areas. During the initial two years of course work, students must receive at least three grades of H (= Honors). Two or more grades below HP (= High Pass) during the initial two-year period constitute grounds for dismissal from

the Ph.D. program. As per graduate school general regulations, grades of F cannot be counted toward degree requirements.

Foundational Courses This requirement ensures that students achieve breadth in several linguistic subfields. Students take at least one sufficiently advanced course in four or more subfields of linguistics. The following courses satisfy this requirement:

LING 7120	Historical Linguistics II	1
LING 7310	Neurolinguistics	1
LING 7350	Phonology II	1
LING 7390	Phonetics II: Speech Production and Perception	1
LING 7540	Syntax II	1
LING 7640	Semantics II	1
LING 7810	Morphology II	1

Students decide on their courses, in consultation with the director of graduate studies (DGS) and other faculty, when they arrive on campus. Other sufficiently advanced courses may also satisfy the requirement, subject to DGS approval.

Methodology Courses For the methodology requirement, students must take three relevant courses. The following courses, which are offered regularly by the department, qualify, but other courses may as well, to be determined in consultation with the adviser and DGS:

LING 6190	Introduction to Linguistic Phylogenetics	1
LING 6249	Mathematics of Language	1
LING 6340	Quantitative Linguistics	1
LING 6349	Experimental Semantics	1
LING 6430	Dynamics of Speech	1
LING 7000	Experimentation in Linguistics	1
LING 7289	Laboratory Phonology	1
LING 7310	Neurolinguistics	1
LING 7360	Articulatory Phonology	1
LING 7410	Field Methods	1
LING 7610	Language Acquisition	1
LING 7960	Semantic Investigations in an Unfamiliar Language	1
An advanced course in statistics such as the following may qualify:		
ENV 755	Modeling Geographic Space	3
PSYC 5180	Multivariate Statistics	1
S&DS 5380	Probability and Statistics	1
S&DS 5630	Multivariate Statistical Methods for the Social Sciences	1
S&DS 6610	Data Analysis	1

One of the methodology courses must be taken during the first year of the program, and two must be completed by the end of the second year. Courses cannot simultaneously satisfy the foundational and methodology requirements.

Seminar Courses Graduate students are active participants in department reading groups and seminars. Students should participate in three advanced seminars in which they read the original literature of the field and write a research paper. With permission of their adviser and the DGS, students may enroll in the appropriate 7900s-numbered LING course and count active participation in a department reading group, including the submission of a final research paper, as satisfying this requirement.

Linguistics Electives Students must take three more linguistics courses that are at least 6000 level.

Research

The primary focus of a Ph.D. program is independent research. In the course of our Ph.D. program, students carry out cutting-edge linguistic research, culminating in the completion of a dissertation. To help students in the transition from "consuming" to also "producing" linguistic research, there are a number of structures and requirements in place.

Research Adviser and First-Year Directed Readings By the end of the first term of the program, students find a department faculty member who acts as their research adviser. This choice should be made on the basis of compatibility of research interests and discussions between the student, faculty member, and DGS. Starting from the spring term of the first year, students will, with the help of their adviser, define a topic of research interest, meeting regularly (minimally once every three weeks) and carrying out a series of readings on this topic. Students should keep a research journal, describing their readings and how they fit in with work in the area, and chronicling the development of their thinking about the research topic. It is the faculty's expectation that this exploration will form the foundation for the research reported in the student's first qualifying paper (on which see below). Note however that the initial choice of research adviser is not binding: students who want to change their choice of topic or adviser for whatever reason may do so. It is the student's responsibility to find a suitable adviser, and students are expected to have a faculty adviser at all times during their enrollment in the program. Some students have two faculty co-advisers.

Portfolio At the conclusion of the first year of the program, students submit to the faculty a portfolio of two research papers, in two distinct subfields (such as Phonetics, Phonology, Morphology, Syntax, Semantics, Pragmatics, Historical Linguistics, Neurolinguistics, Computational Linguistics). These papers should demonstrate a student's mastery of the material in these fields to the level covered in the foundational courses in the area, as well as the ability to identify a significant research question and argue for a possible solution. In short, such papers should be at the level of an excellent term paper, representative of a student's best work during the first year of course work. The faculty do not expect students to write papers expressly for the portfolio. Rather, the portfolio will typically consist of term papers from courses taken during the first year in the program. The default expectation is that these papers will be submitted by May 10 each year.

Annotated Bibliography/Research Plan On the basis of the research journal begun during the first year in the program, students will prepare an annotated bibliography and research plan (ABRP) for their first qualifying paper. The ABRP, which should be approximately twenty pages in length, should lay out the question that the student

wants to explore, motivating its importance through a presentation and synthesis of relevant past literature on the topic. The ABRP should be submitted within the first few weeks of the third term. If this is the fall semester, the default expectation is that it will be submitted by September 10.

Qualifying Papers Once the ABRP has been completed, the student will proceed to work on the qualifying papers (QPs). The goal of the QPs is to develop a student's ability to conduct independent research in linguistics at the level of current scholarship in two different areas of linguistics. The faculty expect a QP to report on the results of a substantial project, which are written up in a manner consistent with the standards of the field, and to be eventually published in an academic journal, working papers, or conference proceedings. Students are strongly encouraged to identify a target journal early in the project.

The process of writing the first QP is broken into a number of smaller steps with specific deadlines for each (all during the second year of the program).

1. Students discuss their preliminary results in an appropriate venue (lab meeting, reading group, seminar, etc.) by no later than the end of the fall term.
2. Also by the end of the fall term, the student will send a request for a QP reader to the DGS. This request must include a title and brief summary of the project, and may also request specific faculty members to be involved. On the basis of research area and faculty availability, the DGS will identify a faculty member other than the adviser to serve as a QP reader. This reader will be involved in the ultimate evaluation of the QP once it is completed. Because it is useful to get a range of feedback on one's work, we encourage students to make the best use of their QP reader by meeting with them and keeping them up to date on the progress of the project.
3. Students submit a first draft of their QP to their adviser and reader within the first few weeks of their sixth semester. If this is the spring semester, the default expectation is that it is submitted by February 1, but advisers may approve a different specific date.
4. Students present their work to the department at the yearly QPFest, which takes the form of a twenty-minute conference talk to members of the department.
5. Students must submit the final version of the paper to their adviser and reader well before the end of the semester. Toward the end of the fourth semester, the student should begin to explore possible areas and advisers for the second QP. Students are expected to identify an area and adviser within the first few weeks of the third year. Students follow the same steps and benchmarks listed above for the second QP, this time during the third year.

The second QP should be in a different area of linguistics, with a different adviser, from the first QP. It is particularly important that students make satisfactory progress toward the first QP and complete all work by the relevant deadlines. Failure to do so may result in being asked to leave the program.

Prospectus At the beginning of the sixth term (typically the spring term of the third year), students choose a dissertation topic and dissertation director. By the beginning of the fourth year, students present a dissertation prospectus to the entire faculty. The prospectus should clearly lay out the student's proposed dissertation topic. It

should motivate the importance of the topic, present the core idea of the proposed work together with its promise and viability, and demonstrate how this work fits into past research in the area. The prospectus should also identify a dissertation committee. The committee must include at least three faculty members (including the adviser), two of whom must be ladder faculty in the Linguistics department. The prospectus document should be about fifteen pages in length. After it is submitted, the prospectus is defended orally in front of the faculty. Upon successful completion of the prospectus defense, students advance to Ph.D. candidacy.

Dissertation By the end of the seventh term, students are expected to complete a chapter of the dissertation, together with a detailed outline of the dissertation and comprehensive bibliography. When the dissertation committee approves the chapter and dissertation outline, students are eligible for a University Dissertation Fellowship, which will support them in their fifth year of graduate study. Once advanced to candidacy, the student will meet with the entire dissertation committee minimally once each term (but with frequency decided by the committee), to evaluate progress toward the dissertation. During this meeting, the committee will complete the committee meeting form, will provide a copy to the student, and will retain one for the department's records.

Students are expected to complete their dissertations by the end of the sixth year. At least one month prior to the dissertation filing date, the completed dissertation must be orally defended. This defense will typically involve a public presentation of the main results of the dissertation and oral examination by the members of the dissertation committee. Committee members must be given the completed dissertation no less than two weeks prior to the date of the defense.

Language Requirement

Students are expected to exhibit some breadth in their knowledge of the languages of the world beyond those most commonly studied and those most similar in structure to the student's first language. LING 7410, Field Methods, fulfills this requirement; alternatively, with the permission of the DGS, the student may instead take an appropriate language structure course, or one or more courses characterized as L3 or higher at Yale or the equivalent elsewhere. This requirement must be completed before the prospectus defense, when the student advances to Ph.D. candidacy.

Teaching Fellow/Research Assistant Requirements

The faculty regard teaching experience as an integral part of the graduate training program in Linguistics. All students serve as teaching fellows for a minimum of two terms, beginning in the first term of the third year. In addition, students must complete two additional terms of teaching assistantship. These may be either as a teaching fellow, or through participation in externally supported, supervised research as a research fellow. Research assistantships may be provided by the Linguistics faculty and by various Yale and Yale-affiliated units. Before accepting a research assistantship in fulfillment of this requirement, students must receive approval from the DGS. To be approved, a research assistantship must meet the following criteria:

1. It must be supervised by a Linguistics department faculty member or a faculty member from an affiliated unit, such as Haskins Laboratories or the Yale School of Medicine.
2. It must provide research experience that complements the student's academic plan of study and is related to the student's dissertation research plans.
3. It must provide at least ten hours of experience per week.

If an approved research assistantship is accepted that does not provide a stipend equal to the standard departmental stipend, a university fellowship will be provided to augment the stipend so as to bring it up to the departmental standard.

MASTER'S DEGREE

M.A. Students who withdraw from the Ph.D. program may be eligible to receive the M.A. degree if they have met the requirements. For the M.A. degree, students must successfully complete the coursework, examinations, and work samples required by the end of the second year of graduate study (see above).

Program materials are available online at http://ling.yale.edu.

COURSES

LING 5000a / ENGL 6500a / MDVL 5700a, Old English I Emily Thornbury
The essentials of the language, some prose readings, and close study of several celebrated Old English poems.

LING 5010b / ENGL 6502b / MDVL 6051b, *Beowulf* and the Beowulf Complex Emily Thornbury
A close reading of *Beowulf* in Old English, within the modern and medieval critical landscapes. Prerequisite: a strong working knowledge of Old English (typically ENGL 500, or the equivalent).

LING 5100a, Introduction to Linguistics Claire Bowern
The goals and methods of linguistics. Basic concepts in phonology, morphology, syntax, and semantics. Techniques of linguistic analysis and construction of linguistic models. Trends in modern linguistics. The relations of linguistics to psychology, logic, and other disciplines.

LING 5150a / SKRT 5100a, Introductory Sanskrit I Aleksandar Uskokov
An introduction to Sanskrit language and grammar. Focus on learning to read and translate basic Sanskrit sentences in the Indian Devanagari script. No prior background in Sanskrit assumed. Credit only on completion of SKRT 520/LING 525.

LING 5160b, Cognitive Science of Language Athulya Aravind
The study of language from the perspective of cognitive science. Exploration of mental structures that underlie the human ability to learn and process language, drawing on studies of normal and atypical language development and processing, brain imaging, neuropsychology, and computational modeling. Innate linguistic structure vs. determination by experience and culture; the relation between linguistic and nonlinguistic cognition in the domains of decision-making, social cognition, and musical cognition; the degree to which language shapes perceptions of color, number, space, and gender.

LING 5179a, Language and Mind Maria Pinango
The course is an introduction to language structure and processing as a capacity of the human mind and brain. Its purpose is to bridge traditional domains in linguistics (phonetics, morphology, syntax) with cognition (developmental psychology, memory systems, inferential reasoning). The main topics covered are morphosyntax and lexical semantics, sentence composition and sentence processing, first- and second-language acquisition, acquisition under unusual circumstances, focal brain lesions, and language breakdown.

LING 5190a or b, Perspectives on Grammar Staff
This biweekly, in-person meeting of all first-year students is led by faculty members and TFs. Students are asked to reflect upon the content introduced in the courses they are taking and share their understanding of how these multiple perspectives connect with each other. The goal is to provide a forum where students can synthesize their views on the grammar of natural language and at the same time create a cohort experience for first-year students. ½ Course cr

LING 5380a / SKRT 5300a, Intermediate Sanskrit I Aleksandar Uskokov
The first half of a two-term sequence aimed at helping students develop the skills necessary to read texts written in Sanskrit. Readings include selections from the *Hitopadesa, Kathasaritsagara, Mahabharata,* and *Bhagavadgita*. Prerequisite: SKRT 520/ LING 525 or equivalent.

LING 5460b, Language and Gender Natalie Weber
Sex-based asymmetries in language structure and language use. Role of language in encoding, reflecting, or reinforcing social attitudes and behavior. The "he-man" lexicon: sex-marking, reform, and resistance. Gender and sexual diversity as linguistic variables. Genderlects: differences (real and perceived) between male and female speech, conversational styles, and linguistic communities.

LING 5640b / FREN 6700b / ITAL 6570b / SPAN 5000b, Principles of Language Teaching and Learning Staff
Introduction to the basic principles of second-language acquisition theory, focusing on current perspectives from applied linguistics, sociolinguistics, and psycholinguistics. Topics include language teaching methodology, communicative and task-based approaches, learner variables, intercultural competence, and models of assessment.

LING 6030b, English in Post Colonial Africa and the African Diaspora Staff
N/A

LING 6120b, Historical I Claire Bowern
Principles governing linguistic change in phonology and morphology. Status and independence of proposed mechanisms of change. Relations between the principles of historical change and universals of language. Systematic change as the basis of linguistic comparison; assessment of other attempts at establishing linguistic relatedness. Prerequisites: LING 512, 632, and 653.

LING 6200a, Phonetics I Jason Shaw
Each spoken language composes words using a relatively small number of speech sounds, a subset of the much larger set of possible human speech sounds. This course introduces tools to describe the complete set of speech sounds found in the world's spoken languages. It covers the articulatory organs involved in speech production and the acoustic structure of the resulting sounds. Students learn how to transcribe sounds

using the International Phonetic Alphabet, including different varieties of English and languages around the world. The course also introduces sociophonetics, how variation in sound patterns can convey social meaning within a community, speech perception, and sound change.

LING 6249b, Mathematics of Language Robert Frank
Study of formal systems that play an important role in the scientific study of language. Exploration of a range of mathematical structures and techniques; demonstrations of their application in theories of grammatical competence and performance including set theory, graphs and discrete structures, algebras, formal language, and automata theory. Evaluation of strengths and weaknesses of existing formal theories of linguistic knowledge.

LING 6270a, Language and Computation I Staff
Design and analysis of computational models of language. Topics include finite state tools, computational morphology and phonology, grammar and parsing, lexical semantics, and the use of linguistic models in applied problems. Prerequisite: prior programming experience or permission of the instructor.

LING 6340a or b, Quantitative Linguistics Staff
This course introduces quantitative methods in linguistics, which are an increasingly integral part of linguistic research. The course provides students with the skills necessary to organize, analyze, and visualize linguistic data using R, and explains the concepts underlying these methods, which set a foundation that positions students to also identify and apply new quantitative methods, beyond the ones covered in this course, in their future projects. Course concepts are framed around existing linguistic research, to help students use these methods when designing research projects and critically evaluating quantitative methods in the academic literature. Assignments and in-class activities are a combination of hands-on practice with quantitative tools and discussion of analyses used in published academic work. Prerequisite: one entry-level linguistics course (e.g., phonetics, phonology, syntax, and psycholinguistics) or permission of the instructor.

LING 6349b, Experimental Semantics Maria Pinango
The structure of meaning as part of the human cognitive system. How language use, which is serial and local in nature, is able to package meaning, which is multidimensional and atemporal. Psycholinguistic and cognitive modeling of core phenomena in lexical and compositional semantics. Readings from the fields of neurocognition and cognitive psychology, model-theoretic and lexico-conceptual semantics, and pragmatics. Prerequisite: 510, 517, 660, 663, or permission of the instructor.

LING 6530a, Syntax I Staff
An introduction to the syntax (sentence structure) of natural language. Introduction to generative syntactic theory and key theoretical concepts. Syntactic description and argumentation. Topics include phrase structure, transformations, and the role of the lexicon.

LING 6630a, Semantics I Simon Charlow
Introduction to truth-conditional compositional semantics. Set theory, first- and higher-order logic, and the lambda calculus as they relate to the study of natural

language meaning. Some attention to analyzing the meanings of tense/aspect markers, adverbs, and modals.

LING 6750b / PHIL 6669b, Pragmatics Simon Charlow
Context-dependent aspects of meaning and inference. Speech act theory, presupposition, implicature. Role of pragmatics in the lexicon and in meaning change. The semantics-pragmatics distinction from different perspectives; the position of pragmatics in linguistic theory.

LING 6790a, Morphology I Jim Wood
In this course, we dive into the fascinating world of morphology, where we uncover the inner workings of words and explore how they're constructed from smaller building blocks. As theoretical linguists—and morphologists—our objective is to understand what shapes language at the morphological level. This semester, we tackle a wide array of topics, from methods of morphological analysis to the mechanisms that seem to give language its flexibility, including affixation, reduplication, compounding, and cliticization. We also examine how morphology interacts with other areas of grammar, such as phonology and syntax. Prerequisites: None

LING 7120a, Historical Linguistics II Claire Bowern
How languages change, how we study change, and how language relates to other areas of society. Applications of historical linguistics to the study of the past (e.g. in linguistic paleontology); quantitative approaches to language change, signed language linguistic change. This course builds on material introduced in Historical Linguistics I.

LING 7289a, Laboratory Phonology Jason Shaw
Experimentation has emerged as an important methodology for studying phonological knowledge, the mental representation of sound patterns in language. This seminar-style course discusses current approaches to analyzing sound patterns of diverse languages using experimental data. We read seminal and recent papers developing methods for relating phonological form, including syllable structure, phonotactics, alternations, stress, and intonation, to its expression in articulatory and acoustic phonetics. Past coursework in phonetics or phonology is required.

LING 7310b, Neurolinguistics Maria Pinango
The study of language as a cognitive neuroscience. The interaction between linguistic theory and neurological evidence from brain damage, degenerative diseases (e.g., Alzheimer's disease), mental illness (e.g., schizophrenia), neuroimaging, and neurophysiology. The connection of language as a neurocognitive system to other systems such as memory and music.

LING 7360b, Articulatory Phonology Jason Shaw
Introduction to phonology as a system for combining units of speech (constriction gestures of the vocal organs) into larger structures. Analysis of articulatory movement data; modeling using techniques of dynamical systems. Emphasis on universal vs. language-particular aspects of gestural combination and coordination. Prerequisite: LING 520 or permission of the instructor.

LING 7410b, Field Methods Staff
Principles of phonetics, phonology, morphology, syntax, and semantics applied to the collection and interpretation of novel linguistic data. Data are collected and analyzed

by the class as a group, working directly with a speaker of a relatively undocumented language.

LING 7540b, Syntax II Jim Wood
Recent developments in syntactic theory: government and binding, principles and parameters, and minimalist frameworks. In-depth examination of the basic modules of grammar (lexicon, X-bar theory, theta-theory, case theory, movement theory). Comparison and critical evaluation of specific syntactic analyses. Prerequisite: LING 653.

LING 7610a, Language Acquisition Athulya Aravind
Language learnability, acquisition of the lexicon. Development of syntactic knowledge. Parameter-setting model of language acquisition and maturation. Experimental methods in developmental psycholinguistics.

LING 7640b, Semantics II Staff
The model-theoretic approach to semantics and its treatment of core linguistic phenomena. Topics include quantification, tense/aspect/modality, context and interpretation, and the semantics-pragmatics interface. Prerequisite: LING 663 or permission of the instructor.

LING 7770a, Topics in Syntax: Agreement in Syntax and Semantics Staff
In this course, we take a detailed look at our current understanding of an area of natural language syntax and open questions in that area. This semester, we focus on two aspects of agreement: (a) locality, especially cross-clausal dependencies and what complementation has to do with it, and (b) semantics, especially the usefulness (or not) of the Agree relation at LF (for phenomena such as switch-reference, honorification, and reflexivity, to name a few examples).

LING 7780a, Lexical Semantics Maria Pinango
This course explores the fundamental issues and concepts in the linguistic study of word meaning, as well as the relation between the semantics of words and other aspects of meaning, such as context-dependent (pragmatic) meaning. The course is organized as an overview of the core semantic properties of three syntactic categories in natural languages: verbs, adjectives, and nouns. Topics to be covered include verb classes, aspect, semantic roles, vagueness, gradability, antonymy, sense and reference, and categorization. Primary emphasis is placed on elucidating the fundamental empirical issues that must be accounted for, but we also explore different theoretical approaches to these issues, with an eye towards identifying the role of lexical item meaning in the overall system of meaning in natural language and in the architecture of the language system. Prerequisites: At least one of the following: LING 110, LING 117/PSYCH 137, LING 120/PSYC 318, CGSC 110/PSYC 130, PSYC 110, LING 375 or consent of instructor. 0 Course cr

LING 7790b, Morphology-Syntax Interface Jim Wood
Syntax and morphology are intertwined in many fascinating ways, and in fact, many current theories take the building of words, phrases, and sentences to involve the same mechanisms in the same modules of grammar. Whether this view is correct or not, there are many phenomena where the form of a word and the structure of a phrase or sentence interact in a way that deserves special attention. This seminar focuses on such phenomena. Prerequisite: The equivalent of LING 6530 (Syntax I) or LING 6790 (Morphology I). Either LING 7810 (Morphology II) or LING 7540 (Syntax II) would

be a huge plus as well, but are not strictly necessary. Please contact the instructor if you have questions.

LING 7800a or b, Topics in Computational Linguistics: Topic TBA Staff
Advanced topics in Computational Linguistics; specific topics to be determined each time it is offered. Prerequisites: Python programming, basic calculus and linear algebra, introduction to linguistic theory (LING 106, 110, 116, 217 or equivalent).

LING 7840b, Computational Psycholinguistics Staff
When processing language, the human mind can perform remarkable feats. For instance, we can acquire a language from a small amount of data (thousands of times less data than current systems in artificial intelligence), and we can infer what another person means even when that person's intended message goes beyond the literal meaning of their words. This course explores how computational modeling can help us characterize our incredible capacity for language learning and processing. We focus on three modeling traditions—symbolic algorithms, Bayesian models, and neural networks—and their application to a range of psycholinguistic phenomena, including parsing, pragmatics, speech perception, word learning, and language acquisition. We also discuss how artificial intelligence can inform theories of human language processing and vice versa.

LING 7910a or b / PHIL 6251a or b, Topics in Semantics: Questions in American Sign Language Staff
This course bridges introductory courses (LING 2630, LING 2640) and advanced seminars in semantics. It explores selected topics in some detail, allowing students to appreciate the nuances of semantic argumentation while at the same time emphasizing the foundational issues involved. The goal of this course is to allow students, within a structured format, to become comfortable engaging with open-ended problems and to gain confidence in proposing original solutions to such problems. Topics vary across semesters. Prerequisite: LING 2630/LING 6630 or permission of instructor.

Management

Edward P. Evans Hall, Rm. 5125A, 203.432.6002
https://som.yale.edu/programs/phd
M.A., M.Phil., Ph.D.

Dean
Kerwin Charles

Director of Graduate Studies
Matthew Spiegel (Evans Hall, Room 4526, 203.432.6017, matthew.spiegel@yale.edu)

Professors Rick Antle, Nicholas Barberis, James Baron, Lorenzo Caliendo, Judith Chevalier, James Choi, Ravi Dhar, Julia DiBenigno, Shane Frederick, Stefano Giglio, William Goetzmann, Gary Gorton, Edward Kaplan, Bryan Kelly, Sang-Hyun Kim, Balázs Kovács, Song Ma, Vahideh Manshadi, Andrew Metrick, A. Mushfiq Mobarak, Tobias Moskowitz, Barry Nalebuff, Nathan Novemsky, Edieal Pinker, K. Geert Rouwenhorst, Nils Rudi, Fiona Scott-Morton, Jiwoong Shin, Kelly Shue, Alp Simsek, Deborah Small, Edward Snyder, Matthew Spiegel, K. Sudhir, Jacob Thomas, Heather Tookes, Gal Zauberman, Frank Zhang

Associate Professors John Barrios, Tristan L. Botelho, Jason Dana, Paul Goldsmith-Pinkham, Zeqiong Huang, Michael Kraus, Vineet Kumar, Taly Reich, Thomas Steffen, Kosuke Uetake, Tauhid Zaman

Participating Faculty from the School of Management Laura Adler, Alexander Burnap, Christopher Clayton, Corey Cusimano, Jennifer Dannals, Raphael Duguay, Paul Fontanier, Adriana Germano, Soheil Ghili, Menaka Hampole, Theis Jensen, Ivana Katic, Joowon Klusowski, Cameron LaPoint, Zhen Lian, Lesley Meng, Faidra Monachou, David Munguia Gomez, Anya Nakhmurina, Jayanti Owens, Aneesh Raghunandan, Tong Wang, Edward Watts, Alexander Zentefis

FIELDS OF STUDY

Current fields include accounting, financial economics, marketing (behavioral), marketing (quantitative), operations, and organizations and management.

CORE REQUIREMENTS FOR THE PH.D. DEGREE

All students are required to take their individual program's seminar and workshop series in every term throughout their years in residence. These are not counted as part of the required number of courses specified below for each of the individual programs and are not required for your degree. All of the programs are full-time, requiring that all students be in residence at Yale during the academic year as well as the summer months. Teaching is considered to be an important part of the doctoral program in Management. Students are expected to serve as teaching fellows in one term of their residence. Additional requirements in each program of study are listed below.

SPECIAL REQUIREMENTS IN ACCOUNTING

The Accounting Ph.D. Program prepares students to become scholars engaged in research and teaching at the highest levels in the general areas of financial information and contracting within and across organizations. The specialization in accounting is designed to develop strong theoretical and empirical skills. There is heavy emphasis

on original research, supported by courses, presentations, feedback, joint work, and informal interactions with the faculty and fellow students in accounting and other disciplines. A key aspect of the program is multifaceted interaction among students and faculty on emerging research through seminars, conferences, brown bag lunches, and informal discussions. To develop this interaction, students must be fully engaged with the program during their stay here. At the beginning of each academic year, the director of graduate studies (DGS) assigns each student to work with a member of the faculty as a research assistant. Also, students have the opportunity to serve as teaching assistants to members of the faculty and gain experience towards becoming independent instructors.

In addition to the general requirements of the graduate school, we emphasize the following:

Courses

During their first four semesters, students must pass a minimum of 12 courses, which are selected in consultation with the faculty advisers and the DGS. In addition, students are required to do the following:

- Register for the Accounting seminar (MGMT 7811) and the Accounting pre-seminar (MGMT 7810) in your first two years
- Attend and participate actively in the Accounting Ph.D. seminars (MGMT 7101, MGMT 7102, MGMT 7103, and MGMT 7104) in years three and four
- Pass all other Ph.D. level seminars taught by Accounting faculty in years one through four.

Other Requirements

During the summers after the first and second year, students work on original research papers, which are due by September 1 and October 1, respectively. When submitted, copies must be sent to the Ph.D. registrar as well.

During the summer after the second year (around mid-June) students take a faculty-written three-day qualifying examination, which assesses their intellectual readiness to begin dissertation research.

The dissertation must be defended by the end of the seventh year in the program.

For the five years that they receive a stipend, students must be in residence at Yale, during the academic year as well as the summer.

Students must participate in the full range of normal academic and other intellectual engagements and activities of the University and SOM and interact with the faculty and fellow students on a day-to-day basis.

Students may be dismissed from the accounting program for any of the following reasons: (1) unsatisfactory performance at the end of the first or second year of the program, if the grade average falls below a High Pass (at least as many Honors grades as Pass), (2) failing the qualifying examination, or (3) unsatisfactory first- or second-year papers.

SPECIAL REQUIREMENTS IN FINANCIAL ECONOMICS

The Ph.D. program (and its accompanying fellowship support) provide the necessary training needed by our students to launch a promising career in academic finance. Towards this end the finance group has set up a series of requirements and milestones that must be met to help insure that students are making progress toward that career goal. It is important for everyone to understand that when a student's progress ceases, it is better for everyone concerned if that student leaves the Ph.D. program.

The requirements that have been set forth are quite difficult. Meeting them is a full-time job. Students should not be engaged in other types of employment (other than work as a research or teaching assistant) during their period of enrollment. Because of the difficulty in fulfilling these requirements, students should plan for them carefully. Where a requirement involves faculty approval, consultation with the relevant faculty should begin well in advance of deadlines. Students should seek out faculty they may wish to work with early in the process to ensure a smooth transition from one stage of the program to the next.

Courses

Students must take and pass at least twelve Ph.D. level courses, in total, to graduate. In the first year of the program students are required to take Financial Economics I (MGMT 7204). Students must also take Microeconomics I & II (ECON 5500; ECON 5501) and Econometrics I & II (ECON 5550; ECON 5551). Some students with limited math or economics backgrounds may be advised to postpone taking some of these courses until their second year in the program. In addition to Financial Economics I, students are also required to take the Ph.D. level courses offered by the Finance faculty. In the recent past this has included courses on Financial Econometrics, Financial Crises, Behavioral Finance, Household Finance, and Applied Empirical Methods. Availability and topic varies by year. Since most students take the qualifying exam in their second year, they are required to take the topics courses offered that year.

To be admitted to candidacy, a student must pass all required courses and must maintain at least an HP grade point average. Students who fail a required course may retake it once, and the grade of the second instance will replace the first on their transcript. The required courses are ECON 5500, ECON 5501, ECON 5550, ECON 5551, MGMT 7204, and the other Ph.D. courses offered by the finance faculty in the student's first two years of the program.

Students must also receive a grade of Honors in at least one full-year or two term-long graduate courses. Students must also satisfy the general program and graduate school grade requirements.

Seminar and Pre-Seminar Series

The finance seminar takes place every Friday from 11:10 to 12:30. Every week during the school year, a prominent academic speaker presents his or her latest work. Seminars allow both students and faculty to get an in-depth look at papers in progress and to see first-hand what elements strengthen or weaken a research piece. Seminars are also useful for generating new research ideas which can help students to formulate their dissertation topics. The pre-seminar takes place at a regularly scheduled date and time prior to the actual seminar. The only exceptions are the weeks when Yale students

are giving their "job talk." The pre-seminar is typically run by the member of the faculty who scheduled the regular seminar series that term. The pre-seminar's format is similar to that of the regular seminar series except that a student, rather than the paper's author, does the presentation. Attendance at both the seminar and pre-seminar is mandatory during a student's entire time at Yale but is not required for the degree.

The Finance Lunch Starting in their third year of the program, students should attend the Finance Lunch, which takes place every Tuesday and features presentations by Yale faculty and students. In the Finance Lunch, students in their third year or beyond are required to do one forty-minute presentation per term on their research. Students on the job market will do a full eighty-minute talk. Students in their first or second year of the program should attend the Finance Lunch if their schedules allow.

Qualifying Exam

The qualifying exam covers the Ph.D.-level finance courses taken in the two prior years of study. Unless given a waiver by the director of the finance Ph.D. program, students must take the qualifying exam before the last business day before June 15.

Format The qualifying exam is a closed book test. It will be either open-note or closed-note; this will be determined by the examining faculty in the spring of the year in which the exam is offered. If there is any other pertinent information about the exam, it will be provided by the finance Ph.D. program director at least four weeks before the exam.

Passing and Failing If a student fails the exam he or she may request to take it, at most, one more time. The makeup exam must be taken by the final business day before August 1st. However, if the student took the exam in their first year and failed, they may delay retaking it until June 15th after their second year. If the makeup exam is also failed, the student will be dismissed from the program. The format of the makeup exam will be identical to that of the original.

First- and Second-Year Papers

These papers are designed to help students begin the process of writing a dissertation by acquainting them with the recent literature in an area. In addition, these papers are meant to give students practice in the art of communicating their results. If you cannot clearly explain, in writing, what you have discovered, it does not matter what you have done. Nobody will read it, and thus nobody will know about it. Papers must meet the literary standards (with regard to both prose and grammar) required by the academic journals to pass. Both papers must be solo-authored, except in cases where a co-author is required in order to access the data needed for the project. These cases must be approved by the DGS.

First-Year Paper Students are required to write a research paper during the summer between their first and second year in the program. The topic of the first-year paper requires written approval by the faculty member acting as the student's adviser. The deadline to submit that approval to DGS is May 15th. An acceptable paper is a literature review that goes over several recent papers in an area, explains their relationship to each other, discusses one or more potential areas for original research, and provides at least some original analysis. Examples of what qualifies as original analysis include the reproduction of at least part of an empirical study on a new data set, or the extension of a theoretical paper along some lines. Of course, more ambitious works are welcome.

This paper is due by the second Monday in August and should be turned into the finance group's Ph.D. program director with a copy sent to the Ph.D registrar.

Second-Year Paper Students are required to write a research paper during the summer between their second and third years in the program. This paper should look more like a potential journal article than the first-year paper. It should include an abstract, an introduction, a main body, and a conclusion. The paper must include at least a preliminary analysis of some problem in finance. While this paper does not need to be as complete as a dissertation chapter, it must demonstrate an ability to identify and set out an agenda to solve an academically interesting problem. By May 15 the second-year paper proposal must be approved by a member of the finance faculty that has agreed to supervise the project. The paper itself is due by the second Monday in August and should be turned into the student's adviser with a copy sent to the Ph.D. registrar.

Papers that Receive a Failing Grade Students whose papers receive a failing grade may be dismissed from the program at the faculty's discretion. For those students that are allowed to continue in the program the deadline for the revised manuscript depends upon the paper's shortcomings.

- If a paper does not pass, due to the quality of the analysis, the student will have until the second Monday in October (of the same year in which the paper was submitted) to produce an acceptable manuscript.
- If a paper does not pass due to the quality of the writing, the student will be required to take an English composition class in the fall term. An acceptable draft of the paper must be turned in prior to the start of the following spring term.

Ph.D. Prospectus

The graduate school requires that, prior to the start of a student's fourth year in the program, he or she must produce a prospectus and line up a dissertation committee. *The finance group requires students to do this prior to the start of the spring term of their third year.* The prospectus provides an overview of the dissertation's first essay and should include at least a paragraph describing two other potential essays. Enough detail should be provided to convince the faculty that the first essay will be completed by the end of the calendar year and that a second essay will be nearly complete. The early deadline for the prospectus reflects the finance group's desire to ensure that students make progress towards their dissertation throughout their stay in the program. Most students are expected to seek an academic position during their fifth year in the program and complete their dissertation by the end of their fifth year.

Unless a dissertation committee is formed and a prospectus is approved by the spring of a student's third year, it is nearly impossible for him or her to finish in four years. The student's dissertation committee must have at least four members: three to act as readers and the dissertation adviser to act as chair. Dissertation advisers may not act as a reader. All four committee members must sign off on the prospectus. At least two members of the committee must be from the finance group unless a waiver is given by the finance group's Ph.D. program director. *If a student cannot form a committee prior to the start of the spring of their third academic year, the student cannot continue in the program.* Most dissertation committees have a primary adviser and two secondary advisers. The primary adviser is the person the student should turn to for most questions regarding their progress towards an acceptable dissertation and job

market strategies. Dissertation advisers play a critical role in a student's career. As such, students are strongly encouraged to seek out potential advisers early on as they progress through the program; the first year is not too early. Students may not remain in the program longer than seven years without the written permission of the DGS.

Dissertation

A typical dissertation contains three essays. They do not need to be that closely related. An acceptable thesis might be titled "Three Essays in Finance." Prior to final acceptance of the dissertation, students must pass a public defense. Before a public defense can be scheduled, all three members of the committee must agree that the student and the dissertation itself are ready. All members of the faculty are invited to a dissertation defense. After the defense, the faculty in attendance will meet to discuss the dissertation. The faculty may pass or fail the student. In addition they may grant a conditional pass. This is done when the faculty believe there are only some minor problems with the dissertation and delegate the final decision regarding these corrections to the committee. After the faculty pass on the dissertation (or the committee passes on the dissertation in the case of a conditional pass), the dissertation is submitted to the graduate school. The graduate school will assign readers who make a final acceptance on the dissertation. The reader assignment is governed by the graduate school; however, they usually assign the two secondary advisers and one other faculty member.

The "Job Market"

The job market for Ph.D. candidates seeking academic positions in finance takes place at the annual meetings of the Financial Management Association in October, and of the American Finance Association (AFA) in early January. Students wishing to interview at these meetings must mail "job market" packets to potential employers at least six weeks prior to the meetings. The packets consist of at least one finished essay and three letters of recommendation. Those seeking positions at the top-level universities interviewing at the AFAs should expect that some of the competition will arrive with two or more finished essays, one of which may have been accepted for publication. As a practical matter students cannot go on the job market unless their dissertation committee approves. As part of their preparation for the job market, students are expected to present their work at the Tuesday Finance Lunch in the fall of the year in which they are going on the market. Students should ask the chair of their dissertation committee for information regarding the scheduling of this seminar.

Critical Dates

Failing any item in *italics* will result in dismissal from the program.

First Year Students must take and pass Financial Economics I.

Summer of the First Year First-year papers are due by the second Monday in August. *Revised papers that did not initially pass due to the quality of the analysis are due the second Monday in October. Revised papers that did not pass due to issues related to writing quality are due prior to the start of the spring term.*

Second Year Students must take and pass the topics courses offered by the finance faculty. Students must take and pass the qualifying exam. This exam will be offered

about one month after the final topics class in that academic year. Students that fail the qualifying exam may, at the faculty's discretion, take a makeup exam about a month later. *To continue in the program, students must pass the qualifying exam, pass all the required courses, and keep an HP grade point average.* If a student fails a required course, they may retake it and the grade of the second instance will replace the first on their transcript.

Summer of the Second Year Second-year paper proposals are due and must be approved by a member of the faculty that has agreed to act as the project's supervisor by May 15. The paper itself is due by the second Monday in August. *Revised papers that did not initially pass due to the quality of the analysis are due the second Monday in October. Revised papers that did not pass due to issues related to writing quality are due prior to the start of the spring term.*

Spring of the Third Year Students must produce a thesis prospectus and line up a thesis committee by start of the spring term of their third year in the program. The committee must have at least three members and at least two members must be from the finance group. *Students that do not meet this deadline cannot continue in the program.*

Every Term while Enrolled Students must attend both the weekly seminar and pre-seminars.

SPECIAL REQUIREMENTS IN MARKETING (BEHAVIORAL)

Admission to the Ph.D. program in Behavioral Marketing is highly selective. We admit two to three of the most promising students annually from an impressive pool of applicants. Academic backgrounds of admitted students are typically in the behavioral sciences or the liberal arts, but we welcome applications from students with degrees in economics, statistics, computer science, mathematics, and engineering. We do not require graduate degrees for admission to the doctoral program.

The Marketing department at Yale is consistently rated as one of the most productive in the field. We have an excellent placement record for our doctoral students, many of whom have gone on to secure tenure-track positions at top research institutions including Harvard, Stanford, Northwestern, and Columbia. The behavioral marketing faculty at Yale are all research-active scholars who specialize in consumer behavior, behavioral economics, and judgment and decision-making. Many of the behavioral faculty have joint appointments in the departments of Psychology and Cognitive Sciences. Ph.D. students are not assigned to a primary adviser prior to admission and are free (and encouraged) to work with multiple faculty members. Research interests and recent publications for the behavioral faculty are provided on the faculty page.

Courses

Students are encouraged to complete their doctoral training within five years. Required coursework is commonly restricted to the first two years of study, while the remaining time is spent completing the dissertation. Students are required to pass twelve Ph.D.-level courses in their first two years. These include the following:

Three behavioral marketing core courses (MGMT 7301, Behavioral Decision-Making I: Choice; MGMT 7302, Behavioral Decision-Making II: Judgment; and MGMT 7304, Foundations of Behavioral Economics); two empirical methods courses that cover the topics of experimental design and statistics; one breadth course that covers the topic

of quantitative marketing; and six electives in behavioral sciences (example course subjects include social cognition, cognitive development, cognitive science of morality, foundations of neuroscience, cognitive science of pleasure, psychology of free will, or an independent study course).

Regular Activities

In order to remain in good standing, students are required to attend three seminar series regularly, including the weekly Ph.D. Research Workshop in Behavioral Marketing (Sprouts), the weekly Marketing Seminar series, the Ph.D. Pre-Workshop in Marketing (immediately prior to most weekly Marketing Seminars). Additionally, students are expected to meet regularly with their primary adviser and any collaborating faculty.

Qualifying Examinations

First-Year Paper and Presentation During their first year, students are expected to develop a project in collaboration with one or more faculty members. During the summer between the first and second year, students are required to write a ten- to twelve-page paper reporting this research, due September 1. Students are also required to give a thirty-minute research presentation summarizing this research in the fall semester of their second year.

Second-Year Paper and Presentation During the second year, students are expected to develop a more in-depth investigation (either an extension of their first year or a new line of work in a related area). Over the summer between the second and third year, students are required to write a paper of at least fifteen pages reporting this research, due September 1. This paper should include an extensive introduction that demonstrates mastery of the relevant literature. Students are also required to give a sixty-minute research presentation summarizing this research in the fall term of their third year. Assessment of the second-year paper and presentation serves as the qualifying exam for the advancement to the Ph.D. candidacy.

Dissertation

The dissertation typically consists of three essays which are completed in years three to five.

Dissertation Prospectus Prior to starting work on the dissertation, students submit a dissertation prospectus that consists of brief descriptions (one to two pages per essay) of the essays to be contained in the dissertation. At this stage, students must also finalize their dissertation committee consisting of the principal adviser and three other faculty members. The prospectus must be completed and accepted by the dissertation committee by the end of the student's third year.

Thesis Defense After completing the dissertation, students must defend it before their doctoral committee, other faculty members, and interested doctoral students. The faculty can accept the dissertation as is, require minor changes, or not accept the dissertation and ask the student to redo one or more essays. (The third result occurs very rarely.) If minor revisions have to be made, the student makes these revisions, gets

them approved by the principal adviser, and submits the dissertation to the graduate school.

Students should consult the graduate school calendar for the March and October deadlines to submit their dissertations for the May or December degrees.

Students may not remain in the program longer than six years unless they obtain permission for a seventh year from the DGS. Very rarely, students may request an eighth year of registration due to serious circumstances beyond their control that have prevented them from completing the dissertation by the end of the seventh year of study. Approval for an eighth year must come from the Dean of the Graduate School of Arts and Sciences. In either case, an Extended Registration Request Form must be submitted.

SPECIAL REQUIREMENTS IN MARKETING (QUANTITATIVE)

Courses

Students are required to pass twelve Ph.D.-level courses in their first two years of study: two microeconomics courses (ECON 5500 and ECON 5501); two empirical methods courses (ECON 5550 and ECON 5551); three depth courses in the student's primary area of study (including one behavioral marketing course); and five electives (examples of suitable electives include ECON 5520, ECON 5521, ECON 5527, ECON 5530, ECON 5531, ECON 5552, ECON 5553, ECON 5554, ECON 5555, ECON 5557, MGT 611, MGMT 7201, S&DS 5510, S&DS 5650).

These twelve courses have to be taken in the first two years. Students can take other courses not listed above as electives if their faculty adviser permits. The grade requirements are as follows: Students are expected to obtain at least two Honors grades and maintain a High Pass grade point average in ten of the twelve courses on the list. Off-list courses are not included when factoring grade point average.

Seminar Attendance

In addition to coursework, students must attend three seminar series regularly: the Ph.D. Workshop in Marketing, the Ph.D. Pre-Workshop in Marketing, and Quantitative Marketing Student Presentation Workshops. The first two seminars are held weekly. The Pre-Workshop consists of a discussion of the paper to be presented in the Ph.D. Workshop in Marketing that day. The discussion is led by a faculty member, and all the students are expected to participate in the discussion. Also, doctoral students make presentations in workshops arranged by the department. Marketing students are expected to attend all presentations made by marketing students and are encouraged to attend seminars in other areas.

Research Paper Requirements

Students are expected to complete an original research paper during the summer following their first year in the Ph.D. program. Students must select faculty advisers for their first-summer paper and work with them during the summer to develop their papers. These papers have to be presented in the PhD Workshop in Marketing (MGMT 781) during the fall of a student's second year. Students must turn in their paper within

a week of presentation and will be graded by the adviser. Please note that students must submit their paper to both their faculty advisor and the PhD Registrar.

Students are also expected to complete another original research paper in the summer following their second year in the program. Again, students select faculty advisers to assist them in writing their papers. These papers must be presented in the Ph.D. Workshop in Marketing (MGMT 7811) in a student's third year. Students must turn in their second-year paper by October 1 of their third year. If the paper does not pass, they may turn in a revised paper by February 1 of their third year. After that date, no further revisions will be considered.

While the primary goal of the first-summer paper is to introduce doctoral students to the world of academic research, the second-summer paper is expected to be comparable in quality with papers published in *Marketing Science*. The first- and second-summer papers could be co-authored with other students or faculty.

Qualifying Examinations

Students have to successfully complete the marketing qualifying examination at the end of their second year in the program. The exam is administered during the summer break. Student and faculty discuss to determine the exact date. The examination consists of two sections given over two days with each section administered as a closed-book, four-hour examination. The general section of the examination covers a variety of empirical and theoretical concepts within Marketing while the specialization section consists of questions relating to a single area of research which the student chooses in co-ordination with the marketing faculty.

The Qualifying exams receive a grade of either Pass, Unsatisfactory, or Fail. Students with a failing grade cannot retake the exam and will be dismissed from the program. Those receiving a grade of Unsatisfactory will be given one opportunity to retake the exam and must do so during August of the year in which the student first took the exam. Failure to earn a passing grade on either the first or second Qualifying exam will result in dismissal from the program.

Dissertation

The dissertation typically consists of three essays which are completed in years three to five. Prior to starting work on their dissertation, students have to write a dissertation prospectus which consists of brief descriptions (one-and-a-half pages per essay) of the essays to be contained in the dissertation. At this juncture, students must also finalize their dissertation committees, consisting of a principal adviser and three other faculty members. The prospectus must be completed and accepted by the dissertation committee by the end of the student's third year.

After a dissertation is complete, students must defend it before their committee, other faculty members, and interested doctoral students. The faculty can accept the dissertation as is, require minor changes (e.g., a more complete bibliography or better writing of the introduction), or not accept the dissertation and ask the student to redo one or more essays.

Students should consult the graduate school calendar for the March and October deadlines to submit their dissertations for the May or December degrees.

Students may not remain in the program longer than six years without written permission of the DGS.

SPECIAL REQUIREMENTS IN OPERATIONS

Admitted students must satisfy six program requirements: (1) twelve courses, (2) a first-year paper, (3) a general exam, (4) operations seminar participation, (5) a dissertation prospectus, and (6) a dissertation. A grade point average of High Pass (HP) must be maintained. Students must also comply with all other rules of the graduate school and of the Yale School of Management Doctoral program. On average, students will need five years to complete these requirements.

Courses

All students must pass at least twelve courses:

- three core courses (MGT 611, Policy Modeling, (MGMT 7401, Models of Operations Research and Management; and MGMT 7403, Modeling Operational Processes),
- five required methods courses (S&DS 5410, Probability Theory; S&DS 5510, Stochastic Processes; S&DS 5420, Theory of Statistics; S&DS 4310, Optimization and Computation; and ECON 5501, General Economic Theory: Microeconomics), and
- four elective courses scheduled upon approval by the student's course adviser.

Typically, all of these courses are completed in the first two years of the program. Under unusual circumstances and with the approval of both their adviser and the DGS, students may fulfill some of the methods course requirements with alternative offerings.

First-Year Paper

During the summer after the first year of coursework, students will work with an operations faculty member on an ongoing research project. By September 30, the students should prepare written reports on their work and prepare presentations on this work for the operations group internal seminar. Continuation in the program is contingent upon the faculty's approval of the report.

General Exam

The General Exam has two components: a coursework exam, based upon the coursework of the first two years, and a second-year research paper. The coursework exam will be scheduled by faculty sometime after the last day of exams of the spring term and prior to June 16. After the coursework exam, students will be provided with a list of research topics by the operations faculty and must choose to work on one of these or, with the approval of the faculty, a topic of their own choosing, with the aim of delivering a paper by September 30. Faculty will evaluate a student's continued enrollment in the program based upon course grades, the coursework exam, and the second-year paper. In rare exceptions, students who do not pass the exam will, at the

discretion of the faculty, be offered a chance for remediation sometime prior to the end of the fall term.

Operations Seminar

Approximately every other week, leading operations scholars will visit to present their latest research. Doctoral students will meet with Operations faculty prior to these seminars to review the papers and related literature. Participation in this seminar is required throughout the program.

Dissertation

No later than the end of their third summer in the program, students must submit a prospectus for their dissertation as an application to doctoral candidacy. Based upon this proposal and a student's previous performance, the faculty will decide whether to admit the student to candidacy. Submission and approval of a completed dissertation will follow the policies of the graduate school. Students failing to complete their dissertation within six years of advancing into candidacy will be dropped from the program.

SPECIAL REQUIREMENTS IN ORGANIZATIONS AND MANAGEMENT

The Yale Organizations and Management doctoral program is designed to prepare individuals for faculty positions in organizational behavior, management, and strategic management at research-oriented business schools. It is unique in its multi-disciplinary orientation, introducing students to psychological, sociological, and economic perspectives both on the internal dynamics of organizations and on how organizations interact with their environments, as well as in the depth of its training in empirical methods. The Yale Organizations and Management program is small, ensuring that each student receives ample faculty attention, and is highly flexible, allowing the program to be tailored to each student's interests. Upon admission, each student will be assigned to a faculty adviser who will help the student to design an individualized program that prepares the student well for doing research in his or her area of interest.

Students in the Ph.D. program in Organizations and Management must satisfy five requirements: (1) pass twelve courses, (2) seminar and workshop participation, (3) a first-year paper, (4) a second-year paper/qualifying exam, and (5) a dissertation (usually consisting of three journal-quality papers). Students must also comply with all other rules of the graduate school and of the Yale SOM doctoral program.

Courses

All students must pass twelve courses: two methods courses (PLSC 5030 and PLSC 5000; or ECON 5550 and ECON 5551; or, students who believe they will primarily do experimental research may take PLSC 5030 and a methods course in psychology such as PSYC 5180 for ECON 5551); four depth courses (MGMT 7502, MGMT 7504, MGMT 7505, MGMT 7507); four social science courses in psychology or sociology (e.g., PSYC 5050, PSYC 5090, SOCY 7250, SOCY 7029); one breadth course outside the student's area of study, chosen in consultation with the student's adviser; and at least one additional elective chosen in consultation with the adviser.

Seminars and Workshops

Organizations and Management Seminar Roughly every other week, the area invites world-class scholars to present their research to Yale faculty and students. Doctoral students are expected to attend these seminars in every term of the program. Prior to the seminar, students will meet with one of the faculty members to discuss the paper being presented.

MGMT 7501, Organizational Behavior in Development (OBID) Ph.D. students, in each term of the program, are required to regularly attend this weekly internal brown-bag seminar series. The seminar is jointly taught by the Organizations and Management faculty doing research with large-scale (usually archival) data sets, behavioral experiments, or qualitative data. These meetings provide a venue for the discussion of study design, research methods, the interpretation of research results, the crafting of papers, and important published research. Beginning in their third year, students are also expected to present in the seminar once per year.

Research Papers and Qualifying Exam

First-Year Paper In the summer between their first and second year in the program, each student must collaborate on a research paper together with a faculty member in the SOM Organizational Behavior group. The idea for this paper may originate with either the student or the faculty member. In either case, an initial draft of the paper must be completed by September 30 of their second year, and the completed paper must be approved by two faculty members and submitted by 5 p.m. of the last day of classes of their fall term, and a copy must be emailed to the Ph.D. registrar. Students will present these co-authored papers in the OBID Workshop in the fall of the second year. Generally, these papers will be submitted to journals and will result in publications prior to the end of a student's time in the program.

Second-Year Paper (Qualifying Exam) In the summer between their second and third year in the program, each student must work on a research paper under the guidance of a faculty member in the SOM Organizational Behavior group. The idea for this paper must originate with the student, though the faculty member may assist in developing the paper for publication. An initial draft of the paper must be completed and submitted by 5 p.m. of the last business day in October of their third year, and a copy must be sent to the Ph.D. registrar. Students will present these papers in the OBID Workshop in their third year. The expectation is that these papers will be submitted to journals.

The second-year paper is considered the qualifying exam and will be vetted by both the Organizations and Management faculty and the DGS. If a student receives a failing grade on their second-year paper, they have ninety days from the date they are notified to submit a passing paper.

Dissertation

Admission to Candidacy Once students have completed their coursework and first- and second-year papers, they may apply for admission to candidacy. As part of this application, students must submit a proposal for their planned dissertation. Admission to candidacy depends on a comprehensive review of the student's performance by the

faculty; completion of the requirements listed above does not guarantee admission. Students must be admitted to candidacy prior to their fourth year in the program. In order to give the faculty enough time to review the prospectus, admission to candidacy paperwork is due to the student's adviser by August 1 before submission to the Doctoral Program registrar.

By the fall of year three, students should propose ideas for their dissertation and form a four-person dissertation committee to advise this research. The dissertation committee's chair must come from the School of Management's Organizations and Management ladder-rank faculty. Students will generally present progress on these papers in the Ph.D. Student Research Workshop on an annual basis.

JOINT J.D./PH.D. IN FINANCE

Students in the joint J.D./Ph.D. in Finance program must meet the following requirements:

Course Requirements, Ph.D. Eight courses, including the following five required courses: ECON 5500; ECON 5501; ECON 5550 and ECON 5551; MGMT 7204 and two additional Ph.D.-level finance courses. Upon reaching the Ph.D. candidacy, students are required to attend MGMT 7821 and MGMT 7820.

Course Requirements, J.D. 71 credit units at Yale Law School, including the required first-term courses taken in one term (Contracts, Constitutional Law, Criminal Law and Administration, and Procedure), Torts and Regulation, a course satisfying the legal ethics requirement, Business Organizations, and six credit units satisfying the experiential learning requirement.

Predissertation Writing Requirements (1) A paper fulfilling the Ph.D. second-year research paper requirement, and (2) a paper fulfilling one of the J.D. writing requirements (substantial or supervised analytic writing). Note: an accepted Ph.D. second-year research paper will fulfill the student's remaining J.D. paper requirement by registration for independent research credit with the student's law school faculty adviser. One of these papers must qualify as the student's prospectus.

Qualifying Examination in Finance The qualifying exam is in three courses: the section of the qualifying exam pertaining to MGMT 7204 and two additional doctoral finance courses. The qualifying exam is taken after the student has completed all required graduate finance courses.

MASTER'S DEGREES

M.Phil. A student who is admitted to candidacy will be eligible to receive the M.Phil. upon the recommendation of the program's faculty and the approval of the graduate school.

M.A. Applications for a terminal master's degree are not accepted. The M.A. degree is awarded only to students not continuing in the Ph.D. program. The student must complete eight graduate-level term courses approved for credit in their program and maintain an average grade of High Pass. Students who are eligible for or who have already received the M.Phil. will not be awarded the M.A.

Program materials are available upon request to the Director of Graduate Studies, Management, Yale University, PO Box 208200, New Haven CT 06520-8200. For

information on the M.B.A. degree, please contact the admissions office at the School of Management.

COURSES

MGMT 521a / ECON 7728a, Workshop: International Trade Staff
Workshop/seminar for presentations and discussion on topics in the field of international trade.

MGMT 7090a, Independent Reading and Research Staff
By arrangement with individual faculty.

MGMT 7103a, Seminar in Accounting Research III Frank Zhang
Study of empirical accounting research that covers topics such as valuation, pricing of accounting information, earnings management, reporting issues, accounting regulation, analyst forecasts, and auditing.

MGMT 7204a / ECON 6670a, Financial Economics I Stefano Giglio
Current issues in theoretical financial economics are addressed through the study of current papers. Focuses on the development of the problem-solving skills essential for research in this area.

MGMT 7206a / ECON 6677a, Financial Econometrics and Machine Learning Bryan Kelly
This course, taught in the first half of the term, provides a theoretical treatment of major topics in corporate finance and banking, including: capital structure; incomplete contract and ownership; agency theory, information, and financial contracting; corporate finance and financial market; banking and intermediaries; and recent topics relating to financial crises. Economics Ph.D. students need to take both this course and Empirical Corporate Finance (ECON 676/MGMT 748) to obtain credit; then, together, they will be counted as one credit. ½ Course cr

MGMT 7215a, Corporate Finance Kelly Shue
This course surveys corporate finance research, including both classic topics and more recent developments in this broad literature. Typically, a class session provides background and context for a given topic and talks about several papers in detail. Major topics covered include corporate capital structure, banking, corporate governance, executive compensation, merger acquisitions, entrepreneurial finance, private equity, corporate innovation, and behavioral corporate finance. This course is designed for Ph.D. students in finance, economics, accounting, and other related fields.

MGMT 7302a / PSYC 5540a, Behavioral Decision-Making II: Judgment Ravi Dhar and Nathan Novemsky
This seminar examines research on the psychology of judgment. We focus on identifying factors that influence various judgments and compare them to which factors individuals want and expect to drive their judgments. Topics of discussion include judgment heuristics and biases, confidence and calibration, issues of well-being including predictions and experiences, regret and counterfactuals. The goal is threefold: to foster a critical appreciation of existing research on individual judgment, to develop the students' skills in identifying and testing interesting research ideas, and to explore research opportunities for adding to existing knowledge. Students generally enroll from a variety of disciplines, including cognitive and social psychology, behavioral economics, finance, marketing, political science, medicine, and public health.

MGMT 7303a, Designing and Conducting Experimental Research Gal Zauberman
This course discusses how to effectively generate, design, evaluate, report, and present behavioral research. Topics include theory development, idea generation, increasing statistical power, internal vs. external validity, between vs. within-subjects designs, psychological measurement, survey research methods, the publication process, writing high-quality abstracts and journal articles, and presenting research findings. This course offers a very practical, learning-by-doing approach. In addition to discussing the weekly readings, class sessions offer students ample opportunity to practice generating appropriate and effective experimental designs, generating high-quality survey questions, critiquing and reviewing existing research, and presenting research findings. This course is primarily for Ph.D. students intent on pursuing an academic career conducting behavioral research in psychology, marketing, organizational behavior, or a related field.

MGMT 7403a, Modeling Operational Processes Nils Rudi
This course covers analytical tools and topics that have not been discussed in previous operations doctoral courses at Yale SOM. The emphasis is on approaches to modeling and analyzing operational processes across various application areas, including supply chains, service operations, retail operations, platform operations, and sustainable operations. Students will explore key ideas and methodologies established in the literature of Operations Research and Operations Management, understand the contexts in which certain conventions have been developed, and learn how to build effective mathematical models.

MGMT 7505a, Designing Social Research Minjae Kim
This is a course in the design of social research. The goal of research design is "to ensure that the evidence obtained enables us to answer the initial [research] question as unambiguously as possible" (de Vaus 2001: 9). A good research design presupposes a well-specified (and hopefully interesting) research question. This question can be stimulated by a theoretical puzzle, an empirical mystery, or a policy problem. With the research question in hand, the next step is to develop a strategy for gathering the empirical evidence that will allow you to answer the question "as unambiguously as possible."

MGMT 7810a, Accounting Doctoral Student Pre-Seminar Thomas Steffen
Accounting Doctoral Student Pre-Seminar 0 Course cr

MGMT 7811a, Accounting Seminar Thomas Steffen
Accounting Seminar 0 Course cr

MGMT 7820a, Finance Doctoral Student Pre-Seminar Christopher Clayton
Accounting doctoral student pre-seminar.

MGMT 7821a, Finance Seminar Christopher Clayton
Finance seminar.

MGMT 7830a, Marketing Doctoral Student Pre-Seminar Tong Wang
Marketing doctoral student pre-seminar.

MGMT 7831a, Marketing Seminar Tong Wang
Marketing seminar.

MGMT 7840a, Operations Doctoral Student Pre-Seminar Faidra Monachou
Operations doctoral student pre-seminar.

MGMT 7841a, Operations Seminar Faidra Monachou
Operations seminar.

MGMT 7850a, Organizations and Management Doctoral Student Pre-Seminar Staff
Organizations and Management doctoral student pre-seminar.

MGMT 7851a, Organizations and Management Seminar Staff
Organizations and Management seminar.

Materials Science

Becton Center, 203.432.4255
https://engineering.yale.edu/materials-science
M.Phil., Ph.D.

Chair
Charles Ahn

Director of Graduate Studies
Liangbing Hu (liangbing.hu@yale.edu)

Professors Charles Ahn,† Gary Brudvig,* Liangbing Hu,† Sohrab Ismail-Beigi,† Corey O'Hern,* Vidvuds Ozolins,† W. Mark Saltzman,* Jan Schroers,† Udo Schwarz,* Hailiang Wang,* Fengnian Xia*

Associate Professors Rebecca Kramer-Bottiglio,* Madhusudhan Venkadesan,* Mingjiang Zhong*

Assistant Professors Amir Pahlavan,* Diana Qiu, Cong Su

* A secondary appointment with primary affiliation in another department or school.

† A joint appointment with another department.

FIELDS OF STUDY

Quantum and low dimensional materials; energy materials; soft, polymer, and bio materials; electronic and optical materials; metals, ceramics, and structural materials; and computational materials science.

INTEGRATED GRADUATE PROGRAM IN PHYSICAL AND ENGINEERING BIOLOGY (PEB)

Students applying to the Ph.D. program in materials science may also apply to be part of the PEB program. See the description under Non-Degree-Granting Programs, Councils, and Research Institutes for course requirements and http://peb.yale.edu for more information about the benefits of this program and application instructions.

QUANTUM MATERIALS SCIENCE AND ENGINEERING (QMSE)

Students applying to the Ph.D. program in materials science may also apply to be part of the QMSE program. See the description under Non-Degree-Granting Programs, Councils, and Research Institutes for course requirements.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Students must complete at least nine graduate-level courses of one credit each. Two of the courses must in an area outside the specific field of study relating to the subject of the dissertation, as judged by the research adviser and approved by the director of graduate studies (DGS). Courses such as Dissertation Research, Master's Thesis, or Seminar do not count towards the nine-course requirement, but up to two terms of

Special Investigation are acceptable. Courses counted toward the nine-course unit minimum must be full-credit graduate courses with clear technical, scientific, or mathematical focus that are related to materials science in the judgment of the first-year adviser or research adviser and the DGS.

Due to the interdisciplinary nature of the department, the detailed program of study for each student is determined in consultation with the student's first-year adviser (or research Adviser after the first year). Students are expected to take three to four graduate courses in each semester of their first year, including three core classes selected from the core requirements listed below. The remaining elective course requirements must be complete by the end of the second year unless an exception is approved by the DGS. Course selections are approved by the DGS, in consultation with the student's adviser.

The core courses will cover foundational materials science topics from a selection of a minimum of three out of six of the following areas:

- Thermodynamics of materials
- Kinetics and phase transformations
- At least one graduate-level math course
- Materials characterization techniques
- Materials synthesis and processing
- Materials theory and modeling

Students are required to take two terms of Special Investigations in their first year. The choice of Ph.D. adviser will normally be finalized at the end of the first year when feedback is given on the Special Investigation, after which students will be funded by their adviser or through external fellowships.

After completing coursework, the next step toward a degree is admission to candidacy, indicating that the student is prepared to do original and independent research. To be admitted to candidacy, students must submit a written research prospectus and pass an area examination by the end of the first semester of the third academic year. If a student has faced unusual circumstances, this deadline can be extended, with the support of the research adviser and approval of the DGS.

The culmination of the program will be original, publishable research presented as a doctoral dissertation. The dissertation defense will include a public seminar and a closed examination by the Dissertation Committee. The dissertation must report original research in an area of materials science, as judged by the faculty of the department, and demonstrate creative thought and scholarly achievement by the student. There is no foreign language requirement.

Teaching experience is regarded as an integral part of the graduate training program at Yale University, and all materials science graduate students are required to serve as teaching fellows for two terms, typically during years two and three. Teaching duties normally involve assisting in laboratories or discussion sections and grading papers. Teaching duties are not expected to require more than ten hours per week. Students are not permitted to teach during the first year of study.

If a student was admitted to the program having earned a score of less than 26 on the Speaking section of the Internet-based TOEFL, the student will be required to take and English as a Second Language (ESL) course each term at Yale until the graduate school's Oral English Proficiency Standard has been met. This must be achieved by the end of the third year for the student to remain in good standing.

HONORS REQUIREMENT

In order to remain in good standing in the program, students are expected to make steady progress in meeting their course requirements and to obtain Honors grades in at least two full-term courses by the end of their fourth term of full-time study. Courses such as Master's Thesis, seminars, or Special Investigations cannot be used to fulfill the requirement for two Honors grades. An extension may be granted on a case-by-case basis at the discretion of the DGS, in consultation with the student's adviser. Students are also expected to maintain an average grade of High Pass during their time at Yale, following the averaging methodology determined by the graduate school.

MASTER'S DEGREES

M.Phil. See Degree Requirements under Policies and Regulations.

M.S. Doctoral students who withdraw from the Ph.D. program may be eligible to receive the M.S. if they have not already received the M.Phil. and have met the following requirements: successful completion of eight full-credit graduate courses (not seminars), no more than two of which may be Special Investigations; an average grade of at least High Pass; and at least one grade of Honors.

Mathematics

219 Prospect St
http://math.yale.edu
M.S., M.Phil., Ph.D.

Chair
Wilhelm Schlag

Director of Graduate Studies
Ivan Loseu

Professors Richard Beals (*Emeritus*), Jeffrey Brock, Andrew Casson (*Emeritus*), Ronald Coifman, Igor Frenkel, Howard Garland (*Emeritus*), Alexander Goncharov, Roger Howe (*Emeritus*), Peter Jones, Richard Kenyon, Ivan Loseu, Gregory Margulis (*Emeritus*), Yair Minsky, Vincent Moncrief (*Physics*), Andrew Neitzke, Hee Oh, Nicholas Read (*Physics*; *Applied Physics*), Vladimir Rokhlin (*Computer Science*), Wilhelm Schlag, John Schotland, George Seligman (*Emeritus*), Charles Smart, Daniel Spielman (*Computer Science*), Van Vu, Lu Wang, John Wettlaufer (*Earth and Planetary Sciences*; *Physics*), Gregg Zuckerman (*Emeritus*)

Assistant Professor Junliang Shen

FIELDS OF STUDY

Fields include real analysis, complex analysis, functional analysis, classical and modern harmonic analysis; linear and nonlinear partial differential equations; dynamical systems and ergodic theory; probability; random matrix theory, Kleinian groups, low dimensional topology and geometry; differential geometry; finite and infinite groups; geometric group theory; finite and infinite dimensional Lie algebras, Lie groups, and discrete subgroups; representation theory; automorphic forms, L-functions; Langlands program; algebraic number theory and algebraic geometry; mathematical physics, relativity; numerical analysis; probabilistic combinatorics; additive combinatorics; and spectral graph theory.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

In order to qualify for the Mathematics Ph.D., all students are required to:

1. complete eight term courses at the graduate level, at least two with Honors grades, and achieve an HP average in coursework required towards the Ph.D.
2. pass qualifying examinations on their general mathematical knowledge;
3. submit a dissertation prospectus;
4. participate in the instruction of undergraduates;
5. be in residence for at least three years; and
6. complete a dissertation that clearly advances understanding of the subject it considers.

All students must also complete any other Graduate School of Arts and Sciences degree requirements; see Degree Requirements under Policies and Regulations.

The normal time for completion of the Ph.D. program is five years. Requirement (1) normally includes basic courses in algebra, analysis, and topology. A sequence of

three qualifying examinations (algebra and number theory, real and complex analysis, topology) is offered each term. All qualifying examinations must be passed by the end of the second year. There is no limit to the number of times that students can take the exams, and so they are encouraged to take them as soon as possible.

The dissertation prospectus should be submitted during the third year.

The thesis is expected to be independent work, done under the guidance of an adviser. This adviser should be contacted not long after the student passes the qualifying examinations. A student is admitted to candidacy after completing requirements (1)–(5) and obtaining an adviser.

In addition to all other requirements, students must successfully complete MATH 9910, Ethical Conduct of Research, prior to the end of their first year of study. This requirement must be met prior to registering for a second year of study.

HONORS REQUIREMENT

Students must meet the Graduate School's Honors requirement by the end of the fourth term of full-time study.

TEACHING

Teaching experience is integral to graduate education at Yale. Therefore, teaching is required of all graduate students, typically one term per year. Generally, first-year students work as coaches for calculus classes, meeting with small discussion sections of undergraduates. Second-year students often work as teaching assistants for a linear algebra class (MATH 2220, MATH 2250, or MATH 2260), real analysis (MATH 2550 or MATH 2560), or discrete mathematics (MATH 2440); duties usually include holding office hours or leading discussion sections.

In the spring of their second year, graduate students attend the Lang Teaching Seminar (MATH 8270). In this lunch seminar, experienced faculty help students understand the challenges of teaching and prepare students to lead their own section of calculus in the following year and beyond.

Students who require additional support from the graduate school after the fifth year of study must teach additional terms, if needed.

MASTER'S DEGREES

M.Phil. The M.Phil. is the only degree conferred en route to the Ph.D. For the full requirements, see Degree Requirements under Policies and Regulations.

M.S. Students who withdraw from the Ph.D. program may be eligible to receive the M.S. degree if they have met the requirements and have not already received the M.Phil. degree. For the M.S., students must successfully complete six term courses with at least one Honors grade, perform adequately on the general qualifying examination, and be in residence at least one year.

COURSES

MATH 5000a, Algebra Ivan Loseu
The course serves as an introduction to commutative algebra and category theory. Topics include commutative rings, their ideals and modules, Noetherian rings

and modules, constructions with rings such as localization and integral extension, connections to algebraic geometry, categories, functors and functor morphisms, tensor product and Hom functors, and projective modules. Other topics may be discussed at the instructor's discretion. Prerequisites: MATH 350 and MATH 370.

MATH 5200a, Measure Theory and Integration Sebastian Hurtado - Salazar
Construction and limit theorems for measures and integrals on general spaces; product measures; Lp spaces; integral representation of linear functionals.

MATH 5260a, Introduction to Differentiable Manifolds Lu Wang
This is an introduction to the general theory of smooth manifolds, developing tools for use elsewhere in mathematics. A rough plan of topics (with the later ones as time permits) includes (1) manifolds, tangent spaces, vector fields and flows; (2) natural examples, submanifolds, quotient manifolds, fibrations, foliations; (3) vector and tensor bundles, differential forms; (4) Lie derivatives, Lie algebras and groups; (5) embedding, immersions and transversality; (6) Sard's theorem, degree and intersection. Prerequisites: some multivariable calculus, linear algebra, and topology.

MATH 5440a, Introduction to Algebraic Topology Yair Minsky
This is a one-term graduate introductory course in algebraic topology. We discuss algebraic and combinatorial tools used by topologists to encode information about topological spaces. Broadly speaking, we study the fundamental group of a space, its homology, and its cohomology. While focusing on the basic properties of these invariants, methods of computation, and many examples, we also see applications toward proving classical results. These include the Brouwer fixed-point theorem, the Jordan curve theorem, Poincaré duality, and others. The main text is Allen Hatcher's *Algebraic Topology,* which is available for free on his website.

MATH 6140a, Complex Algebraic Geometry Alexander Goncharov
When we work over the complex numbers C, smooth projective algebraic varieties are naturally compact Kähler manifolds with integral Kähler classes. The cohomology of these manifolds carry so-called Hodge structures which are powerful tools in understanding their geometry and topology. The purpose of this course is to systematically develop Hodge theory for Kähler manifolds and to discuss its consequences in algebraic geometry. This course is parallel to the course MATH 619, Foundations in Algebraic Geometry, which has emphasis on scheme theory. The minimal prerequisites are MATH 315, Intermediate Complex Analysis, and MATH 526, Introduction to Differentiable Manifolds. We assume comfort with point set topology, calculus on manifolds, and functions with complex variables. Familiarity with the basics of category theory, homological algebra, and algebraic topology is also useful but is reviewed or relegated to exercises as needed.

MATH 6270a, Probability Theory Michail Louvaris
Probability theory concerns rigorous definition and study of random phenomena. Besides being an engaging field of study by itself, or serving as a basis for statistics and other applications, it touches on many parts of Mathematics, such as analysis, combinatorics, statistical mechanics, dynamics, etc. It is also important for mathematical understanding of Physics. The interplay between probability theory and other fields of study has growing influence on the most recent ideas and developments of research. The aim of this course is to deepen probabilistic education and to prepare for work in the areas of Mathematics related to probability theory. The main topics

covered include (time permitting): axiomatic approach and introduction to random structures, limit theorems, random walks and martingales, random point processes, stochastic processes, Brownian motion and basics of Ito calculus, Markov chains and diffusions, introduction to random matrices and to statistical mechanics. Prerequisite: A course in probability or in measure theory, equivalent to Math 241, Math 320, or Math 330. Some knowledge of measure theory and probabilistic intuition will be assumed.

MATH 6400b / AMTH 640b / CPSC 6400b, Topics in Numerical Computation
Vladimir Rokhlin
This course discusses several areas of numerical computing that often cause difficulties to non-numericists, from the ever-present issue of condition numbers and ill-posedness to the algorithms of numerical linear algebra to the reliability of numerical software. The course also provides a brief introduction to "fast" algorithms and their interactions with modern hardware environments. The course is addressed to Computer Science graduate students who do not necessarily specialize in numerical computation; it assumes the understanding of calculus and linear algebra and familiarity with (or willingness to learn) either C or FORTRAN. Its purpose is to prepare students for using elementary numerical techniques when and if the need arises.

MATH 6750a / AMTH 6750a, Numerical Methods for Partial Differential Equations
Vladimir Rokhlin
(1) Review of the classical qualitative theory of ODEs; (2) Cauchy problem. Elementary numerical methods: Euler, Runge-Kutta, predictor-corrector. Stiff systems of ODEs: definition and associated difficulties, implicit Euler, Crank-Nicolson, barrier theorems. Richardson extrapolation and deferred corrections; (3) Boundary value problems. Elementary theory: finite differences, finite elements, abstract formulation and related spaces, integral formulations and associated numerical tools, nonlinear problems; (4) Partial differential equations (PDEs). Introduction: counterexamples, Cauchy–Kowalevski theorem, classification of second-order PDEs, separation of variables; (5) Numerical methods for elliptic PDEs. Finite differences, finite elements, Richardson and deferred corrections, Lippmann–Schwinger equation and associated numerical tools, classical potential theory, "fast" algorithms; (6) Numerical methods for parabolic PDEs. Finite differences, finite elements, Richardson and deferred corrections, integral formulations and related numerical tools; (7) Numerical methods for hyperbolic PDEs. Finite differences, finite elements, Richardson and deferred corrections, time-invariant problems and Fourier transform.

MATH 6810a, Working Seminar on Harmonic Analysis and PDEs Wilhelm Schlag
This seminar complements MATH 680 (Fourier Analysis and PDE). This seminar continues with an exploration of topics in harmonic analysis relevant to PDEs that was started in the fall. Topics include the paradifferential calculus and its applications to nonlinear evolution PDEs. The participants are expected to give presentations on topics that come up in the course. Prerequisite: knowledge of basic harmonic analysis such as the Calderon-Zygmund and Littlewood-Paley theorems. Prerequisites for undergrads: the student should have taken multivariable calculus, MATH 305 and 325. Exposure to complex analysis is recommended as well.

MATH 7120a / ECE 9100a, Topics in Denoising and Structure Recovery from Data
Boris Landa
Recovering signals and underlying structure from noisy observations is a fundamental problem in many areas of science and engineering. Over the past few decades, a

rich body of work has emerged to address this challenge across diverse settings. A common guiding principle is to leverage structural assumptions—such as smoothness, sparsity, or low-rankness in the data—alongside models of the noise to enable effective recovery. This course explores both classical and modern approaches to denoising and structural data recovery, blending theoretical foundations with algorithmic and applied perspectives. Particular emphasis is placed on high-dimensional regimes relevant to modern data analysis, where noise can behave in counterintuitive ways, yet also exhibit predictable patterns that can be exploited for denoising. The course introduces tools and results from high-dimensional probability and random matrix theory that underpin many recent advances in this area.

MATH 7350a, Microlocal Analysis Ruoyu Wang
Microlocal analysis is a geometric theory of distributions as solutions of PDE on manifolds. Those distributions have structured singularities that are not only localized in space, but also in momentum, thus a theory based on cotangent bundles is needed. In this course, we develop the microlocal tools involving pseudodifferential calculus, elliptic regularity, propagation of singularity, and radial point estimates, and see how practically they are used in the study of hyperbolic PDE and dynamical systems.

MATH 7400a, Random Schrödinger Operators Charles Smart
An introductory course on the mathematics of Anderson localization.

MATH 7450a, Introduction to Geometric Langlands Sam Raskin
This course is an introduction to geometric Langlands. One main theme is understanding Drinfeld's construction of an eigensheaf for GL_2. We introduce the Langlands program generally, transition to the geometric theory, and focus on examples and construction, particularly emphasizing Whittaker/Fourier coefficients.

MATH 7460a / ASTR 7460a / PHYS 7460a, Global Properties of Nonlinear Relativistic Fields Vincent Moncrief
Many relativistic field equations of interest in mathematical physics, astrophysics and cosmology are intrinsically nonlinear. Notable examples are various nonlinear wave equations, the Maxwell-Klein-Gordon equations, the Yang-Mills-Higgs equations and the Einstein field equations of general relativity. Techniques for analyzing their global solutions on various manifolds include (higher order) energy estimates and so-called light-cone estimates. An interesting question for the Einstein equations is whether the so-called "cosmological principle," according to which only the very special manifolds admitting (spatially) homogeneous and isotropic metrics need be considered for cosmology, is firmly established or whether this principle can be relaxed to allow for much more general manifolds and still be consistent with observations. Another issue is how the Thurston geometrization theorem, established by Hamilton and Perlman via Ricci flow, relates to the "cosmic censorship conjecture" of Roger Penrose, often regarded as the main open mathematical problem of general relativity.

MATH 7810a, Working Seminar on Homogeneous Dynamics and Geometry Hee Oh
We discuss various topics in homogeneous dynamics.

MATH 8270b, Lang Teaching Seminar Brett Smith and Bailey Heath
This course prepares graduate students for teaching calculus classes. It is a mix of theory and practice, with topics such as preparing classes, presenting new concepts, choosing examples, encouraging student participation, grading fairly and effectively,

implementing active learning strategies, and giving and receiving feedback. Open only to mathematics graduate students in their second year.

MATH 8650a / AMTH 8650a, Inverse Problems John Schotland
This is a course on inverse problems and their applications in imaging. The prototypical problem we consider is to recover the coefficients of a partial differential equation from boundary measurements of its solutions. The fundamental theoretical questions concern the uniqueness, stability, and reconstruction of the coefficients. This is a vast subject, and we are only able to discuss a few of its important aspects. These include: the Radon transform and other ray transforms, the Calderón problem and related problems for elliptic equations, inverse transport problems and optical tomography, and the Gelfand problem and related problems for hyperbolic equations. The necessary tools from partial differential equations, differential geometry, and microlocal analysis are developed as needed. Prerequisite: Real and functional analysis. Some exposure to partial differential equations would be useful but is not essential.

MATH 9910a / CPSC 9910a, Ethical Conduct of Research Yoehan Oh
This course forms a vital part of research ethics training, aiming to instill moral research codes in graduate students of computer science, math, and applied math. By delving into case studies and real-life examples related to research misconduct, students grasp core ethical principles in research and academia. The course also offers an opportunity to explore the societal impacts of research in computer science, math, and applied math. This course is designed specifically for first-year graduate students in computer science, applied math, and math. Successful completion of the course necessitates in-person attendance on eight occasions; virtual participation does not fulfill this requirement. In cases where illness, job interviews, or unforeseen circumstances prevent attendance, makeup sessions are offered. o Course cr

Mechanical Engineering

17 Hillhouse Avenue, 203.432.4220
M.S., M.Phil., Ph.D.

Chair
Corey O'Hern

Director of Graduate Studies
Jan Schroers (jan.schroers@yale.edu)

Professors Charles Ahn,* Ira Bernstein (*Emeritus*), Juan Fernández de la Mora, Aaron Dollar, Alessandro Gomez, Sohrab Ismail-Beigi,† Shun-Ichiro Karato,† Marshall Long (*Emeritus*), Corey O'Hern, Vidvuds Ozolins,† Brian Scassellati,† Jan Schroers, Udo Schwarz, Mitchell Smooke

Associate Professors Rebecca Kramer-Bottiglio, Madhusudhan Venkadesan

Assistant Professors Ian Abraham, Yimin Luo, Amir Pahlavan, Bauyrzhan Primkulov, Daniel Wiznia†

Senior Lecturer Beth Anne Bennett

Lecturers Lawrence Wilen, Joseph Zinter

* A joint appointment with another department.

† A secondary appointment with primary affiliation in another department or school.

FIELDS OF STUDY

Fluids and Thermal Sciences Electrospray theory and characterization; electrical propulsion applications; aerodynamic instrumentation for separation of clusters and aerosol particles; heterogeneous nucleation in the gas phase; combustion and flames; computational methods for fluid dynamics and reacting flows; interfacial flows and instabilities and transport phenomena in disordered media.

Soft Matter/Complex Fluids Jamming and slow dynamics in gels, glasses, and granular materials; mechanical properties of soft and biological materials; rheology and statistical mechanics of muscle; structure and dynamics of proteins and other macromolecules and wetting of soft solids, elastocapillarity, poroelasticity, microrheology, and scattering.

Robotics/Mechatronics Machine and mechanism design; dynamics and control; robotic grasping and manipulation; legged locomotion; multi-agent search and exploration; optimal control for learning; model-predictive control; reinforcement learning; human-machine interface; rehabilitation robotics; haptics; soft robotics; flexible and stretchable electronics; soft material manufacturing; responsive material actuators; artificial muscle; soft-bodied control; electromechanical energy conversion; biomechanics of human movement and human-powered vehicles.

Bioengineering Engineering sciences of living systems; biomechanics; motor control; animal locomotion; cell and tissue mechanics; biomaterials and therapeutics; human

health and orthopaedics; bio-inspired computation and design; biomaterials and cell-material interaction.

For degree requirements and courses, see Engineering & Applied Science.

Medieval Studies

Humanities Quadrangle, Rooms 431 and 438, 203.432.0672
http://medieval.yale.edu
M.A., M.Phil., Ph.D.

Chair and Director of Graduate Studies
Emily Thornbury

Core Faculty Michelle al-Ferzly, Tarren Andrews, Lucas Bender, R. Howard Bloch, Jessica Brantley, Ardis Butterfield, Stephen Davis, John Dillon, Maria Doerfler, Marcel Elias, Hussein Fancy, Paul Freedman, Joe Glynias, Felicity Harley, Samuel Hodgkin, Jacqueline Jung, Volker Leppin, Ivan Marcus, Vasileios Marinis, Christiana Purdy Moudarres, Agnieszka Rec, Emily Thornbury, Shawkat Toorawa, Kevin van Bladel, Jesús Velasco, Mimi Hall Yiengpruksawan, Travis Zadeh, AZ (Anna Zayaruznaya)

Additional Affiliated Faculty Giulia Accornero, Adel Allouche (*Emeritus*), Felisa Baynes-Ross, Gerhard Bowering (*Emeritus*), Orgu Dalgic, Carlos Eire, Roberta Frank (*Emerita*), Alexander Gil Fuentes, Harvey Goldblatt (*Emeritus*), Eric Greene, Dimitri Gutas (*Emeritus*), Valerie Hansen, Peter Hawkins (*Emeritus*), Christina Kraus, Traugott Lawler (*Emeritus*), Noel Lenski, Giuseppe Mazzotta (*Emeritus*), Alastair Minnis (*Emeritus*), Robert Nelson (*Emeritus*), Morgan Ng, James Patterson, Barbara Shailor (*Emerita*), Jane Tylus

FIELDS OF STUDY

Fields in this interdisciplinary program include history, history of art, history of music, religious studies, languages and literatures, linguistics, and philosophy, among others.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Students are required to demonstrate proficiency in at least one medieval language of scholarship (Arabic, classical Chinese, classical Persian, Greek, Hebrew, or Latin) and in two modern languages appropriate to their field of study. Language proficiency may be demonstrated either by passing a departmental examination within the first two years of study, or by achieving at least a High Pass in an advanced language or literature course, as approved by the DGS.

Students will design their programs in close contact with the director of graduate studies (DGS). During the first two years, students take fourteen term courses in at least three disciplinary fields, including one involving the use of primary medieval material sources (normally, palaeography), and must receive an Honors grade in at least four term courses the first year. Students take an oral examination, usually in the fifth term, on a set of three topics worked out in consultation with the DGS. Then, having nurtured a topic of particular interest, the student submits a dissertation prospectus that must be approved by the end of the third year. Upon completion of all predissertation requirements, including the prospectus, students are admitted to candidacy for the Ph.D. degree. What remains, then, is the writing, submission, and approval of the dissertation during the final years.

Students in Medieval Studies participate in the Teaching Fellows Program, usually in the third year and one year thereafter.

MASTER'S DEGREES

M.Phil. See degree requirements under Policies and Regulations. The M.Phil. degree may be requested after all requirements but the dissertation are met.

M.A. Students who withdraw from the Ph.D. program may be eligible to receive the M.A. degree if they have met the requirements and have not already received the M.Phil. degree. For the M.A., students must successfully complete either seven term courses or six term courses and a special project. One course must have a focus on the study of original manuscripts or documents. There must be at least one grade of Honors, and there may not be more than one grade of Pass. Students must maintain a minimum average of High Pass each term.

For more information, please visit the program website, http://medieval.yale.edu.

COURSES

MDVL 5071a / CLSS 5031a / MHHR 5031a, Introduction to Latin Paleography
Hannelore Segers
Latin paleography from the fourth century CE to ca. 1500. Topics include the history and development of national hands; the introduction and evolution of Caroline minuscule, pre-gothic, gothic, and humanist scripts (both cursive and book hands); the production, circulation, and transmission of texts (primarily Latin, with reference to Greek and Middle English); advances in the technical analysis and digital manipulation of manuscripts. Seminars are based on the examination of codices and fragments in the Beinecke Library; students select a manuscript for class presentation and final paper.

MDVL 5610a, Medieval Latin: The Calamitous Life of Peter Abelard John Dillon
This is an introductory reading course in Medieval Latin that is intended to help students improve their reading ability by working directly with a medieval text. We read Peter Abelard's *Historia calamitatum,* "A History of My Calamities," in which the foremost scholar and theologian of the twelfth century gives a candid account of his life. Abelard was a celebrity professor at the dawn of the university, only to spectacularly fall into disgrace for a secret love affair with Heloise that resulted in his castration at the hands of his father-in-law. As we read Abelard's fascinating account of his life, we focus on reinforcing our knowledge of Latin grammar and syntax and pay special attention to the features of Abelard's language that are typical of Medieval Latin. Prerequisite: basic knowledge of Latin grammar and syntax, equivalent to LATN 110 and LATN 120.

MDVL 5615a / FREN 6100a, Old French R Howard Bloch
An introduction to the Old French language, medieval book culture, and the prose romance via study of manuscript Yale Beinecke 229, The Death of King Arthur, along with a book of grammar and an Old French dictionary. Primary and secondary materials are available on DVD. Work consists of a weekly in-class translation and a final exam comprised of a sight translation passage, a familiar passage from Yale 229, and a take-home essay. No previous study of Old French necessary, although a knowledge of French is essential. Conducted in English.

MDVL 5700a / ENGL 6500a / LING 5000a, Old English I Emily Thornbury
The essentials of the language, some prose readings, and close study of several celebrated Old English poems.

MDVL 6035a / CPLT 5550a / ENGL 6535a, Postcolonial Middle Ages Marcel Elias
This course explores the intersections and points of friction between postcolonial studies and medieval studies. We discuss key debates in postcolonialism and medievalists' contributions to those debates. We also consider postcolonial scholarship that has remained outside the purview of medieval studies. The overall aim is for students, in their written and oral contributions, to expand the parameters of medieval postcolonialism. Works by critics including Edward Said, Homi Bhabha, Leela Gandhi, Lisa Lowe, Robert Young, and Priyamvada Gopal are read alongside medieval romances, crusade and jihād poetry, travel literature, and chronicles.

MDVL 6051b / ENGL 6502b / LING 5010b, *Beowulf* and the Beowulf Complex Emily Thornbury
A close reading of *Beowulf* in Old English, within the modern and medieval critical landscapes. Prerequisite: a strong working knowledge of Old English (typically ENGL 500, or the equivalent).

MDVL 6112b / FREN 8120b, The Old French Fable and Fabliaux R Howard Bloch
A study of Marie de France's 103 animal tales and some of the anonymous "Ysopets" as well as of the 170 comic verse tales whose veins of satire, parody, comedy of language, situation, character, and farce are at the root of the European comic tradition. We read the fables and the fabliaux against the background of twelfth- and thirteenth-century social, religious, and literary culture. Fables to be read in the bilingual (Old French and English) edition of Harriet Speigel and fabliaux in the recently published bilingual edition, with translations by Ned Dubin. Conducted in English.

MDVL 7002b / CLSS 7680b / HIST 6002b, Human Migration in Antiquity Noel Lenski
This course examines the processes of human migration in premodern societies with an emphasis on ancient Rome. It explores voluntary and forced migrations, their motivations, processes, and outcomes. Particular attention is paid to sources and problems in the period of late antiquity, when human migration helped drive the collapse of the Roman Empire.

MDVL 7155b / HIST 6155b / JDST 764b / RLST 7770b, Jews in Muslim Lands from the Seventh through the Sixteenth Century Ivan Marcus
Introduction to Jewish culture and society in Muslim lands from the Prophet Muhammad to Suleiman the Magnificent. Topics include Islam and Judaism; Jerusalem as a holy site; rabbinic leadership and literature in Baghdad; Jewish courtiers, poets, and philosophers in Muslim Spain; and the Jews in the Ottoman Empire.

MDVL 7157b / HIST 6157b / JDST 7206b / RLST 6160b, How the West Became Antisemitic: Jews and the Formation of Europe, 800–1500 Ivan Marcus
This seminar explores how medieval Jews and Christians interacted as religious societies between 800 and 1500.

MDVL 7229a / HIST 6229a / JDST 7261a / RLST 7730a, Jews and the World: From the Bible through Early Modern Times Ivan Marcus
The course is a comprehensive introduction for GS students as well as YC students. It serves as a window course to pre-modern Jewish history. For YC students this can lead to taking seminars on more limited topics. For graduate students it is a good preparation for comprehensive exams and provides a model survey course to be offered later on as an instructor.

MDVL 7334a / EMST 8336a / SPAN 8595a, Law and Humanities II: Emotions Jesus Velasco

This is the second installment of a series of graduate seminars on law and humanities. The first one dealt with the question of fiction, and this one interrogates the ways in which legal thinking and legislations are in dialogue with emotions in general, and in particular with the creation of affective spaces through specific forms of legislation and jurisprudence. During our seminar we save some time to write together and share our insights on each of the texts we read.

MDVL 8210a, Marriage and Sexual Relations in Late Antique and Medieval Christian Ritual Practice Gabriel Radle

This course examines the historical practice of marriage formation in late antiquity and the Middle Ages. Beginning with ancient Jewish and Greco-Roman perspectives, it explores how different communities in the Mediterranean conceptualized and enacted nuptial kinship through a ritual process from betrothal through consummation and probes the anthropological and religious underpinnings of these practices. It then considers early Christian debates on the roles of marriage, sex, and family, and analyzes the early evidence for the Christianization of marriage ritual. Through original texts (available in translation), as well as visual and material sources, the course traces the development of these rites across medieval Christian traditions of the West (Italy, Gaul, Spain, etc.) and East (Byzantine, Coptic, Syriac, Slavic, etc.), and explores the diversity of theological visions and socio-cultural values they express. While focused on pre-modern Christianity, this course encourages frequent comparison to Jewish and Islamic traditions (including legal and ritual frameworks, as well as the calendrical regulation of sexual relations), invites comparison to other kinship rituals (such as medieval rites of "brother-making" or filial adoption), and also provides opportunities for students to engage with ritual developments of the Reformation and explore the legacy of historic marriage practices within contemporary religious, legal, and cultural traditions and debates.

MDVL 8212a, The Eucharist Through the Ages Gabriel Radle

The adage attributed to the French theologian Henri de Lubac that "the Church makes the Eucharist and the Eucharist makes the Church" summarizes much of the twentieth-century historical and theological reflection that led numerous Christian denominations to enact a period of liturgical renewal and reform, which in some respects is still ongoing. The goal of this seminar is to academically participate in the process of critically reflecting about the nature of the Eucharist through an examination of the shape, form and texts employed across Christian history, from antiquity to today. We examine studies and original texts (in translation) to provide perspective on the origins and historical development of the eucharistic liturgy, survey the structure and content of different medieval rites both eastern and western, examine artistic, musical and architectural developments, and undertake a systematic reflection on various theological issues across Christian history (e.g. commensality, real presence, transubstantiation, the role of ministers, excommunication, the dynamics of liturgical reform, and other concerns). Illumined by historical and theological reflection, students also engage in critically examining contemporary pastoral concerns as instantiated in different denominations.

MDVL 8731a, Origins of Christian Art in Late Antiquity Felicity Harley
This course examines the origins and development of Christian art in the visual culture of Roman late antiquity, ca. 200–ca. 500 CE. Its aim is to introduce students to key developments in the history of Christian art through the close study of images preserved on a range of objects in different media (including frescoes, glassware, sculpture, coins, textiles, mosaic) made for a variety of purposes. The course involves visits to the Yale Art Gallery and focuses on the importance of situating objects within their larger social and cultural context through the analysis of primary source evidence, which may include archaeological, iconographic, epigraphic, and textual sources (Jewish, early Christian, and other contemporary Roman texts). Topics include the literary and archaeological evidence for early Christian attitudes to visual representation; contexts of manufacture; the social and economic basis of patronage; Roman political influence on Christian iconography; development of new genres of imagery; and the role of imperial patronage in the transformation of civic spaces.

MDVL 8755a, A History of Byzantine Monasticism Vasileios Marinis
Monastics and monasteries constituted a quintessential element of Byzantine society. This seminar investigates Byzantine monasticism in its historical, theological, and social contexts from its origins in the third century to the codification of Hesychastic practice in the fourteenth. The course aims to familiarize students with the foundational texts of this tradition, inquire into lives of monastic saints as both rhetorical constructs and historical sources, analyze foundation documents that regulated liturgical and everyday life in Byzantine monasteries, explore the architecture of and artistic production in Byzantine monasteries, and understand the ways and means by which cults of saints were developed and cultivated in a monastic context.

MDVL 9000a, Directed Reading Staff
By arrangement with faculty.

MDVL 9005a / EALL 7530a / EMST 9600a / NELC 5400a / RLST 9550a, Proseminar for Jobseekers in Premodern Fields Lucas Bender
This course is intended for doctoral students (particularly studying topics in the premodern humanities) in their penultimate and final years. Over the course of the semester, students work with peers as well as faculty convener to build the skills they need to present their research to others in a clear, compelling way. Topics covered include preparing application materials, interviewing, negotiating job offers, alt-ac careers, publishing, CV building, and how to succeed in postdoctoral and junior faculty positions. Weekly sessions generally include workshop time as well as presentations by the convener and visitors. This proseminar is particularly directed toward students affiliated with Archaia and medieval studies but welcomes all those with research interests in the premodern world; if space allows, students working on modern topics can also join. The broad range of primary specialties represented provides students with experience engaging with scholars outside their field, which is increasingly essential for premodernists in the modern academic world.

Microbiology

Boyer Center for Molecular Medicine 354F, 203.737.1087
http://medicine.yale.edu/micropath
M.S., M.Phil., Ph.D.

Director of Graduate Studies
Ya-Chi Ho

Professors Serap Aksoy (*Epidemiology*), Susan Baserga (*Molecular Biophysics and Biochemistry*; *Genetics*; *Therapeutic Radiology*), Choukri Ben Mamoun (*Internal Medicine*; *Microbial Pathogenesis*), Ronald Breaker (*Molecular, Cellular, and Developmental Biology*; *Molecular Biophysics and Biochemistry*), Richard Bucala (*Internal Medicine*; *Epidemiology*; *Pathology*), Michael Cappello (*Pediatrics*; *Epidemiology*; *Microbial Pathogenesis*), Yung-Chi Cheng (*Pharmacology*), Jason Crawford (*Chemistry*; *Microbial Pathogenesis*), Peter Cresswell (*Immunobiology*; *Cell Biology*), Daniel DiMaio (*Genetics*; *Molecular Biophysics and Biochemistry*; *Therapeutic Radiology*), Vanessa Ezenwa (*Ecology and Evolutionary Biology*), Erol Fikrig (*Internal Medicine*; *Epidemiology*; *Microbial Pathogenesis*), Richard Flavell (*Immunobiology*), Jorge Galán (*Microbial Pathogenesis*; *Cell Biology*), Wendy Gilbert (*Molecular Biophysics and Biochemistry*), Andrew Goodman (*Microbial Pathogenesis*), Eduardo Groisman (*Microbial Pathogenesis*), Margarett Hosstetter (*Pediatrics*), Akiko Iwasaki (*Immunobiology*; *Molecular, Cellular, and Developmental Biology*), Barbara Kazmierczak (*Internal Medicine*; *Microbial Pathogenesis*), Albert Ko (*Epidemiology*; *Internal Medicine*), Jun Liu (*Microbial Pathogenesis*), John MacMicking (*Microbial Pathogenesis; Immunobiology*), Ruslan Medzhitov (*Immunobiology*), I. George Miller (*Pediatrics*; *Epidemiology*; *Molecular Biophysics and Biochemistry*), Walther Mothes (*Microbial Pathogenesis*), Joseph Mougous (*Microbial Pathogenesis*), Noah Palm (*Immunobiology*), Melinda Pettigrew (*Epidemiology*), Carla Rothlin (*Immunobiology*; *Pharmacology*), Craig Roy (*Microbial Pathogenesis*; *Immunobiology*), Dieter Söll (*Molecular Biophysics and Biochemistry*; *Chemistry*), Richard Sutton (*Internal Medicine*; *Microbial Pathogenesis*), Jeffrey Townsend (*Biostatistics*; *Ecology and Evolutionary Biology*), Christian Tschudi (*Epidemiology*), Paul Turner (*Ecology and Evolutionary Biology*), Yong Xiong (*Molecular Biophysics and Biochemistry*)

Associate Professors Murat Acar (*Molecular, Cellular, and Developmental Biology*; *Physics*), Charles Dela Cruz (*Internal Medicine*; *Microbial Pathogenesis*), Nathan Grubaugh (*Microbial Diseases*), Ya-Chi Ho (*Microbial Pathogenesis*; *Internal Medicine/Infectious Diseases*), Farren Isaacs (*Molecular, Cellular, and Developmental Biology*), Priti Kumar (*Internal Medicine/Infectious Diseases*), Nikhil Malvankar (*Molecular Biophysics and Biochemistry*), Kathryn Miller-Jensen (*Biomedical Engineering*; *Molecular, Cellular, and Developmental Biology*), E. Hesper Rego (*Microbial Pathogenesis*), Christian Schlieker (*Molecular Biophysics and Biochemistry*; *Cell Biology*), Craig Wilen (*Laboratory Medicine*; *Immunobiology*)

Assistant Professors Amy Bei (*Epidemiology of Microbial Diseases*), Grace Chen (*Immunobiology*), Allison Didychuk (*Molecular Biophysics and Biochemistry*), Ellen Foxman (*Laboratory Medicine*; *Immunobiology*), Benjamin Goldman-Israelow (*Medicine*), Stavroula Hatzios (*Molecular, Cellular, and Developmental Biology*), Caroline Johnson (*Environmental Health Sciences*), Yelizaveta Konnikova (*Pediatrics/Neonatology*), Maudry Laurent-Rolle (*Infectious Diseases*), Caroline Lucas

(*Immunobiology*), David Martinez (*Immunobiology*), Wei Mi (*Pharmacology*), Michael O'Donnell (*Molecular, Cellular and Developmental Biology*), Hualiang Pi (*Microbial Pathogenesis*), Kaitlin Schaefer (*Microbial Pathogenesis*), Esen Sefik (*Immunobiology*), Chantal Vogels (*Epidemiology-Microbial Diseases*), Jing Yan (*Molecular, Cellular, and Developmental Biology*)

FIELDS OF STUDY

The Graduate Program in Microbiology is a multidepartmental, interdisciplinary Ph.D. program in training and research in the study of microorganisms and their effects on their hosts. This program does not offer direct admission to a master's degree. The faculty of the program share the view that understanding the biology of microorganisms requires a multidisciplinary approach; therefore, the Microbiology graduate program emphasizes the need for strong multidisciplinary training. The program is designed to provide individualized education in modern microbiology and to prepare students for independent careers in research and teaching. Students can specialize in various areas, including bacteriology, virology, microbe-host interactions, microbial pathogenesis, cell biology and immunobiology of microbial infections, microbial genetics and physiology, structural biology, parasitology, microbiome, and microbial ecology and evolution.

ADMISSIONS REQUIREMENTS

To enter the Ph.D. program, students apply to the Microbiology track within the interdepartmental graduate program in the Biological and Biomedical Sciences (BBS), http://bbs.yale.edu. An undergraduate major in biology, biophysics, biochemistry, microbiology, or molecular biology is recommended; the GRE General Test or MCAT is no longer required, and scores will not be considered if submitted. Substantial research experience in hypothesis-driven investigations in microbiology, microbial pathogenesis, molecular biology, or related fields is strongly encouraged.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Courses Students are required to take four courses for a grade in the graduate school. Required graded courses for first and second-year students are listed below.

At least three of these microbiology-related courses: *

CBIO 6020	Molecular Cell Biology	1
IBIO 5300	Biology of the Immune System	1
MBIO 6850	The Biology of Bacterial Pathogens II	1
MBIO 6860	The Biology of Bacterial Pathogens I	1
MBIO 7340	Molecular Biology of Animal Viruses	1
PATH 5690	Molecular Mechanisms of Disease	1

* At least one course must be MBIO 6850, MBIO 6860, or MBIO 7340.

Other elective studies can be (but aren't limited to):

CBIO 7701	Illuminating Cellular Function	1
EEB 7729	Microbial Ecology and Evolution	1
EMD 517	Principles of Infectious Diseases I	1
EMD 518	Principles of Infectious Diseases II	1

EMD 550	Epidemiology and Control of Vector Borne Diseases	1
GENE 6250	Basic Concepts of Genetic Analysis	1
GENE 7600	Genomic Methods for Genetic Analysis	1

Required credit-only, nongraded courses for first-year students:

IBIO 6010	Fundamentals of Research: Responsible Conduct of Research	1
MBIO 6700	Laboratory Rotations	1
MBIO 6710	Laboratory Rotations	1
MBIO 6720	Laboratory Rotations	1
MBIO 7000	Seminal Papers on the Foundations of Modern Microbiology	0
MBIO 7010	Research in Progress	1
MBIO 7020	Research in Progress	1
MBIO 7030	Microbiology Seminar Series	1
MBIO 7040	Microbiology Seminar Series	1

Coursework generally occupies the first two years of study. Students choose courses after consulting the DGS and the thesis adviser. Students must receive a grade of Honors in two full-term courses. All students participate in three laboratory rotations (MBIO 6700, MBIO 6710, and MBIO 6720), with different faculty members, in their area of interest. Laboratory rotations ensure that students quickly become familiar with the variety of research opportunities available in the program. At the end of each rotation, students present their rotation project in a ten to twelve-minute seminar. Three rotations are required. There can be an optional fourth rotation. In rare occasions, after discussion with the DGS, a fifth rotation can be taken, if the student cannot join a thesis lab in the first four rotations. Students who are not able to obtain a thesis adviser selection form (signed by the thesis adviser) and join a thesis lab by July 31 during their first year of Ph.D. will be dismissed from the program.

Qualifying Exam and Advancement to Candidacy The qualifying exam is on-topic in both written and oral forms before the end of the second year. With supervision from the adviser, students assemble their own qualifying exam committee, consisting of faculty members from different expertise relevant to the dissertation research. Through multiple one-on-one discussions with their adviser and the thesis committee, students strengthen their thesis proposals. Students write an on-topic thesis proposal based on the NIH F31 fellowship format and defend orally in front of the qualifying exam committee. Students are required to defend their proposals in a chalk-talk format. In the third year, students organize their thesis committee and prepare a dissertation prospectus, which is submitted to the graduate school after approval by their committee. The student is then admitted to candidacy. Committee approvals for both the qualifying exam and the dissertation prospectus are required to advance to the fourth year of Ph.D.

Thesis Committee, Dissertation, and Seminar Students are required to have at least one thesis committee meeting per year and one oral presentation at the Research in Progress Seminar series. Upon completion of the research project, the student will write a dissertation, which will be evaluated and approved by three dissertation research (including at least two Yale readers and one external reader, typically faculty

in academic research institutions). The student will give a thesis seminar and conclude their Ph.D.

Teaching Students are required to serve as a teaching fellow for two terms.

- Teaching two term-long science courses is required as a fulfillment of the Ph.D.
- First-year students do not teach.
- Only one teaching fellow assignment is allowed per semester
- Teaching for additional income is available after the completion of the two required teaching fellow assignments, when openings exist after those selected for credit are hired; approval signatures from the both the adviser and DGS are required.
- The maximum teaching allowed is one course per term.

A one-day seminar entitled Teaching at Yale is offered by the Yale Poorvu Center for Teaching and Learning at the start of each term. Attending this seminar is recommended prior to teaching.

Responsible Conduct of Research In addition to all other requirements, students must successfully complete IBIO 6010, Fundamentals of Research: Responsible Conduct of Research, prior to the end of their first year of study. This requirement must be met prior to registering for a second year of study. In their fourth year of study, all students must successfully complete B&BS 5502, RCR Refresher for Senior BBS Students.

MASTER'S DEGREES

M.Phil. The M.Phil. degree can be awarded to Ph.D. students who have been admitted to candidacy. See Degree Requirements under Policies and Regulations.

M.S. The M.S. degree may only be granted to students who are withdrawing from the Ph.D. program prior to advancing to candidacy. To be eligible for this degree, a student must have completed at least four graduate-level term courses at Yale, including at least three from microbiology-related courses (MBIO 530, MBIO 6850, MBIO 6860, MBIO 7340, CBIO 6020, and PATH 5690) and including at least one of the three core courses. Students must have received at least one Honors or two High Pass grades. In addition, students must have received a Satisfactory grade in the following courses: IBIO 6010, MBIO 6700, MBIO 6710, MBIO 6720, MBIO 7010, and MBIO 7020. Students who are eligible for or who have already received the M.Phil. will not be awarded the M.S.

For more information, please visit https://medicine.yale.edu/micropath/microbiology-phd.

MBIO TBD-2a, Molecular Cell Biology Thomas Melia
A comprehensive introduction to the molecular and mechanistic aspects of cell biology for graduate students in all programs. Emphasizes fundamental issues of cellular organization, regulation, biogenesis, and function at the molecular level. Graduate Prerequisites: Some knowledge of basic cell biology and biochemistry is assumed. Students who have not taken courses in these areas can prepare by reading relevant sections in basic molecular cell biology texts. We recommend Pollard et al., *Cell Biology* (3rd ed., 2016), Alberts et al., *Molecular Biology of the Cell* (6th ed., 2014), or Lodish et al., *Molecular Cell Biology* (8th edition, 2016). Undergraduate Prerequisites: This is a graduate-level cell biology class. Any undergraduates wishing to enroll must have

already taken MCDB 205. In addition, undergraduates are strongly encouraged to reach out to the course directors prior to enrollment.

MBIO 6700a and MBIO 6710a and MBIO 6720b and MBIO 6740b, Laboratory Rotations Ya-Chi Ho
Rotation in three laboratories. Required of all first-year graduate students.

MBIO 6850b, The Biology of Bacterial Pathogens II Hesper Rego
This interdisciplinary course focuses on current topics related to host-pathogen interactions. Each week a lecture is given on the topic, followed by student presentations of seminal papers in the field. All participants are required to present a paper.

MBIO 6860a, The Biology of Bacterial Pathogens I Jorge Galan and Maria Lara-Tejero
The course provides an introduction to basic principles in bacterial pathogenesis. Topics focus on the bacterial determinants mediating infection and pathogenesis, as well as strategies to prevent and treat diseases. Each week a lecture is given on the topic, followed by student presentations of seminal papers in the field. All participants are required to present a paper.

MBIO 7000b, Seminal Papers on the Foundations of Modern Microbiology Ya-Chi Ho
A required course for Microbiology first-year students; not for credit. The course is offered every spring. Students present and discuss papers describing fundamental discoveries in areas related to microbiology. The goal is to familiarize students with the process of scientific discovery and with the history of major developments in the field. Topics include important discoveries involving major human pathogens, fundamental processes in molecular biology, and the development of technology that has a major impact on current biomedical research. o Course cr

MBIO 7010a and MBIO 7020b, Research in Progress Ya-Chi Ho
All students, beginning in their third year, are required to present their research once a year at the Graduate Student Research in Progress. These presentations are intended to give each student practice in presenting the student's own work before a sympathetic but critical audience and to familiarize the faculty with the research.

MBIO 7030a and MBIO 7040b, Microbiology Seminar Series Ya-Chi Ho
All students are required to attend all Microbiology seminars scheduled throughout the academic year. Microbiologists from around the world are invited to describe their research.

MBIO 7340b / GENE 7340b / MB&B 7340b, Molecular Biology of Animal Viruses Walther Mothes and Maudry Laurent-Rolle
Lecture course with emphasis on mechanisms of viral replication, oncogenic transformation, and virus-host cell interactions.

Molecular Biophysics and Biochemistry

334A Bass Center, 203.432.5662
https://mbb.yale.edu
M.S., M.Phil., Ph.D.

Chair
Ronald Breaker

Director of Graduate Studies
Wendy Gilbert (SHM C-127, 203.785.7580, wendy.gilbert@yale.edu)

Professors Karen Anderson (*Pharmacology*), Susan Baserga, Ronald Breaker (*Molecular, Cellular, and Developmental Biology*), Gary Brudvig (*Chemistry*), Sandy Chang (*Laboratory Medicine*), Enrique De La Cruz, Daniel DiMaio (*Genetics*; *Therapeutic Radiology*), Donald Engelman, Mark Gerstein, Wendy Gilbert, Nigel Grindley (*Emeritus*), Mark Hochstrasser, Jonathon Howard, Michael Koelle, Anthony Koleske, William Konigsberg (*Emeritus)*, Mark Lemmon (*Pharmacology),* J. Patrick Loria (*Chemistry*), I. George Miller (*Pediatric Infectious Diseases*; *Public Health*), Andrew Miranker, Peter Moore (*Emeritus*; *Chemistry*), Karla Neugebauer, Lynne Regan (*Emerita*), Karin Reinisch (*Cell Biology*), David Schatz (*Immunobiology*), Christian Schlieker, Robert Shulman (*Emeritus*), Fred Sigworth (*Cellular and Molecular Physiology*; *Biomedical Engineering*), Dieter Söll (*Emeritus*), Mark Solomon, Joan Steitz, Scott Strobel, Kenneth Williams (*Adjunct*; *Research*), Yong Xiong, Carl Zimmer (*Adjunct*)

Associate Professors Julien Berro, Titus Boggon (*Pharmacology*), Erdem Karatekin (*Cellular and Molecular Physiology*), Nikhil Malvankar, Matthew Simon, Sarah Slavoff (*Chemistry*), Seyedtaghi Takyar (*Internal Medicine/Pulmonary*), Yongli Zhang (*Cell Biology*)

Assistant Professors Franziska Bleichert, Allison Didychuk, Luisa Escobar-Hoyos (*Therapeutic Radiology*), Lilian Kabeche, Wei Mi (*Pharmacology*), Candice Paulsen, Shaogeng (Steven) Tang, Kai (Jack) Zhang

FIELDS OF STUDY

The principal objective of members of the department is to understand living systems at the molecular level. Laboratories in MB&B focus on a diverse collection of problems in biology. Some specialize in the study of DNA dynamics, including replication, recombination, transposition, and/or functional genomics. Others focus on transcriptional regulation, from individual transcription factors to the control of lymphocyte activation, the interferon response, and organismal development. Other groups study RNA catalysis, RNA-protein interactions, and ribonucleoproteins including spliceosomes and the ribosome. Additionally there are those that emphasize protein folding and design, transmembrane signaling, cell cycle control, cytoskeletal dynamics, and neuroscience. Structural and computational biology is a strong component of many of these research efforts.

To enter the Ph.D. program, students apply to an interest-based track within the interdepartmental graduate program in Biological and Biomedical Sciences (BBS), https://medicine.yale.edu/bbs.

INTEGRATED GRADUATE PROGRAM IN PHYSICAL AND ENGINEERING BIOLOGY (PEB)

Students applying to one of four tracks of the Biological and Biomedical Sciences program may simultaneously apply to be part of the PEB program. See the description under Non-Degree-Granting Programs, Councils, and Research Institutes for course requirements, and http://peb.yale.edu for more information about the benefits of this program and application instructions.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

All first-year students (except M.D.-Ph.D.) perform three laboratory rotations (encompassed by MB&B 6500 and MB&B 6510, Lab Rotation for BQBS First-Year Students). All students from the BQBS track who affiliate with MB&B are required to take, for credit, six one-term science courses. To obtain the desired breadth and depth of education, students coming from the BQBS track are required to take MB&B 7200, MB&B 7300, one course in molecular biophysics or quantitative biology, and one course in molecular biology (MB&B 7430 is strongly recommended but not required). The credit in molecular biophysics or quantitative biology and the credit in molecular biology may be satisfied by taking appropriate courses from an approved list available each fall and listed in the MB&B graduate handbook. Students originating from a BBS track other than BQBS must discuss their curriculum with the MB&B DGS prior to joining the department to ensure equivalent foundational course work in MB&B topic areas; these students are strongly encouraged to take or audit MB&B 7200. Additional courses, chosen from within MB&B or from related graduate programs, should form a coherent background for the general area in which the student expects to do dissertation research. All students also attend MB&B 6760, Responsible Conduct of Research. In their fourth year of study, all students must complete MB&B 6770, RCR Refresher for Senior MB&B Students. Students with an extensive background in biochemistry or biophysics are permitted to substitute advanced courses for the introductory courses. There is no foreign language requirement. The student's research committee (see below) makes the final decision concerning the number and selection of courses required of each student.

All students are required to assist in teaching two terms during their graduate careers, usually during the second and third years. Students who require additional support from the graduate school must teach additional terms, if needed, after they have fulfilled the academic teaching requirement.

The student selects a research adviser by the end of the second term of residence. At that time two additional faculty members are chosen to form a research committee, with the total committee including at least two MB&B faculty members. The chair of the committee will be an MB&B faculty member who is not the research adviser. Students are required to meet with this committee in the spring of years two and three, and in both the fall and spring of subsequent years. The qualifying examination, usually taken in the fall of the second year, is an oral defense of a research proposal consisting of (1) thesis aims and (2) extended goals on the same topic. The extended

goals should include approaches beyond those in the thesis aims, typically beyond those generally employed by the host lab. Thus, a predominantly molecular biological set of thesis aims should be accompanied by biophysical approaches in the extended goals section, and vice versa. The three-member oral examination committee usually includes at least one of the two members of the research committee excluding the thesis adviser. Requirements for admission to candidacy, which usually takes place after four terms of residence, include (1) completion of course requirements; (2) completion of the qualifying examination; (3) certification of the student's research abilities by vote of the faculty upon recommendation from the student's research committee; and (4) submission of a brief prospectus of the proposed thesis research. Completion of the teaching requirement is not required for admission to candidacy. Once final drafts of the thesis chapters have been approved by the research committee, the student presents a dissertation seminar to the entire department, and only afterward may the thesis be submitted. Students must have written at least one first-author paper that is submitted, in press, or published by the time of the thesis seminar.

HONORS REQUIREMENT

Students must meet the graduate school's Honors requirement by the end of the fourth term of full-time study; see Degree Requirements under Policies and Regulations. Students must also maintain an overall High Pass average. Student progress toward these goals is reviewed at the ends of the first and second terms.

M.D.-PH.D. STUDENTS

M.D.-Ph.D. students must satisfy the requirements listed above for the Ph.D. with the following modifications: Laboratory rotations are not required but are available. Assisting in teaching of one lecture course is required. Students are required to take MB&B 8000 as part of their medical curriculum in addition to the two courses in molecular biophysics described above. Students with weak backgrounds in molecular biology will need to take MB&B 7430.

MASTER'S DEGREES

M.Phil. See Degree Requirements under Policies and Regulations. Awarded only to students admitted to candidacy who are continuing for the Ph.D. Students need not have completed their teaching requirement to receive the M.Phil. Students are not admitted for this degree.

M.S. Students are not admitted for this degree. It may only be awarded to a student in the Ph.D. program who is in good standing upon completion of at least two terms of graduate study and who will not continue in the Ph.D. program. A student must receive grades of Pass or higher in at least five courses approved by the DGS as counting toward a graduate degree, exclusive of seminars or research. Students must have taken at least ten courses. A typical schedule would consist of six traditional courses, two terms of MB&B 6500 and MB&B 6510, and one term each of MB&B 6750 and MB&B 6760. A student must also meet the graduate school's Honors requirement for the Ph.D. program and maintain a High Pass average. Students who are eligible for or who have already received the M.Phil. will not be awarded the M.S.

More detailed program materials are available upon request to the Director of Graduate Admissions, Department of Molecular Biophysics and Biochemistry, Yale University, PO Box 208114, New Haven CT 06520-8114.

COURSES

MB&B TBD-3a, Seminar in Molecular Cell Biology Min Wu
A graduate-level seminar in modern cell biology. The class is devoted to the reading and critical evaluation of classical and current papers. The topics are coordinated with the CBIO 602 lecture schedule. Thus, concurrent enrollment in CBIO 602 is required. Prerequisites: Any undergraduates wishing to enroll must have already taken MCDB 205. In addition, undergraduates are strongly encouraged to reach out to the course directors prior to enrollment.

MB&B 5000a or b / MCDB 5000a or b, Biochemistry Staff
An introduction to the biochemistry of animals, plants, and microorganisms, emphasizing the relations of chemical principles and structure to the evolution and regulation of living systems.

MB&B 5170b / ENAS 5170b / MCDB 5170b / PHYS 5170b, Methods and Logic in Interdisciplinary Research Corey O'Hern and Emma Carley
This full PEB class is intended to introduce students to integrated approaches to research. Each week, the first of two sessions is student-led, while the second session is led by faculty with complementary expertise and discusses papers that use different approaches to the same topic (for example, physical and biological or experiment and theory).

MB&B 5200a, Boot Camp Biology Emma Carley and Corey O'Hern
An intensive introduction to biological nomenclature, systems, processes, and techniques for graduate students with previous backgrounds in non-biological fields including physics, engineering, and computer science who wish to perform graduate research in the biological sciences. Counts as 0.5 credit toward MB&B graduate course requirements. ½ Course cr

MB&B 5310a / MCDB 5310a / PHYS 5610a, Modeling Biological Systems I Thierry Emonet and Kathryn Miller-Jensen
Biological systems make sophisticated decisions at many levels. This course explores the molecular and computational underpinnings of how these decisions are made, with a focus on modeling static and dynamic processes in example biological systems. This course is aimed at biology students and teaches the analytic and computational methods needed to model genetic networks and protein signaling pathways. Students present and discuss original papers in class. They learn to model using MatLab in a series of in-class hackathons that illustrate the biological examples discussed in the lectures. Biological systems and processes that are modeled include: (1) gene expression, including the kinetics of RNA and protein synthesis and degradation; (2) activators and repressors; (3) the lysogeny/lysis switch of lambda phage; (4) network motifs and how they shape response dynamics; (5) cell signaling, MAP kinase networks and cell fate decisions; and (6) noise in gene expression. Prerequisites: MATH 115 or 116, BIOL 101–104, or with permission of instructors. This course also benefits students who have taken more advanced biology courses (e.g. MCDB 200, MCDB 310, MB&B 300/301).

MB&B 5450b, Methods and Logic in Molecular Biology Candie Paulsen and Julien Berro

An examination of fundamental concepts in molecular biology through analysis of landmark papers. Development of skills in reading the primary scientific literature and in critical thinking. Open only to MB&B students pursuing the B.S./M.S. degree.

MB&B 5620b / AMTH 765b / CB&B 5620b / ENAS 5620b / INP 562b / INP 7562b / PHYS 5620b, Modeling Biological Systems II Thierry Emonet, Jing Yan, and Damon Clark

This course covers advanced topics in computational biology. How do cells compute, how do they count and tell time, how do they oscillate and generate spatial patterns? Topics include time-dependent dynamics in regulatory, signal-transduction, and neuronal networks; fluctuations, growth, and form; mechanics of cell shape and motion; spatially heterogeneous processes; diffusion. This year, the course spends roughly half its time on mechanical systems at the cellular and tissue level, and half on models of neurons and neural systems in computational neuroscience. Prerequisite: a 200-level biology course or permission of the instructor.

MB&B 5650b, Biochemistry and Our Changing Climate Karla Neugebauer

Climate change is impacting how cells and organisms grow and reproduce. Imagine the ocean spiking a fever: cold-blooded organisms of all shapes, sizes, and complexities struggle to survive when water temperatures go up two–four degrees. Some organisms adapt to extremes, while others cannot. Predicted and observed changes in temperature, pH, and salt concentration do and will affect many parameters of the living world, from the kinetics of chemical reactions and cellular signaling pathways to the accumulation of unforeseen chemicals in the environment, the appearance and dispersal of new diseases, and the development of new foods. In this course, we approach climate change from the molecular point of view, identifying how cells and organisms—from microbes to plants and animals—respond to changing environmental conditions. To embrace the concept of "one health" for all life on the planet, this course leverages biochemistry, cell biology, molecular biophysics, and genetics to develop an understanding of the impact of climate change on the living world. We consider the foundational knowledge that biochemistry can bring to the table as we meet the challenge of climate change. Prerequisites: MB&B 500, MB&B 600, and MB&B 601, or permission of the instructor.

MB&B 5700a or b and MB&B 5701b, Intensive Research for B.S./M.S. Candidates Christian Schlieker

Required of students in the joint B.S./M.S. program with Yale College. 2 Course cr per term

MB&B 5910b / ENAS 5710b / MCDB 5910b / PHYS 5710b, Integrated Workshop Corey O'Hern

This required course for students in the PEB graduate program involves a series of modules, co-taught by faculty, in which students from different academic backgrounds and research skills collaborate on projects at the interface of physics, engineering, and biology. The modules cover a broad range of PEB research areas and skills. The course starts with an introduction to MATLAB, which is used throughout the course for analysis, simulations, and modeling.

MB&B 6000a, Principles of Biochemistry I Matthew Simon and Michael Koelle
Discussion of the physical, structural, and functional properties of proteins, lipids, and carbohydrates, three major classes of molecules in living organisms. Energy metabolism, hormone signaling, and muscle contraction as examples of complex biological processes whose underlying mechanisms can be understood by identifying and analyzing the molecules responsible for these phenomena. o Course cr

MB&B 6010b, Principles of Biochemistry II Christian Schlieker and Franziska Bleichert
A continuation of MB&B 600 that considers the chemistry and metabolism of nucleic acids, the mechanism and regulation of protein and nucleic acid synthesis, and selected topics in macromolecular biochemistry.

MB&B 6020a / CBIO 6020a / MCDB 6020a, Molecular Cell Biology Thomas Melia
A comprehensive introduction to the molecular and mechanistic aspects of cell biology for graduate students in all programs. Emphasizes fundamental issues of cellular organization, regulation, biogenesis, and function at the molecular level. Graduate Prerequisites: Some knowledge of basic cell biology and biochemistry is assumed. Students who have not taken courses in these areas can prepare by reading relevant sections in basic molecular cell biology texts. We recommend Pollard et al., *Cell Biology* (4th ed., 2024), Alberts et al., *Molecular Biology of the Cell* (7th ed., 2022), or Lodish et al., *Molecular Cell Biology* (9th edition, 2021). Undergraduate Prerequisites: This is a graduate-level cell biology class. Any undergraduates wishing to enroll must have already taken MCDB 2050. In addition, undergraduates are strongly encouraged to reach out to the course directors prior to enrollment.

MB&B 6250a / GENE 6250a / MCDB 6250a, Basic Concepts of Genetic Analysis Jun Lu
The universal principles of genetic analysis in eukaryotes are discussed in lectures. Students also read a small selection of primary papers illustrating the very best of genetic analysis and dissect them in detail in the discussion sections. While other Yale graduate molecular genetics courses emphasize molecular biology, this course focuses on the concepts and logic underlying modern genetic analysis.

MB&B 6300b / MCDB 6300b, Biochemical and Biophysical Approaches in Molecular and Cellular Biology Sigrid Nachtergaele
In this course, we provide an overall of various biochemical and biophysical approaches used in modern research in molecular and cellular biology, ranging from spectroscopic tools, microscopy, to X-ray crystallography. The goal of the course is to make students familiar with these techniques so that they can find relevant materials in their future research. Does not count for graduate course credit for BQBS graduate students.

MB&B 6350a / CBIO 635 / ENAS 5180a, Quantitative Methods in Biophysics Nikhil Malvankar, Julien Berro, and Yong Xiong
An introduction to quantitative methods relevant to analysis and interpretation of biological data. Topics include statistical testing, data presentation, and error analysis; introduction to artificial intelligence-based data analysis tools, Alpha Fold Tutorial, introduction to mathematical modeling of biological dynamics; and Fourier analysis in signal/image processing and macromolecular structural studies. Instruction in basic programming skills and data analysis using MATLAB; study of real data from

MB&B research groups. Prerequisites: MATH 120 and MB&B 600 or equivalents, or permission of the instructors.

MB&B 6500a and MB&B 6510b, Lab Rotation for BQBS First-Year Students Ailong Ke

Required of all first-year BQBS graduate students. Credit for full year only.

MB&B 6750a, Seminar for First-Year Students Ailong Ke, Thierry Emonet, and Karen Anderson

Required of all first-year BQBS graduate students.

MB&B 6760b, Responsible Conduct of Research Susan Baserga, Sarah Slavoff, Luisa Escobar-Hoyos, Jun Liu, Allison Didychuk, Steven Tang, Yong Xiong, Anthony Koleske, and Franziska Bleichert

Designed for students who are beginning to do scientific research. The course seeks to describe some of the basic features of life in contemporary research and some of the personal and professional issues that researchers encounter in their work. Approximately six sessions, run in a seminar/discussion format. Required of and open only to first-year graduate students in BQBS.

MB&B 6770b, RCR Refresher for Senior MB&B students Wendy Gilbert, Mark Solomon, Karen Anderson, and Mark Hochstrasser

This course meets the NIH requirement that students receive training in the responsible conduct of research at least every four years. The course consists of eight half-hour recorded lectures combined with four one-hour small-group discussions. Required of and open only to senior MB&B graduate students, typically in their fourth year. The course is graded Satisfactory/Unsatisfactory.

MB&B 7100b / C&MP 5710, Electron Cryo-Microscopy for Protein Structure Determination Ailong Ke, Steven Tang, and Yong Xiong

Understanding cellular function requires structural and biochemical studies at an ever-increasing level of complexity. The course is an introduction to the concepts and applications of high-resolution electron cryo-microscopy. This rapidly emerging new technique is the only method that allows biological macromolecules to be studied at all levels of resolution from cellular organization to near atomic detail. ½ Course cr

MB&B 7110b / C&MP 7110, Practical Cryo-EM Workshop Yong Xiong and Franziska Bleichert

This laboratory course provides hands-on training in the practical aspects of macromolecular structure determination by cryo-electron microscopy (cryo-EM). Topics include cryo-EM data collection, image preparation and correction, single-particle picking and 2D classification, 3D classification, refinement and post-processing, model building, refinement and evaluation. The course includes training in the use of computer programs used to perform these calculations. Prerequisite: MB&B 710/C&MP 710. ½ Course cr

MB&B 7200a, Macromolecular Structure and Biophysical Analysis Yong Xiong, Jonathon Howard, Steven Tang, and Franziska Bleichert

An in-depth analysis of macromolecular structure and its elucidation using modern methods of structural biology and biochemistry. Topics include architectural arrangements of proteins, RNA, and DNA; practical methods in structural analysis;

and an introduction to diffraction and NMR. Prerequisites: physical chemistry (may be taken concurrently) and biochemistry.

MB&B 7300a, Methods and Logic in Molecular Biology Wendy Gilbert, Julien Berro, Mark Solomon, Steven Tang, and Matthew Simon
The course examines fundamental concepts in molecular biology through intense critical analysis of the primary literature. The objective is to develop primary literature reading and critical thinking skills. Required of and open only to first-year graduate students in BQBS.

MB&B 7340b / GENE 7340b / MBIO 7340b, Molecular Biology of Animal Viruses Walther Mothes and Maudry Laurent-Rolle
Lecture course with emphasis on mechanisms of viral replication, oncogenic transformation, and virus-host cell interactions.

MB&B 7430b / GENE 7430 / MCDB 7430b, Advanced Eukaryotic Molecular Biology Mark Hochstrasser, Wendy Gilbert, Matthew Simon, and Franziska Bleichert
Selected topics in transcriptional control, regulation of chromatin structure, mRNA processing including spliceosomal splicing, mRNA turnover, RNA interference, translational regulation, protein modification, and protein degradation. Emphasis is placed on how these processes are regulated and the experiments that led to their discovery and understanding. Prerequisite: biochemistry or permission of the instructor.

MB&B 7520b / CB&B 7520b / CPSC 7520b / MB&B 753 / MB&B 754 / MCDB 7520b, Biomedical Data Science: Mining and Modeling Mark Gerstein and Matthew Simon
Biomedical data science encompasses the analysis of gene sequences, macromolecular structures, and functional genomics data on a large scale. It represents a major practical application for modern techniques in data mining and simulation. Specific topics to be covered include sequence alignment, large-scale processing, next-generation sequencing data, comparative genomics, phylogenetics, biological database design, geometric analysis of protein structure, molecular-dynamics simulation, biological networks, normalization of microarray data, mining of functional genomics data sets, and machine-learning approaches to data integration. Prerequisites: biochemistry and calculus, or permission of the instructor.

MB&B 8000a, Advanced Topics in Molecular Medicine Susan Baserga and Mark Solomon
The seminar, which covers topics in the molecular mechanisms of disease, illustrates timely issues in areas such as protein chemistry and enzymology, intermediary metabolism, nucleic acid biochemistry, gene expression, and virology. M.D. and M.D./Ph.D. students only. Prerequisite: biochemistry (may be taken concurrently).

MB&B 9000a or b, Reading Course in Molecular Biophysics and Biochemistry Wendy Gilbert
Directed reading course in molecular biophysics and biochemistry. Term paper required. By arrangement with faculty. Open only to graduate students in MB&B. Please see the syllabus for additional requirements.

Molecular, Cellular, and Developmental Biology

Yale Science Building, 203.432.3538
http://mcdb.yale.edu
M.S., Ph.D.

Chair
Scott Holley

Director of Graduate Studies
Joshua Gendron

Professors Ronald Breaker, John Carlson, Damon Clark, Lynn Cooley,* Craig Crews, Stephen Dellaporta, Thierry Emonet, Paul Forscher, Valerie Horsley, Mark Hochstrasser,* Scott Holley, Vivian Irish, Farren Isaacs, Akiko Iwasaki,* Douglas Kankel, Paula Kavathas,* Haig Keshishian, Kathryn Miller-Jensen,* Mark Mooseker, Jon Morrow,* Anna Pyle, Hugh Taylor*

Associate Professors Shirin Bahmanyar, Nadya Dimitrova, Joshua Gendron, Stavroula Hatzios, Yannick Jacob, Megan King,* Josien van Wolfswinkel, Weimin Zhong

Assistant Professors David Breslow, Hattie Chung,* Harry McNamara, Kirstin Meyer, Binyam Mogessie, Jacob Musser, Sigrid Nachtergaele, Michael O'Donnell, Jing Yan

Lecturers Robert Bazell, Edgar Benavides, Francine Carland, Surjit Chandhoke,* Seth Guller,* Richard Harrington, Amaleah Hartman, Ronit Kaufman, Thomas Loreng, Maria Moreno, Kenneth Nelson, Aruna Pawashe,* Joseph Wolenski

* A secondary appointment with primary affiliation in another department or school.

FIELDS OF STUDY

Research in the Department of Molecular, Cellular, and Developmental Biology spans biology from the organismal to the molecular levels. Topics in genetics and molecular biology include studies of non-coding RNAs, genome engineering, genome organization and regulation, gene dosage, bacterial chemotaxis, oncogenes, and systems and synthetic biology. Research topics in cellular and developmental biology include structure and dynamics of the cell cytoskeleton, molecular motors, chemical biology, the nuclear envelope, lncRNAs, regeneration, developmental biomechanics, vertebral column development, stem cell biology, and systems developmental biology. Research in neurobiology focuses on growth cone motility, neural differentiation, synaptogenesis, visual perception, olfaction, and the formation of topographic maps. Research in the plant sciences provides training in the molecular genetics of flowering, meristematic activity, epigenetics, the physiology of hormone action, sex determination, and the circadian clock. Because of the breadth of the department, students are provided with unique training and research opportunities for interdisciplinary studies.

To enter the Ph.D. program, students apply to the Molecular Cell Biology, Genetics, and Development (MCGD) track; the Biochemistry, Quantitative Biology, Biophysics, and Structural Biology (BQBS) track; or the Plant Molecular Biology (PMB) track

within the interdepartmental graduate program in Biological and Biomedical Sciences (BBS), https://medicine.yale.edu/bbs.

INTEGRATED GRADUATE PROGRAM IN PHYSICAL AND ENGINEERING BIOLOGY (PEB)

Students applying to the MCGD or BQBS track of the Biological and Biomedical Sciences program may simultaneously apply to be part of the PEB program. See the description under Non-Degree-Granting Programs, Councils, and Research Institutes for course requirements, and http://peb.yale.edu for more information about the benefits of this program and application instructions.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Each student is expected to take at least three courses, in addition to MCDB 9000/MCDB 9010, Research Skills and Ethics I and II. With the help of a faculty committee, each student will plan a specific program that includes appropriate courses, seminars, laboratory rotations, and independent reading fitted to individual needs and career goals. There is no foreign language requirement. At the beginning of the third term of study, the student meets with a faculty committee to decide on a preliminary topic for dissertation work and to define the research areas in which the student is expected to demonstrate competence. By the end of the fall term of the second year, each student prepares a dissertation prospectus outlining the research proposed for the Ph.D. The student is admitted to candidacy for the Ph.D. when (1) the prospectus is accepted by a dissertation committee of faculty members, (2) the committee is satisfied that the student has demonstrated competence in the areas necessary to conduct the proposed work, and (3) the other requirements indicated above are fulfilled. The student should complete the requirements for admission to candidacy by March of the student's second year and no later than the end of the second year of study. Following admission to candidacy, students are required to meet with their thesis advisory committee at least once a year. The remaining requirements include completion of the dissertation research, presentation and defense of the dissertation, and submission of acceptable copies of the dissertation to the graduate school and to the Marx Science and Social Science Library. All students are required to teach in two one-term courses during their Ph.D. study, but not during the first year of graduate study. Students who require additional support from the graduate school must teach additional terms, if needed, after they have fulfilled the academic teaching requirement. Requirements for M.D.-Ph.D. students are the same as for Ph.D. students, except that a single term of teaching is required. During their first year of study, students must successfully complete MCDB 9000/MCDB 9010, Research Skills and Ethics I and II, to fulfill the responsible conduct and ethics in research requirement. This requirement must be met prior to registering for a second year of study. Additionally, students in their second year are required to enroll in the departmental grant-writing course, MCDB 9400, Developing and Writing a Scientific Research Proposal. Further, in the fourth year of study, all students must successfully complete MCDB 5040, RCR Refresher for Senior BBS Students.

HONORS REQUIREMENT

Students must meet the graduate school's Honors requirement by the end of the fourth term of full-time study. (See Degree Requirements under Policies and Regulations.)

MASTER'S DEGREE

M.S. (en route to the Ph.D.) The minimum requirements for award of the Master of Science degree are (1) two academic years registered and in residence full-time in the graduate program; (2) satisfactory completion of the first two years of study and research leading to the Ph.D.; this requirement may be met either (a) by completing a minimum of five courses with an average grade of High Pass and at least one Honors grade, in addition to satisfactory performance in MCDB 9000/MCDB 9010, or (b) by (i) successfully completing at least three courses with an average grade of High Pass and at least one Honors grade, (ii) satisfactory performance in MCDB 9000/MCDB 9010, and (iii) passing the prospectus examination; (3) recommendation by the department for award of the degree, subject to final review and approval by the degree committee. No courses that were taken prior to matriculation in the graduate program, or in Yale College, or in summer programs may be applied toward these requirements.

Prospective applicants are encouraged to visit the BBS website (https://medicine.yale.edu/bbs), MCGD, BQBS, and PMB tracks.

COURSES

MCDB 603a / CBIO 6030a, Seminar in Molecular Cell Biology Min Wu
A graduate-level seminar in modern cell biology. The class is devoted to the reading and critical evaluation of classical and current papers. The topics are coordinated with the CBIO 6602 lecture schedule. Thus, concurrent enrollment in CBIO 6602 is required. Prerequisites: Any undergraduates wishing to enroll must have already taken MCDB 205. In addition, undergraduates are strongly encouraged to reach out to the course directors prior to enrollment.

MCDB 913b and MCDB 9130b / CBIO 9130b / GENE 9130b, Third Laboratory Rotation Andrew Xiao
Third laboratory rotation for Molecular Cell Biology, Genetics, and Development (MCGD) and Plant Molecular Biology (PMB) track students.

MCDB 5000a or b / MB&B 5000a or b, Biochemistry Staff
An introduction to the biochemistry of animals, plants, and microorganisms, emphasizing the relations of chemical principles and structure to the evolution and regulation of living systems.

MCDB 5170b / ENAS 5170b / MB&B 5170b / PHYS 5170b, Methods and Logic in Interdisciplinary Research Corey O'Hern and Emma Carley
This full PEB class is intended to introduce students to integrated approaches to research. Each week, the first of two sessions is student-led, while the second session is led by faculty with complementary expertise and discusses papers that use different approaches to the same topic (for example, physical and biological or experiment and theory).

MCDB 5300a / IBIO 5300a / MBIO 530, Biology of the Immune System Nikhil Joshi and Grace Chen
The development of the immune system. Cellular and molecular mechanisms of immune recognition. Effector responses against pathogens. Immunologic memory and vaccines. Human diseases including allergy, autoimmunity, cancer, immunodeficiency, HIV/AIDS.

MCDB 5310a / MB&B 5310a / PHYS 5610a, Modeling Biological Systems I Thierry Emonet and Kathryn Miller-Jensen

Biological systems make sophisticated decisions at many levels. This course explores the molecular and computational underpinnings of how these decisions are made, with a focus on modeling static and dynamic processes in example biological systems. This course is aimed at biology students and teaches the analytic and computational methods needed to model genetic networks and protein signaling pathways. Students present and discuss original papers in class. They learn to model using MatLab in a series of in-class hackathons that illustrate the biological examples discussed in the lectures. Biological systems and processes that are modeled include: (1) gene expression, including the kinetics of RNA and protein synthesis and degradation; (2) activators and repressors; (3) the lysogeny/lysis switch of lambda phage; (4) network motifs and how they shape response dynamics; (5) cell signaling, MAP kinase networks and cell fate decisions; and (6) noise in gene expression. Prerequisites: MATH 115 or 116, BIOL 101–104, or with permission of instructors. This course also benefits students who have taken more advanced biology courses (e.g. MCDB 200, MCDB 310, MB&B 300/301).

MCDB 5500a / BENG 5200a / C&MP 5500a / PHAR 5500 / PTB 5500, Physiological Systems W. Mark Saltzman and Stuart Campbell

The course develops a foundation in human physiology by examining the homeostasis of vital parameters within the body, and the biophysical properties of cells, tissues, and organs. Basic concepts in cell and membrane physiology are synthesized through exploring the function of skeletal, smooth, and cardiac muscle. The physical basis of blood flow, mechanisms of vascular exchange, cardiac performance, and regulation of overall circulatory function are discussed. Respiratory physiology explores the mechanics of ventilation, gas diffusion, and acid-base balance. Renal physiology examines the formation and composition of urine and the regulation of electrolyte, fluid, and acid-base balance. Organs of the digestive system are discussed from the perspective of substrate metabolism and energy balance. Hormonal regulation is applied to metabolic control and to calcium, water, and electrolyte balance. The biology of nerve cells is addressed with emphasis on synaptic transmission and simple neuronal circuits within the central nervous system. The special senses are considered in the framework of sensory transduction. Weekly discussion sections provide a forum for in-depth exploration of topics. Graduate students evaluate research findings through literature review and weekly meetings with the instructor.

MCDB 5600b / BENG 5270b / C&MP 5560 / PHAR 5600, Cellular and Molecular Physiology: Molecular Machines in Human Disease Emile Boulpaep

The course focuses on understanding the processes that transfer molecules across membranes at the cellular, molecular, biophysical, and physiological levels. Students learn about the different classes of molecular machines that mediate membrane transport, generate electrical currents, or perform mechanical displacement. Emphasis is placed on the relationship between the molecular structures of membrane proteins and their individual functions. The interactions among transport proteins in determining the physiological behaviors of cells and tissues are also stressed. Molecular motors are introduced and their mechanical relationship to cell function is explored. Students read papers from the scientific literature that establish the connections between mutations in genes encoding membrane proteins and a wide variety of human genetic diseases.

MCDB 5700b, Biotechnology Craig Crews, Joseph Wolenski, and F Kenneth Nelson
The principles and applications of cellular, molecular, and chemical techniques that advance biotechnology. Topics include the most recent tools and strategies used by government agencies, industrial labs, and academic research to adapt biological and chemical compounds as medical treatments, as industrial agents, or for the further study of biological systems.

MCDB 5850b, Research in MCDB for B.S./M.S. Candidates Stephen Dellaporta
A two-credit course taken in the third-to-last term (typically the second term of the junior year). At the start of this course, each student forms a committee composed of the student's adviser and two faculty members that meets to discuss the research project. At the end of this course, students complete a detailed prospectus describing their thesis project and the work completed thus far. The committee evaluates an oral and written presentation of this prospectus; the evaluation determines whether the student may continue in the combined program. Required of students in the joint B.S./M.S. program with Yale College. 2 Course cr

MCDB 5910b / ENAS 5710b / MB&B 5910b / PHYS 5710b, Integrated Workshop Corey O'Hern
This required course for students in the PEB graduate program involves a series of modules, co-taught by faculty, in which students from different academic backgrounds and research skills collaborate on projects at the interface of physics, engineering, and biology. The modules cover a broad range of PEB research areas and skills. The course starts with an introduction to MATLAB, which is used throughout the course for analysis, simulations, and modeling.

MCDB 5950a and MCDB 5960b, Intensive Research in MCDB for B.S./M.S. Candidates Stephen Dellaporta
A four-credit, yearlong course (two credits each term) that is similar to MCDB 495/496 and is taken during the senior year. During this course, students give an oral presentation describing their work. At the end of the course, students are expected to present their work to the department in the form of a poster presentation. In addition, students are expected to give an oral thesis defense, followed by a comprehensive examination of the thesis conducted by the thesis committee. Upon successful completion of this examination, as well as other requirements, the student is awarded the combined B.S./M.S. degree. Required of students in the joint B.S./M.S. program with Yale College. 2 Course cr per term

MCDB 6020a / CBIO 6020a / MB&B 6020a, Molecular Cell Biology Thomas Melia
A comprehensive introduction to the molecular and mechanistic aspects of cell biology for graduate students in all programs. Emphasizes fundamental issues of cellular organization, regulation, biogenesis, and function at the molecular level. Graduate Prerequisites: Some knowledge of basic cell biology and biochemistry is assumed. Students who have not taken courses in these areas can prepare by reading relevant sections in basic molecular cell biology texts. We recommend Pollard et al., *Cell Biology* (4th ed., 2024), Alberts et al., *Molecular Biology of the Cell* (7th ed., 2022), or Lodish et al., *Molecular Cell Biology* (9th edition, 2021). Undergraduate Prerequisites: This is a graduate-level cell biology class. Any undergraduates wishing to enroll must have already taken MCDB 2050. In addition, undergraduates are strongly encouraged to reach out to the course directors prior to enrollment.

MCDB 6250a / GENE 6250a / MB&B 6250a, Basic Concepts of Genetic Analysis Jun Lu

The universal principles of genetic analysis in eukaryotes are discussed in lectures. Students also read a small selection of primary papers illustrating the very best of genetic analysis and dissect them in detail in the discussion sections. While other Yale graduate molecular genetics courses emphasize molecular biology, this course focuses on the concepts and logic underlying modern genetic analysis.

MCDB 6300b / MB&B 6300b, Biochemical and Biophysical Approaches in Molecular and Cellular Biology Sigrid Nachtergaele

In this course, we provide an overall of various biochemical and biophysical approaches used in modern research in molecular and cellular biology, ranging from spectroscopic tools, microscopy, to X-ray crystallography. The goal of the course is to make students familiar with these techniques so that they can find relevant materials in their future research. Does not count for graduate course credit for BQBS graduate students.

MCDB 6500a, Epigenetics Nadya Dimitrova, Josien van Wolfswinkel, and Yannick Jacob

Study of epigenetic states and the various mechanisms of epigenetic regulation, including histone modification, DNA methylation, nuclear organization, and regulation by noncoding RNAs. A detailed critique of papers from primary literature and discussion of novel technologies, with specific attention to the role of epigenetics in development and its impact on human health.

MCDB 6700b, Advanced Seminar in Biochemistry and Genetics Ronald Breaker and Anna Marie Pyle

This seminar is designed to expand students' abilities to critically read and evaluate the primary scientific literature relevant to some of the most active areas of biochemical and genetic research. Special emphasis is placed on topics that deal with recent discoveries in nucleic acids, such as catalytic RNA and DNA, functions of noncoding RNA, gene regulation by RNA, and genomic processing and instability. Students read assigned papers in advance. Discussion focuses on experimental design used by the authors, results of the experiments, and conclusions drawn by the authors.

MCDB 6770b / GENE 7770b, Mechanisms of Development Kaelyn Sumigray and Salil Garg

An advanced graduate seminar on animal development focusing on conserved mechanisms that govern germline development, embryogenesis, and somatic differentiation in molecular detail. The course runs parallel to the spring session of the Department of Genetics Seminar Series and is divided into two components: six Yale faculty-led lectures on core concepts in development and six combined journal club/student-led discussions with outside developmental biology speakers on their cutting-edge research. Over the course of the semester, small student groups are responsible for presenting one journal club-formatted discussion on two papers selected from the outside speaker's lab, as well as emceeing a dedicated question and answer session between the class and the speaker. This course provides a rare opportunity for Yale students to actively engage with world leaders on their work in developmental genetics, epigenetics, and cell biology, as well as learn essential skills in experimental thinking and scientific communication. The course grade is based on 40 percent take-home problems, 40 percent class participation and 20 percent student-led journal club/distinguished speaker question-and-answer session. There are no official

prerequisites. However, some familiarity with concepts and techniques of modern biology is necessary to get the most out of the course.

MCDB 6800a, Advances in Plant Molecular Biology Yannick Jacob, Josh Gendron, Vivian Irish, and Alex Canto-Pastor

The study of basic processes in plant growth and development to provide a foundation for addressing critical agricultural needs in response to a changing climate. Topics include the latest breakthroughs in plant sciences with emphasis on molecular, cellular, and developmental biology; biotic and abiotic plant interactions; development, genomics, proteomics, epigenetics, and chemical biology in the context of plant biology; and the current societal debates about agrobiotechnology.

MCDB 7000b, Molecular and Biochemical Principles of Gene Function Anna Marie Pyle and Farren Isaacs

Although many graduate students in the physical sciences begin conducting their thesis work on problems in the biological sciences, many of them lack preparation in the molecular foundations of the discipline. MCDB200 provides these students with a strong foundational and practical knowledge of the contemporary field of molecular biology and genetic manipulation, greatly facilitating their thesis research. Prerequisites: CHEM 161 or 163, and BIOL 101 (or placement out of BIOL 101 via BIOL 101 placement exam, or via AP5 or IB7HL with permission of core course instructor). 0 Course cr

MCDB 7200a, Neurobiology Haig Keshishian and Harry McNamara

Examination of the excitability of the nerve cell membrane as a starting point for the study of molecular, cellular, and intracellular mechanisms underlying the generation and control of behavior.

MCDB 7430b / GENE 7430 / MB&B 7430b, Advanced Eukaryotic Molecular Biology Mark Hochstrasser, Wendy Gilbert, Matthew Simon, and Franziska Bleichert

Selected topics in transcriptional control, regulation of chromatin structure, mRNA processing including spliceosomal splicing, mRNA turnover, RNA interference, translational regulation, protein modification, and protein degradation. Emphasis is placed on how these processes are regulated and the experiments that led to their discovery and understanding. Prerequisite: biochemistry or permission of the instructor.

MCDB 7520b / CB&B 7520b / CPSC 7520b / MB&B 7520b / MB&B 753 / MB&B 754, Biomedical Data Science: Mining and Modeling Mark Gerstein and Matthew Simon

Biomedical data science encompasses the analysis of gene sequences, macromolecular structures, and functional genomics data on a large scale. It represents a major practical application for modern techniques in data mining and simulation. Specific topics to be covered include sequence alignment, large-scale processing, next-generation sequencing data, comparative genomics, phylogenetics, biological database design, geometric analysis of protein structure, molecular-dynamics simulation, biological networks, normalization of microarray data, mining of functional genomics data sets, and machine-learning approaches to data integration. Prerequisites: biochemistry and calculus, or permission of the instructor.

MCDB 9000a / CBIO 9000a / GENE 9000a, Research Skills and Ethics I Andrew Xiao
This course consists of a weekly seminar that covers ethics, writing, and research methods in cellular and molecular biology as well as student presentations ("rotation talks") of work completed in the first and second laboratory rotations.

MCDB 9010b / CBIO 9010b / GENE 9010b, Research Skills and Ethics II Chenxiang Lin
This course consists of a weekly seminar that covers ethics, writing, and research methods in cellular and molecular biology as well as student presentations ("rotation talks") of work completed in the third laboratory rotation.

MCDB 9020a, Advanced Graduate Seminar Josh Gendron
The course allows students to hone their presentation skills through yearly presentation of their dissertation work. Two students each give thirty-minute presentations in each class session. Students are required to present every year beginning in their third year in the MCDB program. Each MCDB graduate student is expected to attend at least 80 percent of the class sessions. Two faculty members co-direct the course, attend the seminars, and provide feedback to the students.

MCDB 9110a / CBIO 9110a / GENE 9110a, First Laboratory Rotation Andrew Xiao
First laboratory rotation for Molecular Cell Biology, Genetics, and Development (MCGD) and Plant Molecular Biology (PMB) track students.

MCDB 9120a / CBIO 9120a / GENE 9120a, Second Laboratory Rotation Andrew Xiao
Second laboratory rotation for Molecular Cell Biology, Genetics, and Development (MCGD) and Plant Molecular Biology (PMB) track students.

MCDB 9400a, Developing and Writing a Scientific Research Proposal Josh Gendron
Through lectures, discussions, writing activities, and revisions, students become familiar with the principles of scientific grant writing, including language, style, content, and how to formulate a hypothesis and specific aims. Students effectively articulate their overall research plan and the significance of their research in writing and in oral presentations, and they learn to critique and review grant proposals by engaging in peer-review activities with fellow classmates. By the end of the term, students review, revise, and complete the research strategy for an NRSA F31 or NSF and/or the foundation for their qualifying proposal.

MCDB 9500a, Second-Year Research Staff
By arrangement with faculty.

Music

Stoeckel Hall, 203.432.2986
http://yalemusic.yale.edu
M.A., M.Phil., Ph.D.

Chair
Ian Quinn [F]
Gundula Kreuzer [Sp]

Director of Graduate Studies
Michael Veal (Stoeckel, 203.432.2986, dgs.music@yale.edu)

Professors Ardis Butterfield, Brian Kane, Gundula Kreuzer, Pauline LeVen, Ian Quinn, Braxton Shelley, Gary Tomlinson, Michael Veal, AZ Zayaruznaya

Assistant Professors Giulia Accornero, Ameera Nimjee, Jessica Peritz, Daniel Walden, Lindsay Wright

FIELDS OF STUDY

Fields include music history, music theory, and ethnomusicology. (Students interested in degrees in performance, conducting, or composition should apply to the Yale School of Music.)

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Two years of coursework, comprising a minimum of fourteen courses. All students must take the proseminars in ethnomusicology, music history, and music theory. In addition, students in the theory program must take both of the history of theory seminars; students in the music history program must take one history of theory seminar. Students in ethnomusicology can take up to five courses in other departments, and students in music history and music theory can take up to four courses in other departments subject to DGS approval. Consult the Music Graduate Student Handbook for further details specific to each program.

A student must receive at least four Honors grades in departmental seminars in order to proceed to the qualifying examination, administered in August following the second year. Students must also pass a reading examination in two languages other than English before they are admitted to candidacy. The purpose of these language exams is to ensure that students have basic proficiency in important languages of their discipline and/or those languages in which they plan to conduct their research. Third-year students attend a weekly prospectus/dissertation colloquium. Approval of the dissertation prospectus admits a student to candidacy, provided that all other requirements are met. Only students admitted to candidacy can continue into the fourth year of study. Fourth- and fifth-year students attend the dissertation colloquium in the spring terms.

The faculty considers teaching to be essential to the professional preparation of graduate students in Music. Students in Music typically participate in the Teaching Fellows Program in their third, fourth, and sixth years.

COMBINED PH.D. PROGRAMS

Music and Black Studies

The Department of Music offers, in conjunction with the Department of Black Studies, a combined Ph.D. degree in music and Black studies. For further details, see Black Studies.

Music and Early Modern Studies

The Department of Music offers, in conjunction with the Early Modern Studies Program, a combined Ph.D. in Music and Early Modern Studies. For further details, see Early Modern Studies.

MASTER'S DEGREES

M.Phil. See Degree Requirements under Policies and Regulations.

M.A. Students may apply for a terminal master's degree in music. For the M.A. degree, students must successfully complete seven courses, at least six of which are seminars given in the department, along with the passing of the style and repertory examination and an examination in one foreign language. Of the six departmental seminars, at least two grades must be Honors; the remaining five grades must average High Pass. Candidates in combined programs will be awarded the M.A. only when the master's degree requirements for both programs have been met. Doctoral students who withdraw from the Ph.D. program may be eligible to receive the M.A. if they have met the above requirements and have not already received the M.Phil.

COURSES

MUSI 5300a / EMST 7300a, The Castrato Jessica Peritz
This mezzanine seminar locates the intriguing, anxiety-inducing figure of the castrato at the nexus of fact and fiction, working to disentangle the historical realities of castrato lives from fantasies (both popular and scholarly) about castrato bodies, voices, and sexualities. Though the practice of castration has a long and complicated global history, the Italian term *castrato* denotes a particular group of people within that history: the many thousands of Italian boys, mostly from poor families, who were subjected to surgery between 1550 and 1850 with the express purpose of altering their voices for music-making. As the most celebrated performers of vocal music in early modern Europe, castrati were adored, worshipped, and heaped with wealth—but also mocked, shunned, and denied basic human rights. These and other contradictions characterize the castrato's fraught place within music history, while also resonating across time with twenty-first-century concerns about constructions of gender, sexuality, race, class, and (dis)ability. Each of the seminar's weekly sessions revolves around a different approach to the castrato, spanning the historical and transhistorical, factual and fantastical, music-oriented and otherwise. Through reading and analyzing an array of primary sources, musical objects, and scholarly literature, we explore how representations of the castrato in any given time and place reveal a much broader network of cultural ideologies at work under the surface. All told, the figure of the castrato helps us understand historical modes of embodiment and music-making, while also raising still-pressing questions about desire, bodily agency, and the limitations of the archive.

MUSI 6740a, Musical Amateurs Lindsay Wright
What does a musical amateur sound like? With etymological roots in the Latin *amare,* amateurism initially referred favorably to someone pursuing an activity for love rather than financial gain. Today, musical amateurs are often understood as those who perform outside of professional settings, receiving little or no compensation for their labor. In other contexts, "amateur" has become a pejorative term for those without substantial skill or talent—as George Bernard Shaw famously put it, "hell is full of musical amateurs." These definitions, however, barely scratch the surface of amateurism's complex meanings across musical practices and communities. In this course, we interrogate the shifting role and reputation of the musical amateur, exploring the fluid boundaries between amateur and professional. We also question the relevance of this distinction entirely, considering other ways to understand humans' motivations for making music—and the standards by which that music is evaluated. Engaging with scholarship across and beyond the music disciplines, we consider how amateurs have provoked conversations around music's relationship with capitalism, with expertise, with formal education, with pleasure, and with failure.

MUSI 6990a, Proseminar: Musicology Jessica Peritz
A historiographical survey of major topics, issues, and techniques of musicological research. We consider the position of musicology in the broader context of historical thought and provide a conceptual foundation for further work in the field.

MUSI 7230a / AFAM 7230, Black Music and Social Life in the Digital Episteme Braxton Shelley
Black music's online life unfolds at the intersection of two kinds of social media: musical sound and technological ecologies. Through exploring this intersection, this seminar brings crucial aspects of both media into relief. In dialogue with work in the fields of musicology, ethnomusicology, music theory, media studies, visual culture, and philosophy, we analyze remediations of Black music and musicalities on platforms like X, Instagram, TikTok, YouTube, WhatsApp, and Facebook, among others. The seminar engages with the theory of "digital antiphony" as a framework for understanding the modes of creativity that many digital artifacts reveal and the ways of listening that these potentially-viral objects solicit, showing how various notions of musicality shape the experience of Blackness and sociality in the digital episteme.

MUSI 8120a, Directed Studies: Ethnomusicology Michael Veal
n/a

MUSI 8140a, Directed Studies: History of Music Michael Veal
By arrangement with faculty.

MUSI 8510a, Workshop: Writing About Popular Music, Jazz, and World Music Michael Veal
This seminar is organized as a writing craft workshop in which we will read, critique, and emulate different styles/genres of popular music writing including works of academic scholarship, journalism, biography, and memoir. The goal is to develop facility in different styles of music writing, with the longer-term goal of preparing students for a variety of potential music-writing-based career paths. None.

MUSI 9140a, Directed Studies: Theory of Music Michael Veal
By arrangement with faculty.

MUSI 9980a, Prospectus Workshop Lindsay Wright
n/a

Near Eastern Languages and Civilizations

Humanities Quadrangle, 203.432.2944
http://nelc.yale.edu
M.A., M.Phil., Ph.D.

Chair
Nadine Moeller

Director of Graduate Studies
Kevin van Bladel

Professors Victoria Almansa-Villatoro, John Darnell, Benjamin Foster, Eckart Frahm, Nadine Moeller, Shawkat Toorawa, Kevin van Bladel, Harvey Weiss

Senior Lecturers and Senior Lectors Sarab Al Ani, Muhammad Aziz, Gojko Barjamovic, Jonas Elbousty, Ozgen Felek, Shiri Goren, Randa Muhammed, Dina Roginsky, Farkhondeh Shayesteh, Kathryn Slanski, M. Ezgi Yalcin, Orit Yeret

Lecturers and Lectors Nicholas Brown, Agnete Lassen, Gregory Marouard, Klaus Wagensonner

FIELDS OF STUDY

Fields include Arabic Humanities, Assyriology, the Classical Near East, and Egyptology.

SPECIAL ADMISSIONS REQUIREMENTS

Applicants should state their specific field of study and intended specialization. Evidence of reading knowledge of both French and German is required of all Ph.D. students. Proficiency in one of these languages is normally a prerequisite for admission and is demonstrated by passing a departmental examination upon registration at Yale. Proficiency in the second language must be achieved before admission to the second year of study. Ph.D. students admitted with only one of the two required languages or who fail the departmental examination are expected to enroll in an appropriate course given by the French or German department at Yale (or the equivalent elsewhere, with the approval of the director of graduate studies [DGS]). Completion of such a course with a grade of A or B will be accepted as fulfilling the proficiency requirement in either language; exceptions, for instance, for native speakers of French or German, may be made by the department upon recommendation of the DGS. For students in the M.A. program, evidence of reading knowledge of either French or German is sufficient.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Coursework

The department normally requires that students take a minimum of twenty to twenty-three courses over three years. The minimum number depends on the area of specialization as follows: Arabic Humanities and Egyptology, twenty courses; Assyriology and Classical Near East, twenty-three courses. For all students, this normally means five semesters of full course load (four courses per semester) followed by a sixth semester of reduced course load in preparation for the qualifying examinations. Normal progress in course work is considered to be consistent achievement of grades of High Pass or better, and at least four term courses or two

yearlong courses with Honors per year. Students entering the program with an M.A. may ask that up to three graduate courses they took before arrival at Yale be counted toward the course requirement. If the request is approved by their adviser and the DGS, they can meet the requirement within two and a half years.

Of the required courses for graduate study, at least three quarters should be taken within the department, usually within the student's primary field of study. Courses taken outside of the department should be clearly related to the student's primary field or constitute a coherent second field. For students who take no courses outside of the department, minimum competence in a second field within NELC is required, defined as follows: at least two terms of a Near Eastern language, to be evaluated either by examination or a course grade of High Pass or better, or at least two terms of nonlanguage courses outside the area of specialization.

Committees

While doing coursework, students are mentored by a faculty adviser from their field and by the DGS. Students writing dissertations may, if they so wish, be mentored by a committee headed by a primary adviser from NELC (not necessarily the faculty adviser from the course work years) and staffed with one, two, or more additional members, from either inside or outside the department, depending on the student's specific needs. Committees are to be approved by the DGS. Interested students are encouraged to seek out suitable and willing faculty to serve on their advisory committees.

Special Language and Course Requirements

Course work should be planned to meet two departmental general standards: core languages for the primary fields of study, and minimum competence in a secondary field. The core languages in each of the major fields of study are as follows:
Arabic Humanities Arabic and one other Near Eastern language, typically Hebrew, Persian, or Turkish.
Assyriology Sumerian and Akkadian.
Classical Near East Arabic and at least two of the following: Armenian, Aramaic (Babylonian or Syriac), Coptic, Greek, Hebrew, Middle Persian, New Persian, or Sanskrit.
Egyptology Egyptian and at least four terms of Demotic or Coptic.

Minimum competence in a secondary field of study is defined as follows: at least two terms of a Near Eastern language to be evaluated either by examination or with a course grade of High Pass or better, or at least two terms of nonlanguage courses outside the area of specialization. A minimum grade of High Pass in these courses will be considered successful fulfillment of this requirement.

In Arabic Humanities, the minimum competence can be extended to an interdisciplinary course of study in a minor field. Minors may include six to eight term courses in such departments and programs as Comparative Literature, French, History, History of Science and Medicine, Italian Studies, Judaic Studies, Linguistics, Medieval Studies, Philosophy, Religious Studies, Spanish and Portuguese, or others as applicable.

Students in all four fields of the department will be expected to declare their choice of a secondary language or area, or a minor field, by their third term of study.

Training in Teaching

NELC students normally acquire four terms of teaching experience, between their second and fourth years in residence. Teaching Fellow assignments will be made by the DGS in consultation with the relevant faculty and will, whenever possible, take student preferences into account.

Examinations and the Dissertation

The qualifying examination is normally taken at the end of the third year of study or no later than the beginning of the fourth year of study. Students meeting the course requirement after five semesters may take the qualifying examination at the end of the fall term of their third year. Qualifying examinations normally include three written and one oral examination, including language, literature, history, and other topics to be determined by the DGS in consultation with the student and the relevant faculty. Qualifying examinations may be based in part on reading lists of primary core texts and secondary literature compiled in advance by the student and the relevant faculty. Primary texts and secondary literature from course work may also be topics of the examination. For language examinations, unseen texts may also be included. In the case of the program in Arabic Humanities, for students electing to do a minor, the written portion will consist of two language examinations and one subject in the minor field, and the oral will consist of two subjects in Arabic studies and one in the minor field. Written examinations are set by the individual faculty members responsible for particular areas of study, but the oral portion may be conducted by the full staff of the department. The dissertation proposal is normally submitted one month after completing the qualifying examination.

In their final term of course work, students may, with the permission of the DGS and the relevant faculty, enroll in a directed readings course related to the general field of the prospective dissertation topic. Coursework should include preparation of a comprehensive, annotated bibliography for the prospective topic and exploration of selected aspects of the topic in a research paper. Students availing themselves of this option may present some of their work at the NELC Roundtable.

The dissertation prospectus may comprise up to thirty pages, excluding the bibliography. A two-page summary of the prospectus will normally be circulated among and voted upon by the faculty, though the full prospectus will be available for consideration.

Successful completion of the comprehensive examination and submission of an acceptable prospectus will qualify the student for admission to candidacy for the Ph.D. degree. After completion of the dissertation, the candidate may receive a final examination concerned primarily with the defense of the thesis.

ARCHAIA GRADUATE QUALIFICATION

Students can participate in the Yale Program for the Study of Ancient and Premodern Cultures and Societies (Archaia) and receive a graduate qualification by fulfilling the

necessary requirements. For further information, see Archaia, under Non-Degree-Granting Programs, Councils, and Research Institutes.

MASTER'S DEGREES

M.Phil. See Degree Requirements under Policies and Regulations.

Terminal Master's Degree Program The Department of Near Eastern Languages and Civilizations occasionally admits students to pursue a terminal M.A. degree. No financial aid is available. Students enrolled in the M.A. program must complete a minimum of twelve term courses, with an average of High Pass and at least two grades of Honors.

Students in the Ph.D. program who leave the program prior to completion of the doctoral degree may be eligible to receive the terminal M.A. degree upon completion of a minimum of twelve courses, with an average of High Pass and at least two grades of Honors. Automatic petition for the M.A. degree is not available to students in Near Eastern Languages and Civilizations.

COURSES

AKKD 5000a, Elementary Akkadian I Eckart Frahm
Introduction to the language of ancient Babylonia and its cuneiform writing system, with exercises in reading, translation, and composition.

AKKD 5010b, Elementary Akkadian II Staff
Introduction to the language of ancient Babylonia and its cuneiform writing system, with exercises in reading, translation, and composition.

AKKD 5210a, Old Assyrian Language II Gojko Barjamovic
Continuation of Old Assyrian dialect of the Akkadian language in the context of Northern Mesopotamia and Anatolia in the early second millennium BC. Reading of texts from a wide variety of genres, including private and state letters, legal and administrative records, loans and quittances, caravan texts, commercial records, partnership contracts, family and state law, political treaties, literature, magic, religion, and royal inscriptions. Course readings combine standard introductions and thematic and core studies in the field.

AKKD 5460a, Mythological and Ritual Texts from Ancient Mesopotamia Eckart Frahm
A survey of mythological and ritual texts from ancient Mesopotamia.

AKKD 5470b, Assyrian Letters Eckart Frahm
An introduction to Assyrian letters, mostly from the Assyrian "state archives" of the first millennium B.C.E. Prerequisite: AKKD 1100 and AKKD 1200.

ARBC 5000a, Elementary Modern Standard Arabic I Staff
A two-term course for students who have no previous background in Arabic. Students learn the Arabic alphabet, basic vocabulary and expression, and basic grammatical structures and concepts, and concentrate on developing listening and speaking skills. The course aims at developing the following skills: reading to extract the gist of written Modern Standard Arabic texts; speaking with increased ease, good pronunciation, sound grammatical forms, and correct usage; writing to respond to simple daily life issues; forming and recognizing grammatically correct Modern Standard Arabic.

ARBC 5010b, Elementary Modern Standard Arabic II Staff
A two-term course for students who have no previous background in Arabic. Students learn the Arabic alphabet, basic vocabulary and expression, and basic grammatical structures and concepts, and concentrate on developing listening and speaking skills. The course aims at developing the following skills: reading to extract the gist of written Modern Standard Arabic texts; speaking with increased ease, good pronunciation, sound grammatical forms, and correct usage; writing to respond to simple daily life issues; forming and recognizing grammatically correct Modern Standard Arabic.

ARBC 5020a, Intermediate Modern Standard Arabic I Muhammad Aziz
A two-term course for students with previous background in Arabic. It is designed to improve proficiency in aural and written comprehension as well as in speaking and writing skills. The course aims to develop the following skills: reading to extract the gist as well as key details of written Modern Standard Arabic texts on a variety of academic, social, cultural, economic, and political topics; speaking with greater fluency and enhanced engagement in conversations on a variety of topics; mastering writing, easily forming and recognizing grammatically correct Arabic sentences. Prerequisite: ARBC 5010 or successful completion of a placement test.

ARBC 5030b, Intermediate Modern Standard Arabic II Muhammad Aziz
A two-term course for students with previous background in Arabic. It is designed to improve proficiency in aural and written comprehension as well as in speaking and writing skills. The course aims to develop the following skills: reading to extract the gist as well as key details of written Modern Standard Arabic texts on a variety of academic, social, cultural, economic, and political topics; speaking with greater fluency and enhanced engagement in conversations on a variety of topics; mastering writing, easily forming and recognizing grammatically correct Arabic sentences. Prerequisite: ARBC 5010 or successful completion of a placement test.

ARBC 5040a, Advanced Modern Standard Arabic I Jonas Elbousty
Focus on improving the listening, writing, and speaking skills of students who already have a substantial background in the study of modern standard Arabic. Prerequisite: ARBC 5030 or permission of the instructor.

ARBC 5050b, Advanced Modern Standard Arabic II Jonas Elbousty
Focus on improving the listening, writing, and speaking skills of students who already have a substantial background in the study of modern standard Arabic. Prerequisite: ARBC 5030 or permission of the instructor.

ARBC 5090a, Beginning Classical Arabic I Staff
Introduction to classical Arabic, with emphasis on grammar to improve analytical reading skills. Readings include Qur'anic passages, literary material in both poetry and prose, biographical entries, and religious texts. Prerequisite: ARBC 5010 or permission of the instructor. May be taken concurrently with ARBC 5020 or ARBC 5040.

ARBC 5100b, Beginning Classical Arabic II Staff
Introduction to classical Arabic, with emphasis on analytical reading skills, grammar, and prose composition. Readings from the Qur'an, Islamic theology, and literature and history of the Middle East, as well as Jewish and Christian religious texts in Arabic.

ARBC 5110a, Intermediate Classical Arabic I Staff
A course on Arabic grammar and morphology that builds on the skills acquired in ARBC 1460 or 5100, with emphasis on vocabulary, grammar, and reading skills and

strategies. Readings drawn from a variety of genres, such as biography, history, hadith, and poetry. ARBC 1460 or 5100 or permission from instructor.

ARBC 5120b, Intermediate Classical Arabic II Staff
A continuation of Intermediate Classical Arabic grammar and morphology that builds on the skills acquired in ARBC 1560 or 5110, with emphasis on vocabulary, grammar, and reading skills and strategies. Readings drawn from a variety of genres, such as biography, history, hadith, and poetry. ARBC 1560 or 5110 or permission from instructor.

ARBC 5200a, Egyptian Arabic Randa Muhammed
An Egyptian Arabic dialect course.

ARBC 5220a, Modern Standard Arabic for Heritage Learners I Sarab Al Ani
This course is designed for students who have been exposed to Arabic—either at home or by living in an Arabic speaking country—but who have little or no formal training in the language. The main purpose of the course is to build on the language knowledge students bring to the classroom to improve their skills and performance in the three modes of communication (interpersonal, presentational, and interpretive) to fulfill various needs. Particular attention is paid to building, controlling, and mastering language structures. Effective study strategies are used in this course to strengthen writing skills in MSA. Various assignments and tasks are designed to improve the learner's understanding of several issues related to culture in various Arabic speaking countries. Prerequisite: Students must take the placement test or have permission of the instructor.

ARBC 5230a, Arabic Narrative Prose Muhammad Aziz
Close reading of some of Naguib Mahfouz's novels. Attention to idiomatic expressions, structural patterns, literary analysis, and discussions. Students write a brief report on their weekly reading and discuss the main ideas of the assigned reading. Short midterm paper relevant to Mahfouz (to be discussed with the instructor) and a final paper. Prerequisite: ARBC 5030 or permission of the instructor.

ARBC 5300b, Arabic Seminar: Early Adab Kevin van Bladel
Study and interpretation of classical Arabic texts for advanced students. Prerequisite: ARBC 5100 or permission of the instructor.

ARBC 5320b, Modern Standard Arabic for Heritage Learners II Sarab Al Ani
Continuation of ARBC 1220, MSA for Heritage Learners I. This course is designed for students who have been exposed to Arabic—either at home or by living in an Arabic-speaking country—but who have little or no formal training in the language. The main purpose of the course is to build on the language knowledge students bring to the classroom to improve their skills and performance in the three modes of communication (Interpersonal, Presentational, and Interpretive) in MSA to fulfill various needs. Particular attention is paid to building, controlling, and mastering language structures. Effective study strategies are used in this course to strengthen writing skills. Various assignments and tasks are designed to improve the learner's understanding of several issues related to culture in various Arabic speaking countries. Prerequisite: ARBC 1220, successful completion of placement test, or instructor permission.

ARBC 5610a, Graduate Arabic Seminar: Medieval Poetry Shawkat Toorawa
Study and interpretation of classical Arabic texts for graduate students. This is a graduate seminar that will adjust its subtitle according to the materials, texts, and subjects covered.

ARBC 5980b, Tracing the Image of the Arab "Other" Jonas Elbousty
This course places the modern Arabic novel in conversation with the West in an effort to uncover both dominant narratives regarding Arab identity as well as counter narratives that present a challenge to these dominant narratives. We study the tradition of modern Arabic literature, looking specifically to the ways in which the image of the "other" is presented in Arabic narratives as well as the ways in which the image of the Arab is constructed through the others' literature. Prerequisite: ARBC 1510.

EGYP 5000a, Introduction to Classical Hieroglyphic Egyptian I Staff
First part of a two-term introduction to the language of ancient pharaonic Egypt (Middle Egyptian) and its hieroglyphic writing system, with short historical, literary, and religious texts. Grammatical analysis with exercises in reading, translation, and composition.

EGYP 5010b, Introduction to Classical Hieroglyphic Egyptian II John Darnell
A two-term introduction to the language of ancient pharaonic Egypt (Middle Egyptian) and its hieroglyphic writing system, with short historical, literary, and religious texts. Grammatical analysis with exercises in reading, translation, and composition. EGYP 1100.

EGYP 5100a, Elementary Biblical Coptic I Melania Linderman
The native Egyptian language in the Roman and Byzantine periods. Thorough grounding in grammar and vocabulary of the Sahidic dialect as a basis for reading biblical, monastic, and Gnostic texts. Credit only on completion of EGYP 520.

EGYP 5200b, Elementary Biblical Coptic II David Baldi
Continuation of EGYP 510. Prerequisite: EGYP 5100.

EGYP 5330a, Intermediate Egyptian I: Literary Texts John Darnell
Close reading of Middle Egyptian literary texts; introduction to the hieratic (cursive) Egyptian script. Readings include the Middle Kingdom stories of "Sinuhe" and the "Eloquent Peasant" and excerpts from wisdom literature. Prerequisite: EGYP 5010.

EGYP 5410b, Intermediate Egyptian II: Historical Texts Staff
Close reading of Middle Egyptian historical texts in original hieroglyphic and hieratic script. Initial survey of ancient Egyptian historiography and grammatical forms peculiar to this genre of text. Prerequisite: EGYP 5010.

EGYP 5500b, Introduction to Demotic John Darnell
Introduction to the script and grammar of demotic, including readings of the *Instruction of Onkhsheshonqy* and excerpts from the bilingual decrees.

EGYP 5780a, The Egyptian Netherworld Books John Darnell
Study of the Underworld texts from the royal tombs of the New Kingdom. Readings from the *Amduat,* the Book of Gates, the Book of Caverns, the Book of the Creation of the Solar Disk, the Book of the Day and the Night, the cryptographic Books of the Solar-Osirian Unity, the Book of the Heavenly Cow, and the Book of Nut. Discussions of the significance of these texts for understanding Egyptian religion and the possible

contributions of these compositions to the Hermetica and Christian Gnosticism. Prerequisites: EGYP 1100 and EGYP 1200 or equivalents.

HEBR 5000a, Elementary Modern Hebrew I Dina Roginsky
A two-term introduction to the language of contemporary Israel, both spoken and written. Fundamentals of grammar; extensive practice in speaking, reading, writing, and comprehension under the guidance of a native speaker. No previous knowledge required. Successful completion of the fall term required to enroll in the spring term.

HEBR 5010b, Elementary Modern Hebrew II Orit Yeret
A two-term introduction to the language of contemporary Israel, both spoken and written. Fundamentals of grammar; extensive practice in speaking, reading, writing, and comprehension under the guidance of a native speaker. No previous knowledge required. Successful completion of the fall term required to enroll in the spring term.

HEBR 5020a, Intermediate Modern Hebrew I Orit Yeret
A two-term review and continuation of grammatical study leading to a deeper comprehension of style and usage. Focus on selected readings, writing, comprehension, and speaking skills. Prerequisite: HEBR 5010 or equivalent.

HEBR 5030b, Intermediate Modern Hebrew II Netta Sovinsky
A two-term review and continuation of grammatical study leading to a deeper comprehension of style and usage. Focus on selected readings, writing, comprehension, and speaking skills. Prerequisite: HEBR 5020 or equivalent.

HEBR 5100a, Conversational Hebrew: Israeli Media Shiri Goren
An advanced Hebrew course for students interested in practicing and enhancing conversational skills. The course aims to improve the four language skills while stressing listening comprehension and various forms of discussions including practical situations, online interactions, and content analysis. Prerequisite: HEBR 5020 or permission of the instructor.

HEBR 5110a, Elementary Biblical Hebrew I Dina Roginsky
A two-term introduction to Biblical Hebrew. Intensive instruction in grammar and vocabulary, supplemented by readings from the Bible. No prior knowledge of Hebrew required.

HEBR 5120b, Elementary Biblical Hebrew II Eric Reymond
A two-term review and continuation of instruction in grammar and vocabulary, supplemented by readings from the Bible. Prerequisite: HEBR 5100 or equivalent.

HEBR 5130a, Intermediate Biblical Hebrew I Eric Reymond
A two-term review and continuation of instruction in grammar and vocabulary, supplemented by readings from the Bible. Prerequisite: HEBR 5100 or equivalent.

HEBR 5630b / JDST 8295b, From Biblical to Modern Hebrew Dina Roginsky
This course aims to support students who have reading knowledge of Biblical Hebrew but cannot read or converse in Modern Hebrew. The course concentrates on reading and aims at enabling students to use Modern Hebrew for research purposes. The texts chosen are tailored to students' particular areas of interest. Prerequisite: two years of Biblical or Modern Hebrew studies, or permission of the instructor. Conducted in English.

HEBR 5780b / JDST 8274b, Languages in Dialogue: Hebrew and Arabic Dina Roginsky
Hebrew and Arabic are closely related as sister Semitic languages. They have a great degree of grammatical, morphological, and lexical similarity. Historically, Arabic and Hebrew have been in cultural contact in various places and in different aspects. This advanced Hebrew language class explores linguistic similarities between the two languages as well as cultural comparisons of the communities, built on mutual respect. Students benefit from a section in which they gain a basic exposure to Arabic, based on its linguistic similarity to Hebrew. Conducted in Hebrew. Prerequisite: HEBR 5030, or placement test, or permission of the instructor.

MESO 5040a, History of Mesopotamia: First Millennium Benjamin Foster
Readings and discussion of issues and evidence for the first millennium of Mesopotamian history.

MESO 5060a, Selected Mesopotamian Texts: Sumerian Benjamin Foster
Survey of selected Mesopotamian texts in Sumerian.

MESO 5340b, Sumerian Literature Benjamin Foster
Sumerian Literature.

NELC 5170a, Beginnings of Business: A History of Early Trade Gojko Barjamovic
When did trade begin? When did business go global? How has the organization of commerce changed through time? What are our fundamental financial instruments and how and in what order where they developed? Are there fundamental rules behind the way in which humans conduct business? What roles have states and institutions historically played in facilitating or restricting trade? What sources and approaches are available to study trade in pre-modern times? Can business innovations from the past help us think about business in the present? To explore all these questions, this course draws upon data and case studies drawn broadly from the ancient world but with focus on evidence from ancient Mesopotamia. With the benefit of a giant canvas of history we paint a detailed picture of how business developed through time. We look at examples where business was strictly regulated by state-controlled institutions as well as examples entrepreneurs would have to rely on informal enforcement mechanisms, such as kin-relationships and reputation in repeated interactions. We dive into the effects of shock on individuals and systems, from production shortages to pandemics. And we ask what happens when systems collapse or value becomes immeasurable (as people have claimed for the 2008 crash). We study family-controlled business groups as an alternative to integrated and professionally managed corporations. And we observe how entrepreneurs adapted to face the financial challenges of states and dawning globalization. Beginnings of Business immerses students in the history of trade and draws on guests from widely different fields and disciplines to showcase the variety of approaches with which scholars address questions of business history. Meetings are built around lectures but emphasize participation and discussion. We run business simulations and make visits to institutions and collections to provide as broad and engaging a learning experience for students as possible about the practice of trade since the dawn of history.

NELC 5250b, Ancient Mesopotamia: The First Half of History Eckart Frahm
An introduction to the history and culture of the peoples and societies of ancient Iraq, from 3500 BCE to 75 CE, with a focus on Sumer, Babylonia, and Assyria. Students

explore the origins of core features of Mesopotamian civilization, many still with us, from writing, literature, law, science, and organized religion to urbanism, long-distance trade, and empire. In addition to secondary sources, readings (all in English) include the Epic of Gilgamesh, the Babylonian Epic of Creation, liver omens from the world's first universal library, cuneiform letters and legal documents, as well as the world's earliest cookbooks, housed in the Yale Babylonian Collection.

NELC 5260b, Tiny but Mighty: Cylinder, Button, and Scarab Seals in Ancient Egypt and Beyond Staff

Small and easily missed, seals stand as ubiquitous archaeological discoveries and museum artifacts. Through careful study, these unassuming objects have led to such important discoveries as documenting otherwise unattested kings. In this seminar we explore the evolution of shapes and uses of seals and pseudo-seals in ancient Egypt, tracing their origins as cylinder seals in the Early Dynastic period (c. 3200 BCE) to the spread of scarab amulets in the western Mediterranean (c. 900–300 BCE). Seals served different purposes in ancient Egypt, and their clay impressions (sealings) are used by modern historians and archaeologists to date sites and better understand ancient Egyptian administrative and economic practices. Despite their archaeological prevalence and historical importance, seals and sealings have not received much attention in Egyptology, and the study of glyptics in ancient Egyptian is still in its infancy. In this seminar we embark on the exploration of questions that illuminate ancient Egypt in novel ways. Some of the issues that we investigate are of broader humanistic and interdisciplinary concern, reading on topics of literacy, pre-industrial bureaucratic state, individual access to the divine, and ethnicity. Indeed, besides becoming familiar with the different typologies of seals, and how to recognize the objects to which the seals were originally attached by inspecting the impressed back of the sealings, we ask such questions as: do seals represent individuals or offices? Were figurative seals a way to include illiterate people in a town or household's administration? Why did more women than men own stamp seals? Is there a parallel, non-official, folk tradition surviving alongside hieroglyphic writing in figurative seals throughout the millennia? Why were Egyptian seals and scarabs manufactured outside of Egypt? Why did Phoenicians bury themselves with scarab seals bearing the name of long-gone Egyptian pharaohs?

NELC 5280a, From Gilgamesh to Persepolis: Introduction to Near Eastern Literatures Kathryn Slanski

This course is an introduction to Near Eastern civilization through its rich and diverse literary cultures. We read and discuss ancient works, such as the *Epic of Gilgamesh*, *Genesis*, and "The Song of Songs," medieval works, such as *A Thousand and One Nights*, selections from the *Qur'an*, and *Shah-nama: The Book of Kings*, and modern works of Israeli, Turkish, and Iranian novelists and Palestinian poets. Students complement classroom studies with visits to the Yale Babylonian Collection and the Beinecke Rare Book and Manuscript Library, as well as with film screenings and guest speakers. Students also learn fundamentals of Near Eastern writing systems, and consider questions of tradition, transmission, and translation. All readings are in translation.

NELC 5370b, Unequal: Dynamics of Power and Social Hierarchy in Ancient Egypt and Mesopotamia Gojko Barjamovic

When we talk about root causes for intolerance, study the terrors of slavery, or argue the nature of imperialism, we refer to the past. Our beliefs about this past are more than just interpretations of what came before. They actively shape society's present—as ultimate origin is tied in the mind to current purpose. The past not only gives form to, but also serves to explain, present reality. Histories of our early past in particular are treated as our own origin myth. And like all origin myths, this narrative has enormous power. Variation on its theme can be found in various forms on the shelves of every airport bookshop. It informs the debates of contemporary policymakers. It permeates popular culture. Popular books lay out narratives of the past, each in their own way, to evoke images, argue ideologies, promote diets, or stir emotions in the present. Most of these myths share a common theme of "progress" and "freedom." It is often told as follows: early humans formed roaming bands of egalitarian hunters and gatherers. As societies grew larger, more complex, wealthy, and "civilized," they became progressively less equal. Settlement and farming required the management of labor, notions of value, rules of ownership. Early states demanded even steeper hierarchies, and with them, the full package of leaders, administrators, division of labor, social class. Equality and freedom were traded for growth and progress. This class challenges the myth that inequality is simply hardwired into society. It does so by going back to the rise of the first states 5000 years ago in ancient Egypt and Mesopotamia and studying how those states were imagined and structured as well as how they changed over time. We look at early historical examples of alternative large-scale collectives and explore historical cases that allow us to study societal structure and change on an epochal scale to ask if inequality is truly an inescapable result of complexity. We venture to transcend mythmaking and identify basic patterns of inequality that resonate across time and into current society. Using examples drawn from early human history we think about key features of our present and explore roots of identity, possession, value, freedom, and power, and how their legacy structures contemporary life.

NELC 5380b, Imaging Ancient Worlds in Museum Collections Klaus Wagensonner and Agnete Lassen

What is digitization of cultural heritage? What are its merits, challenges, and best practices? The course highlights the documentation and interpretation of archaeological artifacts, in particular artifacts from Western Asia. The primary goal of the course is the use of new technologies in computer graphics, including 3D imaging, to support current research in archaeology and anthropology. The course does put particular emphasis on the best practices of digitizing artifacts in collections. The prime study subjects are the artifacts housed in the Yale Babylonian Collection (https://babylonian-collection.yale.edu). For some background information on the collection see here. Students engage directly with the artifacts while practicing the various imaging techniques.

NELC 5400a / EALL 7530a / EMST 9600a / MDVL 9005a / RLST 9550a, Proseminar for Jobseekers in Premodern Fields Lucas Bender

This course is intended for doctoral students (particularly studying topics in the premodern humanities) in their penultimate and final years. Over the course of the semester, students work with peers as well as faculty convener to build the skills they need to present their research to others in a clear, compelling way. Topics covered

include preparing application materials, interviewing, negotiating job offers, alt-ac careers, publishing, CV building, and how to succeed in postdoctoral and junior faculty positions. Weekly sessions generally include workshop time as well as presentations by the convener and visitors. This proseminar is particularly directed toward students affiliated with Archaia and medieval studies but welcomes all those with research interests in the premodern world; if space allows, students working on modern topics can also join. The broad range of primary specialties represented provides students with experience engaging with scholars outside their field, which is increasingly essential for premodernists in the modern academic world.

NELC 5620a, Death, Memorial, and Immortality in the Hebrew Bible and Its World Jacqueline Vayntrub

What does the Hebrew Bible have to say about human mortality, divine immortality, and the afterlife? Are these ideas more consistent with later Jewish and Christian notions of death and the afterlife, or are they closer to the views of their ancient Near Eastern neighbors? In this course we examine the development of biblical and ancient Near Eastern concepts of death and life-after-death. We look at a variety of different types of texts that touch upon these themes, such as narrative, poetry, ritual, and law in biblical and other ancient Near Eastern texts. Topics include the depiction of human mortality and divine immortality in literature; dying as a social process; the development of the notion of an afterlife and the concept of the "soul"; communication with the dead; how these texts have been received in the West; and how they have shaped inherited ideas of the immortality of the soul, human suffering, and divine justice. The aim of the course is to develop an awareness of the ancient historical and cultural context in which these texts were authored, and to deepen our understanding of modern views of mortality. Prerequisite: an introductory course in the Bible at some level is preferred.

NELC 5690a, Visible Language: The Origins of Writing in Mesopotamia and Ancient Egypt Klaus Wagensonner

Exploration of writing in the ancient Near East and the profound effects this new method of communication had on human society. Focus on Egypt and Mesopotamia, where advanced writing systems first developed and were used for millennia.

NELC 5810b, Critical Readings Gojko Barjamovic

A weekly seminar for graduate students in which we read and discuss a selection of old and new monographs (and perhaps a few key articles) relevant to the field of ancient studies. Three weekly presenters give a fifteen-minute oral review of a book, which is followed by a thirty-five-minute discussion. Everyone reads a short passage from the work assigned by the presenter one week in advance. It should not exceed ten to twelve pages on average and should be exemplary of the work. Presenters focus on extracting main points from the chosen work and discuss its place within the broader framework of ancient studies. The seminar targets students in Assyriology, Classics, Egyptology, Hebrew Bible, and Religion, but others may find it interesting and relevant. For our first meeting, we all read and discuss the same book: Liverani's *Imagining Babylon*, which, despite its alleged focus on the Near East, presents a concise and somewhat controversial summary of the history of ancient history. At the first meeting we also divide up the coming weeks and readings between us. The topic for each week is left intentionally broad so as to accommodate a wide selection of books. The selection of themes, on the other hand, ensures that we make it through several major topics within

ancient studies, from economics and religion to art and archeology. We rehearse skills in critical reading, writing scholarly reviews, debating, and, of course, we engage with a massive amount of literature that we might not otherwise find the time to read.

NELC 6350a / CPLT 6010a, The Education of Princes: Medieval Advice Literature of Rulership and Counsel Shawkat Toorawa
In this course we read "mirrors for princes," a type of political writing by courtiers and advisors. The genre flourished in the courts of medieval Europe and the Islamic world. We learn about the ethical and moral considerations that guided (or were meant to guide) rulers in their conduct, in the formulation of their policies, and about theories of rule and rulership. The works we read are from several cultural, religious, and political traditions, and include: Christine de Pizan, *A Medieval Woman's Mirror of* Honor; Einhard, *Life of Charlemagne*; Erasmus, *Education of a Christian Prince*; Ibn al-Muqaffa', *Kalilah and Dimnah,* John of Salisbury, *Policraticus: Book of the Statesman*; Machiavelli, *The Prince*; Nizam al-Mulk, *The Book of Government.* All texts are in English translation. Instructor permission required.

NELC 6580a / RLST 7210a, Introduction to Arabic and Islamic Studies Travis Zadeh
Comprehensive survey of the various subjects treated in Arabic and Islamic studies, with representative readings from each. Detailed investigation into the methods and techniques of scholarship in the field, with emphasis on acquiring familiarity with the bibliographical and other research tools.

NELC 7260a, The Archaeology of Abusir: Tombs, Temples, and Settlements Nadine Moeller
This graduate seminar focuses on the recent archaeological discoveries and research made at the ancient site of Abusir, located on the western desert edge, south of modern Cairo, Egypt. Abusir was an important royal necropolis starting in Dynasty 5 (ca. 2495–2345 BCE) which included pyramids and mastaba tombs of Egypt's elite and courtiers. It is also the site of the enigmatic sun-temples that had religious and economic functions. Remains of settlements have been detected in relation to the mortuary and valley temples associated with the pyramids at the site. However, the occupation and building activities at Abusir did not stop in the Old Kingdom but saw the construction of a Ramesside temple and the emergence of an important cemetery dating to the Saite-Persian Period (sixth century BCE) later on. The recent fieldwork by several Czech missions has resulted in some groundbreaking new publications, which are studied and discussed in depth during this seminar. By instructor permission only. This seminar requires a good foundation in ancient Egyptian history and culture.

NELC 7290b / ANTH 5328b / ARCG 5328b, Magic and Ritual in Ancient Egypt and the Near East John Darnell
Introduction to ancient Egyptian and Near East magic and rituals with an overview on the use of magic and discussion of the different rituals and festivals.

NELC 7320a, The Valley of the Kings: Its Life and Afterlife Nicholas Brown
This course provides students with an introduction to the New Kingdom royal necropolis at Thebes—the Valley of the Kings. Throughout the semester, students are introduced to several important subjects related to this archaeological site, including the "lifecycle" and "afterlife" of the necropolis. Students explore the origins of the valley, its development over time, and the eventual decline of this royal burial ground. As a class, we explore the boundaries and rules of death space: who has access and when?

How did the natural topography affect the development of the necropolis over time? What influences do religious beliefs and political, social, and economic events have on the evolution of this sacred space over time? The overall goal of this graduate seminar is to examine this important site through a different perspective, to view the activities of western Thebes during the New Kingdom through a new lens.

NELC 7430a / ARCG 6345a / ARCG 645, Archaeology of Ancient Egypt - The Age of the Pyramids Gregory Marouard

This lecture course introduces the archaeology of ancient Egypt, beginning with an overview of the environment, climate, and history of the discipline, as well as the new archaeological methods used in contemporary fieldwork in Egypt. The course then explores ancient Egypt's origins, starting with the Predynastic and Early Dynastic Periods (5300–2800 BCE) and continuing chronologically to the great pyramids of the Old Kingdom (2800–2055 BCE) and the Middle Kingdom (2055–1700 BCE). It covers the historical framework, the evolution of ancient Egyptian art and architecture, and material culture, and includes specific case studies of important archaeological sites and discoveries. This course is the first of two introductory lecture courses. However, it is not necessary to take both parts, and the order in which you take them does not matter. Discussion sections are included.

NELC 7440b / ARCG 6242b, Ancient Egyptian Materials and Techniques: Their Histories and Socioeconomic Implications Gregory Marouard

This seminar investigates in detail ancient Egyptian materials, techniques, and industries through the scope of archaeology, history, and socioeconomical, textual, and iconographic data. When possible, ethnoarchaeological and experimental approaches of the antique *chaîne-opératoire* are discussed in order to illustrate skills and professions that have now completely disappeared. This class is organized according to various themes within a diachronical approach, from the fourth millennium BCE to the Roman period. Copper and precious metals, construction stones, hard stones and gems, glass and faience production, imported wood or ivory—we explore multiple categories of materials; where and how they were collected or exchanged; the way these products were transported, transformed, refined, or assembled; and the complex organization of the work involved and administration that was required in order to satisfy the tastes of Egyptian elites or their desires to worship their gods. Some other vernacular savoir-faire linked to everyday life and death is explored, through food production and mummification practices. The aim is not only to give an overview of the history of techniques for this early civilization but also, beyond how things were made, to acquire a more critical view of ancient Egyptian culture through material culture and the strong economic and sociological implications linked to objects and constructions#rather than the usual focus on Egyptian temples and tombs.

NELC 8290b, History of the Arabic Language Kevin van Bladel

The course covers the development of the Arabic language from the earliest epigraphic evidence through the formation of the Classical 'Arabiyya and further, to Middle Arabic and Neo-Arabic. Readings of textual specimens and survey of secondary literature.

OTTM 5300b, Reading and Research in Ottoman History and Literature Ozgen Felek

This is a text reading course. The course aims to introduce students to a variety of historical and literary Ottoman texts and documents from the fourteenth to nineteenth centuries. We read and analyze excerpts from original Ottoman texts, such as the

chronicles, heroic narratives, advice books, physiognomy texts, travel accounts, and hagiographical stories. The students participating in the course develop skills that enable them to read Ottoman Turkish texts and pursue independent work in Ottoman studies. Prerequisite: knowledge of modern Turkish is required.

OTTM 6900a, Directed Readings: European Goods in the Fifteenth and Early Sixteenth-Century Ottoman Archives Ozgen Felek
Under the supervision of the instructor, students read, study, and analyze Ottoman texts from a variety of genres.

OTTM 6930a, Ottoman Society Through the Lens of its Gazettes: Late Nineteenth–Early Twentieth Centuries Ozgen Felek
This course explores nineteenth- to twentieth-century Ottoman society, culture, and politics through the lens of its gazettes. The first official gazette of the Ottoman Empire, the *Takvim-i Vekayi*, was published in 1831, followed ten years later by the second major newspaper, the *Ceride-i Havadis* (1840). Following these two earliest Turkish newspapers, the Ottoman press began to evolve independently of the state newspapers, with publications beginning to openly criticize government policies. This course focuses on chronological readings of articles and essays published in Ottoman newspapers to help students understand the nineteenth- and twentieth-century Ottoman society from direct accounts and perspectives. We read excerpts from popular newspapers of the period, starting with the *Takvim-i Vekayi* and other gazettes published in Ottoman script until the alphabet revolution in 1928. Students examine the evolutions of themes of women's roles, fashion, minorities, social and cultural events, intellectual, literary, and political movements in the Ottoman (and early Republican) society. These readings also highlight the evolution of the Ottoman language through the contributions of influential writers of the period. The course emphasizes building a richer vocabulary, developing proficiency in Ottoman Turkish reading skills, and deepening an understanding of Turkish grammar and syntax. Students engage with key principles of textual criticism to achieve a deeper understanding of Ottoman society, linguistics, and cultural transformations as reflected in its press.

PERS 5000a, Elementary Persian I Farkhondeh Shayesteh
A two-term introduction to modern Persian with emphasis on all four language skills: reading, writing, listening, and speaking. The objective is to allow students to develop the foundational knowledge necessary for further language study. Designed for nonnative speakers.

PERS 5010b, Elementary Persian II Farkhondeh Shayesteh
A two-term introduction to modern Persian with emphasis on all four language skills: reading, writing, listening, and speaking. The objective is to allow students to develop the foundational knowledge necessary for further language study. Designed for nonnative speakers.

PERS 5020a, Intermediate Persian I Farkhondeh Shayesteh
This two-term course is a continuation of PERS 5010 with emphasis on expanding vocabulary and understanding of more complex grammatical forms and syntax. Designed for nonnative speakers. Prerequisite: PERS 5010 or permission of the instructor.

PERS 5030b, Intermediate Persian II Farkhondeh Shayesteh
This two-term course is a continuation of PERS 5010 with emphasis on expanding vocabulary and understanding of more complex grammatical forms and syntax. Designed for nonnative speakers. Prerequisite: PERS 5010 or permission of the instructor.

PERS 5040a, Thematic Survey of Modern Persian Literature Farkhondeh Shayesteh
An advanced course focusing on continuing development of language skills for nonnative speakers. Emphasis on reading and writing through modern Persian literary prose and poetry. Prerequisite: PERS 5020 or permission of the instructor.

SMTC 5230a / RLST 8480a, Intermediate Syriac I Jimmy Daccache
This two-term course is designed to enhance students' knowledge of the Syriac language by reading a selection of texts, sampling the major genres of classical Syriac literature. By the end of the year, students are familiar with non-vocalized texts and are capable of confronting specific grammatical or lexical problems. Prerequisite: RLST 839 / SMTC 5140 or knowledge of Syriac.

SMTC 5420a, Introduction to Classical Ethiopic Hannah Stork
An introduction to the Classical Ethiopic language, focusing on acquiring the essentials of grammar and vocabulary. Prerequisite: knowledge of a Semitic language or permission of the instructor.

SMTC 5430b, Readings in Classical Ethiopic Hannah Stork
Reading and analysis of texts in Classical Ethiopic. Prerequisite: SMTC 5420 or knowledge of Classical Ethiopic.

SMTC 5470a / RLST 8370a, Northwest Semitic Inscriptions: Official Aramaic Jimmy Daccache
Official Aramaic is the *lingua franca* of the Persian Empire during the sixth and fourth centuries BCE. This course is designed to familiarize students with texts from Achaemenid Egypt (the abundant papyri of Elephantine and Hermopolis), Bactria, Anatolia, and Mesopotamia. The Aramaic grammar is illustrated through the texts. Prerequisite: RLST 835, or some knowledge of Aramaic or a related Semitic language.

SMTC 5530a / RLST 8740a, Advanced Syriac I Jimmy Daccache
This course is designed for graduate students who are proficient in Syriac and is organized topically. Topics vary each term and are listed in the syllabus on Canvas.

Nursing

400 West Campus Drive, 203.785.2389
https://nursing.yale.edu/academics/phd-program-nursing
M.Phil., Ph.D.

Dean
Azita Emami

Director of Graduate Studies
M. Tish Knobf (203.785.6455, tish.knobf@yale.edu)

Professors Xiaomei Cong, Azita Emami, M. Tish Knobf, LaRon Nelson, Tatiana Sadak, David Vlahov, Xuehong Zhang

Associate Professors Deena Costa, Soohyun Nam, Monica Ordway, Hermine Poghosyan, Raquel Ramos, Julie Womack

Assistant Professors Bridget Basile-Ibrahim, Joan Combellick, Shelli Feder, Zhao Ni

FIELDS OF STUDY

Common areas of inquiry include chronic conditions; self- and family management; symptom science; maternal and child health; sleep and sleep disorders; global health; mHealth interventions; health equity and health disparities; end-of-life and palliative care; environmental influences on health; and community-based interventions.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Coursework

Completion of fifteen core courses and four cognates in the student's area of specialization (including one advanced analysis course) is required. Successful completion of the Dissertation Seminar (NURS 9906 in the fall and NURS 9907 in the spring) every term until the final dissertation defense is also required.

REQUIRED CORE COURSES

BIS 505	Biostatistics in Public Health II	1
BIS 633	Population and Public Health Informatics	1
CDE 534	Applied Analytic Methods in Epidemiology	1
or S&DS 5630	Multivariate Statistical Methods for the Social Sciences	
NURS 5908	Synthesis of Knowledge and Skills for Nursing Science	1
NURS 5915	Nurse Scientist and Grant Writing	1
NURS 5929	Responsible Conduct of Research	1
NURS 6901	Quantitative Methods for Health Research	1
NURS 6902	Qualitative Methods for Health Research	1
NURS 6903	Measurement of Biobehavioral Phenomena	1
NURS 6904	Mixed Methods Research	1
NURS 6905	Intervention Development and Introduction to Implementation Science	1
NURS 6912	Knowledge Development for Nursing Science	1

NURS 6913	Chronic Conditions: Risk Factors, Prevention, and Management of Adverse Outcomes	1
NURS 9850	Achieving Population Health Equity	2
PUBH 505	Biostatistics in Public Health	1

Cognates may be taken in any area related to the student's dissertation research, including appropriate methodology and statistics courses. Some examples of the disciplines that doctoral students have chosen are public health, psychology, anthropology, divinity, and sociology.

The grading system includes Honors, High Pass, Pass, and Fail. Students must maintain a High Pass average and achieve a grade of Honors in at least two core courses to remain in good standing. After the first year, no more than one grade of Pass in a core course will be permitted. A grade of Pass or better is required for all cognates.

In addition to all other requirements, students must successfully complete NURS 5929, Responsible Conduct of Research, prior to the end of their first year of study. This requirement must be met prior to registering for a second year of study.

The Yale School of Nursing does not offer the option of a combined degree.

Graduate Research Assistant and Teaching Fellow Experience

During the first two years of the program, students are Graduate Research Assistants with faculty mentors and participate in the mentor's ongoing research.

Teaching experience is also considered to be an integral part of graduate education. Therefore, two terms as a Teaching Fellow are required. Teaching Fellows assist with the teaching of master's-level courses, typically during their third year of doctoral study.

Examinations

Successful completion of three examinations is required.

1. The preliminary examination is taken in June after the first year of coursework has been completed. The preliminary examination is intended to allow the student to demonstrate mastery of doctoral coursework. Passing the preliminary examination is a prerequisite for continuing in the second year of doctoral study.
2. The qualifying examination typically takes place at the end of the second year of study, when required coursework is completed. If the qualifying examination is not completed by the end of the sixth term, the student will be placed on Academic Probation. If not completed by the end of the seventh term, the student will be dismissed from the program. The student prepares a comprehensive dissertation proposal containing a statement of the problem to be studied, conceptual framework, critical review of relevant literature, design, methods, and plan for analysis. The oral qualifying examination typically lasts one to one-and-a-half hours. The student gives a twenty-minute formal presentation of the proposed study and answers questions regarding the research and related topics. Successful completion of the Qualifying Examination is required for candidacy for the doctoral degree.
3. The final oral examination is based on the dissertation. The dissertation is intended to demonstrate that the student is competent in the chosen area of study and has

conducted independent research. The final oral examination typically lasts one-and-a-half to two hours. The student gives a twenty-minute formal presentation of the dissertation and answers questions. Successful completion of the final oral examination is required before the Ph.D. can be awarded.

MASTER'S DEGREE

M.Phil. This degree will be granted to Ph.D. students who successfully complete two years of coursework, but do not progress to the dissertation stage. To be awarded the M.Phil. degree, students need to complete all core courses, four cognates (may include independent study with faculty), and two years of graduate research assistant experience, and must pass the preliminary examination. This degree is normally granted only to students who are withdrawing from the Ph.D. program.

For information on the terminal master's degree offered by the Yale School of Nursing (Master of Science in Nursing), please visit the school's website, https://nursing.yale.edu.

REQUIRED NURSING COURSES

All Ph.D. students are required to take the following courses. For a complete list of Nursing courses, see the School of Nursing bulletin, online at https://bulletin.yale.edu; and Yale Course Search at https://courses.yale.edu.

NURS 5908a, Synthesis of Knowledge and Skills for Nursing Science M Tish Knobf
This course is designed to develop beginning competencies necessary to engage in a career as a nurse scientist. It includes the basic principles and processes of scientific writing, literature searches, synthesis of research evidence, and presentation skills.

NURS 6901a, Quantitative Methods for Health Research Soohyun Nam
This course introduces students to quantitative research methods and how to evaluate various scientific designs for investigating problems of importance to nursing and health. Emphasis is placed on scientific rigor, validity, and the critical appraisal of research. Experimental, quasi-experimental, and observational designs are presented and evaluated for internal, external, construct, and statistical validity. The interrelationships of the research question and study aims with study design and method are thoroughly explored. The course prepares students for designing a quantitative study. Required of first-year Ph.D. students in nursing. Three hours per week for fourteen weeks.

NURS 6903a, Measurement of Biobehavioral Phenomena Raquel Ramos
This course is designed to review measurement theory, reliability, and validity of measurement methods and discuss the accuracy and precision of biological and behavioral measures for clinical research. Measures are evaluated through the lens of diverse communities and populations, with the goals of promoting health equity. Required of all second-year Ph.D. students in nursing. Open to advanced graduate students in other schools of the university. Three hours per week for fourteen weeks.

NURS 6904a, Mixed Methods Research Shelli Feder
The purpose of this course is to provide an overview of mixed methods research. This overview consists of the history, philosophical foundations, purpose, data collection, analysis, and evaluation of the common mixed methods designs. Required of all Ph.D. students in nursing. Three hours per week for seven weeks.

NURS 6912a, Knowledge Development for Nursing Science Deena Costa
This course introduces the historical perspective of the philosophy of science and the relationship to nursing science. Students review nursing's disciplinary perspective and examine the philosophical, theoretical, and conceptual linkages for knowledge development for nursing science. The course is required of all first-year students in the Ph.D. program and open to others by permission of the instructor. Three hours per week for fourteen weeks.

NURS 9906a, Dissertation Seminar I M Tish Knobf
This required doctoral course provides the student with advanced study and direction in research leading to development of the dissertation proposal and completion of the dissertation. Students are guided in the application of the fundamentals of scientific writing and criticism. All Ph.D. students in nursing are required to take this seminar every term. Three hours every other week for fourteen weeks.

Pathology and Molecular Medicine

140 Brady Memorial Laboratory
https://medicine.yale.edu/pathology/training/graduateprogram
M.S., M.Phil., Ph.D.

Chair
Chen Liu

Director of Graduate Studies
Themis Kyriakides

Professors Nita Ahuja (*Surgery*), Ranjit Bindra (*Therapeutic Radiology*), Marcus Bosenberg (*Dermatology*), Richard Bucala (*Internal Medicine*), Sandy Chang (*Laboratory Medicine*), Keith Choate (*Dermatology*), Vishwa Deep Dixit, Rong Fan (*Biomedical Engineering*), Carlos Fernandez-Hernando (*Comparative Medicine*), Gary Friedlaender (*Orthopedics and Rehabilitation*), Patrick Gallagher (*Pediatrics*), Stephanie Halene (*Hematology*), Erica Herzog (*Internal Medicine*), Robert Homer, Steven Kleinstein, Yuval Kluger, Christine Ko (*Dermatology*), Diane Krause (*Laboratory Medicine*), Themis Kyriakides, Francis Lee (*Orthopaedics and Rehabilitation*), Chen Liu, Vincent Marchesi, Gilbert Moeckel, Ruth Montgomery (*Rheumatology*), Jon Morrow, Jordan Pober (*Immunobiology*), Katerina Politi, Yibing Qyang (*Internal Medicine*), David Rimm, David Stern, Yajaira Suarez (*Comparative Medicine*), Qin Yan

Associate Professors Demetrios Braddock, Karin Finberg, Joanna Gibson, Pallavi Gopal, Anita Huttner, Ryan Jensen (*Therapeutic Radiology*), Samuel Katz, Peggy Myung (*Dermatology*), Don Nguyen, Manoj Pillai (*Hematology*), Kurt Schalper, Edward Stiles (*Laboratory Medicine*), Silvia Vilarinho (*Internal Medicine*), Dean Yimlamai (*Pediatrics*)

Assistant Professors Sarah Aitkin, Arnaud Augert, Mathieu Bakhoum (*Ophthalmology and Visual Sciences*), Gianfilippo Coppola, William Damsky (*Dermatology*), Marcello DiStasio, Romina Fiorotto (*Internal Medicine*), Salil Garg (*Lab Medicine*), Brian Hafler (*Neurology*), Albert Higgins-Chen (*Psychiatry*), Won Jae Huh, Jeffrey Ishizuka (*Medical Oncology*), Nelson LaMarche, Mark Lee (*Laboratory Medicine*), Stephania Libreros, Yang Liu, Caleigh Mandel-Brehm, Goran Micevic (*Dermatology*), Sathish Ramakrishnan, Jenny Huanjiao Zhou

FIELDS OF STUDY

Fields of study include molecular and cellular basis of diseases including cancer, biology, biochemistry, genetics, and pathology of molecules, cells, tissues, and organ systems; including plasma membrane dynamics, mitochondrial dysfunction, signal transduction, and response to stimuli of connective tissue; assembly of viruses and their interactions with animal cells; somatic cell genetics and birth defects; biology of vascular cells; and computational and high-throughput approaches to understanding disease pathology.

For entry to the Pathology and Molecular Medicine Ph.D. program, students apply to an interest-based track, usually the Translational Molecular Medicine, Pharmacology, and Physiology (TMMPP) track within the interdepartmental graduate program of

Biological and Biomedical Sciences (BBS). After successful completion of rotations, BBS students choose a department to join.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Course Requirements

PATH 5503	Responsible Conduct of Research, 4th-Year Refresher	1
PATH 5640	Developing and Writing a Scientific Research Proposal	1
PATH 5650	Biology of Cancer	1
PATH 5660	The Responsible Conduct of Research	1
PATH 5679	Seminar in Molecular Medicine, Pharmacology, and Physiology	1
PATH 5680	Seminar in Molecular Medicine, Pharmacology, and Physiology	1
PATH 5690	Molecular Mechanisms of Disease	1

In addition, students must take two additional graduate-level electives, which can include courses in biochemistry, genetics, immunology, cell biology, and pathology, to be chosen in consultation with the director of graduate studies (DGS), based on the student's background and interest.

All requirements of the graduate school must be met including the school's two Honors Grade requirement by the end of the fourth term of full-time study. Students must also maintain an overall High Pass average. Annual presentations for the Departmental Research in Progress talks and biannual updates to the Individual Development Plan are also required.

Teaching Requirements In accordance with the BBS program, Ph.D. students are expected to participate in two terms (or the equivalent) as a Teaching Fellow after they have passed their qualifying exam. Pathology and molecular medicine students do not teach in years one and two. Students who have passed their qualifying examination begin teaching for requirement in year three.

Qualifying Examination The qualifying examination of the Pathology and Molecular Medicine graduate program consists of the following:

1. Enrollment in PATH 5640, Developing and Writing a Scientific Research Proposal, in the fall term of year two and preparation of a proposal on the topic of the student's research. Students will receive assistance from a faculty member who will later be part of the qualifying committee.
2. Two literature reading periods in the spring term of year two specifically related to the grant proposal.
3. The oral exam in which students are examined by the qualifying exam committee on the research proposal, the reading periods, and general knowledge of pathology and molecular medicine. At least two of the qualifying committee members must be Department of Pathology faculty, with at least one with a primary appointment. The DGS must approve the membership of the committee. Students will read with two of the faculty members individually during the reading period. The primary

faculty member will serve as chair and is responsible for documenting the results of the exam and submitting to the DGS.

Prospectus and Admission to Candidacy In year three, upon successful completion of the qualifying examination, students will form a dissertation committee including a minimum of three members in addition to their dissertation/thesis adviser. At least two of the committee members must be Department of Pathology faculty, with at least one with a primary appointment. The DGS must approve the membership of the committee. Students will prepare a written thesis prospectus, consisting of a summary of background information in the field of interest, the specific questions to be answered, a rationale for choosing those questions, and a research plan for addressing those questions. Upon a successful prospectus and completing departmental and graduate school requirements, students are admitted to candidacy.

Annual Thesis Committee Meetings Following approval of the prospectus, thesis committee meetings are held at least one once a year at the discretion of the committee. Students should prepare a brief report and forward it to the committee at least one week before the meeting. At the committee meeting, the student should give a brief presentation covering the following:

- Data acquired since the last committee meeting
- Plans for the next twelve months
- The committee can aid in interpreting the results, prioritizing experiments, and assessing whether the project is on track
- If a manuscript is in preparation, students should include an outline in the annual report. The outline could include a summary of the manuscript's main points, a list of subtitled sections, and a list of figures and tables with brief descriptions of the data to be included in each. It should be noted which experiments have been completed and which remain to be done.

M.D.-PH.D. STUDENTS

M.D.-Ph.D. students must satisfy all the requirements listed above for the Ph.D. with the following modifications:

- Two five-week laboratory rotations are required.
- Students must serve as a teaching assistant in one course.
- Both PATH 5660, Responsible Conduct of Research, and PATH 5679/PATH 5680, Seminar in Translational Molecular Medicine, Pharmacology, and Physiology Seminar, may be waived with DGS permission. Additional classes may be waived with DGS permission.

Requirements for Transfer Students Transfer students must satisfy the requirements listed above for the Ph.D. But both PATH 5503 and PATH 5679/PATH 5680 may be waived with DGS permission. Additional classes may also be waived with DGS permission.

See graduate school degree requirements under Policies and Regulations.

MASTER'S DEGREES

See graduate school degree requirements under Policies and Regulations.

M.Phil. Students are not admitted for this degree. The M.Phil. is awarded only to students who are continuing for the Ph.D. Students must have completed all their course requirements, their qualifying exam, and have been admitted to candidacy as described above to be awarded this degree. Students are automatically petitioned by the university for a M.Phil. after successful completion of the requirements at the end of the third year.

M.S. Students are not admitted for this degree. On a case-by-case basis and subject to faculty vote, students who are not continuing for the Ph.D. may be considered for an M.S. degree if they have successfully completed the course requirements for the Ph.D. degree listed above with an average of High Pass and received a grade of Honors in at least two courses. Recommendation by the department for award of the degree is subject to final review and approval by the degree committee. Students who meet this criterion are eligible to petition for the M.S degree. Students who have already received the M.Phil. will not be awarded the M.S.

Additional information can be found on the Pathology and Molecular Medicine graduate-student website, https://medicine.yale.edu/pathology/training/graduateprogram.

PATH 5503b / C&MP 5503b / PHAR 5503b / PTB 5503b, Responsible Conduct of Research, 4th-Year Refresher Staff
The NIH requires that students receive training in the responsible conduct of research every four years. This mandatory course meets that requirement for fourth-year students. The course meets a total of eight hours (four two-hour) sessions. Faculty facilitate discussions based on RCR topics.

PATH 5620a and PATH 5622b / C&MP 5511a and C&MP 5512b / PHAR 5511a and PHAR 5512b / PTB 5620a and PTB 5622b, Laboratory Rotations Staff
TMMPP laboratory rotations, fall term.

PATH 5640a / B&BS 5640a, Developing and Writing a Scientific Research Proposal Katerina Politi, Renato Polimanti, Nelson LaMarche, Rui Chang, Jean-Ju Chung, and Stephania Libreros
The course covers the intricacies of scientific writing and guides students in the development of a scientific research proposal on the topic of their research. All elements of an NIH fellowship application are covered, and eligible students submit their applications for funding. Enrollment limited to twelve. Required of second-year graduate students in Pathology and Molecular Medicine. Registration allowed by prior authorization from course directors only.

PATH 5650b, Biology of Cancer David Stern and Qin Yan
A comprehensive survey of cancer research from the cellular to the clinical level. The relation of cancer to intracellular and intercellular regulation of cell proliferation is emphasized, as are animal models for cancer research. Background in molecular genetics and cell biology is assumed. Open to advanced undergraduates with permission of the organizers.

PATH 5660b / C&MP 5650b / PHAR 5580b / PTB 5650b, The Responsible Conduct of Research Barbara Ehrlich
Organized to foster discussion, the course is taught by faculty in the Pharmacology, Pathology, and Physiology departments and two or three senior graduate students.

Each session is based on case studies from primary literature, reviews, and two texts: Francis Macrina's *Scientific Integrity* and Kathy Barker's *At the Bench*. Each week, students are required to submit a reaction paper discussing the reading assignment. Students take turns leading the class discussion; a final short paper on a hot topic in bioethics is required.

PATH 5679a and PATH 5680b / C&MP 5629a and C&MP 5630b / PHAR 5501a and PHAR 5502b / PTB 5629a and PTB 5630b, Seminar in Molecular Medicine, Pharmacology, and Physiology Staff

Readings and discussion on a diverse range of current topics in molecular medicine, pharmacology, and physiology. The class emphasizes analysis of primary research literature and development of presentation and writing skills. Contemporary articles are assigned on a related topic every week, and a student leads discussions with input from faculty who are experts in the topic area. The overall goal is to cover a specific topic of medical relevance (e.g., cancer, neurodegeneration) from the perspective of three primary disciplines (i.e., physiology: normal function; pathology: abnormal function; and pharmacology: intervention). Required of and open only to Ph.D. and M.D./Ph.D. students in the Molecular Medicine, Pharmacology, and Physiology track.

PATH 5681a, Advanced Topics in Cancer Biology Ryan Jensen and Kurt Schalper

This advanced course focuses on readings and discussion on three or four major topics in cancer biology, such as targeted therapy, tumor immunology, tumor metabolism, and genomic evolution of cancer. For each topic, the class starts with an interactive lecture, followed by critical analysis of primary research literature. Recent research articles are assigned, and a student leads discussions with input from faculty who are experts in the topic area. Prerequisite: PATH 5650 or permission of the instructor. Open to all Ph.D., M.D./Ph.D., and M.P.H. students and to advanced undergraduates at the discretion of the instructor.

PATH 5682b, Cancer Clinical Translation Samuel Katz and Ranjit Bindra

This course builds on basic cancer biology knowledge to study the impact of scientific knowledge on real-world clinical oncology issues through didactic sessions, working tumor board attendance, and workshop discussions. The first half of the course emphasizes practical issues in moving research ideas into the clinic, design and execution of standard and novel forms of clinical trials, and statistical analysis of clinical trial data. The second half covers the perspectives of clinicians on the most important outstanding biological questions that should be addressed by cancer investigators. Enrollment limited, with priority given to Cancer Biology Training Program trainees. Advanced undergraduates or graduate students may be admitted with permission of the organizers. Prerequisite: PATH 681.

PATH 5690a, Molecular Mechanisms of Disease Sathish Ramakrishnan and Carlos Fernandez-Hernando

This course covers aspects of the fundamental molecular and cellular mechanisms underlying various human diseases. Many of the disorders discussed represent major forms of infectious, degenerative, vascular, neoplastic, and inflammatory disease. Additionally, certain rarer diseases that illustrate good models for investigation and/or application of basic biologic principles are covered in the course. The objective is to highlight advances in experimental and molecular medicine as they relate to understanding the pathogenesis of disease and the formulation of therapies.

Pharmacology

Sterling Hall of Medicine B316, 203.785.7469
http://medicine.yale.edu/pharm
M.S., M.Phil., Ph.D.

Chair
Mark Lemmon (SHM B 203/WC ABC-301B, mark.lemmon@yale.edu)

Directors of Graduate Studies
David Calderwood (SHM B 395C, 203.737.2311, david.calderwood@yale.edu)
Kathryn Ferguson (WC ABC-305C/SHM B 226C, kathryn.ferguson@yale.edu)

Professors Karen Anderson, Anton Bennett, David Calderwood, Yung-Chi Cheng, Joseph Contessa (*Therapeutic Radiology*), Craig Crews (*Mollecular, Cellular, and Developmental Biology*), Barbara Ehrlich, Jonathan Ellman, Seth Herzon (*Chemistry*), Leonard Kaczmarek, Irit Lax, Mark Lemmon, Elias Lolis, Kathleen Martin (*Cardiovascular Medicine*), Angus Nairn (*Psychiatry*), Joseph Schlessinger, Dianqing Wu

Associate Professors Titus Boggon, Jason Cai (*Radiology and Biomedical Imaging*), Kathryn Ferguson, Daryl Klein, Yansheng Liu, Ya Ha, Faye Rogers (*Therapeutic Radiology*), Benjamin Turk

Assistant Professors Claudio Alarcón, Assaf Alon, Moitrayee Bhattacharyya, Joel Butterwick, Sangwon Lee, Ken Loh (*Comparative Medicine*), Wei Mi

FIELDS OF STUDY

Research in Pharmacology encompasses a broad range of fields that are both interdisciplinary and interdepartmental. The central focus is to understand and treat human diseases. Areas of focus in the Pharmacology Graduate Program include, but are not limited to, molecular pharmacology, mechanisms of drug action, signal transduction, structural biology, infectious diseases, neuropharmacology, and chemotherapy.

To enter the Ph.D. program, students should apply to the interdepartmental graduate program in Biological and Biomedical Sciences (BBS), https://medicine.yale.edu/bbs, and select one of the interest-based tracks. Most students interested in a Ph.D. in pharmacology select the Translational Molecular Medicine, Pharmacology, and Physiology (TMMPP) or the Biochemistry, Quantitative Biology, Biophysics, and Structural Biology (BQBS) tracks.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

The field of pharmacology encompasses many disciplines. Flexibility in the Pharmacology Graduate Program permits students to concentrate in the areas of their particular interest. Students are required to take at least five graded courses. Students must take at least one graduate seminar course (usually PHAR 5501, PHAR 5502, or MB&B 7300) but equivalent courses from another program are acceptable with DGS approval. Additional courses are selected based on the interest of each student, but must include at least one of the following core courses: PHAR 5504, PHAR 5528, PHAR 5529, MB&B 7200, or other DGS-approved BBS courses. Students are also required to do three laboratory rotations in their first year. The graduate school requires a grade of

Honors for a minimum of two courses. Honors for rotations cannot be used toward this requirement. Students must meet this Honors requirement prior to being admitted to candidacy and must maintain an overall High Pass average. A grade of Honors or High Pass is required for the selected core courses. Student progress toward these goals is reviewed at the end of the second and subsequent terms.

Prior to registering for a second year of study, students must successfully complete PHAR 5580, The Responsible Conduct of Research, or the equivalent from another department. In addition, PHAR 5503, Responsible Conduct of Research, 4th-Year Refresher, must be completed by the end of the fourth year. PHAR 5580 and PHAR 5503 do not count towards the five required courses.

Students are required to pass the qualifying examination by the end of their fourth term. In preparation for this, Pharmacology Graduate Program students must take Developing and Writing a Scientific Research Proposal in the spring term of their second year (this does not count toward the five-course requirement). Before the end of the third year, a dissertation prospectus must be submitted and accepted prior to admission to candidacy. Once a student's original doctoral dissertation research is largely complete, they give an oral presentation to the Pharmacology faculty (pre-defense) for approval. Within six months of passing the pre-defense, the student must submit a preliminary written dissertation to the dissertation committee and an outside reader. A public Ph.D. dissertation seminar will then be scheduled, followed by a closed examination by the student's thesis committee and the outside examiner. Once the draft of the written dissertation is approved by the dissertation committee, it is submitted to the graduate school. One first-author manuscript is required from the dissertation research and this must be publicly available (with DOI) prior to the dissertation defense seminar. The Pharmacology Graduate Program faculty recognizes that some very rare circumstances may make it impossible to produce a first-author paper in a reasonable time. In such cases, this must be discussed with the Dissertation Committee, the DGS, and the Pharmacology Program faculty before scheduling the pre-defense. In these exceptional cases, and with approval, the student can proceed to give the pre-defense, presenting their dissertation work essentially as described above. If there is agreement across the faculty that the student has made substantial progress in their project, the faculty can exempt a student from the first-author paper requirement by formal vote, the student may proceed to writing the dissertation and schedule the public dissertation seminar. If deemed necessary, with agreement across the faculty that the student has made substantial progress in a project of this sort, the faculty can exempt a student from the one first-author paper requirement.

An important aspect of graduate training in pharmacology is the acquisition of teaching skills through participation in teaching courses related to the student's scientific interests. These opportunities can be drawn from a diverse menu of lecture, laboratory, and seminar courses given at the undergraduate, graduate, and medical school levels. Ph.D. students are required to participate in two terms (or the equivalent) of teaching. Students are not expected to teach during their first year and are not required to teach an undergraduate level course.

M.D.-PH.D. STUDENTS

M.D.-Ph.D. students must satisfy all of the above requirements for the Ph.D. with the following modifications: (1) only two of three laboratory rotations are required; (2)

some medical-school courses (except pharmacology) can qualify as graduate-school courses as long as the M.D.-Ph.D. student registers for them in OCS (Online Course Selection); and (3) only one term of teaching is required. Current graduate-school courses cannot be used to fulfill any medical-school course requirements.

MASTER'S DEGREES

M.Phil. See Degree Requirements under Policies and Regulations.

M.S. Students who withdraw from the Ph.D. program may be eligible to receive the M.S. degree if they have met the requirements and have not already received the M.Phil. degree. For the M.S., students must successfully complete the first three terms of the Ph.D. program. This includes one year of lab rotations and course requirements.

Program materials are available upon request to the Director of Graduate Studies, Department of Pharmacology, Yale University, PO Box 208066, New Haven CT 06520-8066.

COURSES

PHAR 5501a and PHAR 5502b / C&MP 5629a and C&MP 5630b / PATH 5679a and PATH 5680b / PTB 5629a and PTB 5630b, Seminar in Molecular Medicine, Pharmacology, and Physiology Staff

Readings and discussion on a diverse range of current topics in molecular medicine, pharmacology, and physiology. The class emphasizes analysis of primary research literature and development of presentation and writing skills. Contemporary articles are assigned on a related topic every week, and a student leads discussions with input from faculty who are experts in the topic area. The overall goal is to cover a specific topic of medical relevance (e.g., cancer, neurodegeneration) from the perspective of three primary disciplines (i.e., physiology: normal function; pathology: abnormal function; and pharmacology: intervention). Required of and open only to Ph.D. and M.D./Ph.D. students in the Molecular Medicine, Pharmacology, and Physiology track.

PHAR 5503b / C&MP 5503b / PATH 5503b / PTB 5503b, Responsible Conduct of Research, 4th-Year Refresher Staff

The NIH requires that students receive training in the responsible conduct of research every four years. This mandatory course meets that requirement for fourth-year students. The course meets a total of eight hours (four two-hour) sessions. Faculty facilitate discussions based on RCR topics.

PHAR 5504a / PTB 5504a, Molecular Mechanisms of Drug Actions Wei Mi and Karen Anderson

This course provides fundamental background in core principles of pharmacology, molecular mechanisms of drug action, and important research areas in contemporary pharmacology. Material covered includes quantitative topics in pharmacology such as drug-receptor theory, multiple equilibria and kinetics, pharmacokinetics, therapeutic drug monitoring, and drug metabolism. Specific content on the mechanisms of drug action includes autonomics; ion channel blockers; endocrine agents (hormones); cardiovascular drugs (ACE inhibitors, organic nitrates, β-blockers, acetylsalicylic acid); antimicrobials (anti-bacterials, fungals, and virals); anti-cancer, anti-inflammatory, anti-asthma, and anti-allergy drugs; and immunosuppressants. Students learn how to model drug-receptor interaction parameters and how to analyze steady-state enzyme kinetics and inhibition data. Senior students serving as teaching assistants

lead discussion groups covering problem sets, review topics or assigned manuscripts. The course includes a self-study component consisting of video modules produced in collaboration with Yale faculty and Merck that explore the preclinical and clinical phases of drug development.

PHAR 5511a and PHAR 5512b / C&MP 5511a and C&MP 5512b / PATH 5620a and PATH 5622b / PTB 5620a and PTB 5622b, Laboratory Rotations Staff
TMMPP laboratory rotations, fall term.

PHAR 5537a, Systems Pharmacology and Integrated Therapeutics Kathryn Ferguson
This course provides an in-depth, "hands-on" experience in drug design, drug discovery, high-throughput screening, state-of-the-art proteomics, and target validation.

PHAR 5538a, Pharmacokinetics and Pharmacodynamics in Neuropharmacology Jason Cai
This course is designed to give a historic account of drug discovery and development for brain diseases, introduce methods to understand the pharmacological mechanisms of drugs working on neurological systems, and inspire young generations to join the endeavor of drug discovery and development for brain diseases. It is designed for advanced graduate students, postdocs, and residents with basic knowledge in chemistry, pharmacology, and neuroscience. The lecturers and guest lecturers are leading experts in the field of PET and MR imaging, and industry leaders in pharmaceutical science. This course also introduces the applications of advanced imaging technologies (PET, MRI) in the study of pharmacokinetics and pharmacodynamics of CNS drugs in humans and its implications to our understanding of neurodegenerative and neuropsychiatric disorders. Each class constitutes a forty-five-minute didactic lecture and a thirty-minute interactive discussion section. The classroom activities are expected to prepare students for their future endeavor in the field of neuropharmacology. Open to students second-year and up.

PHAR 5580b / C&MP 5650b / PATH 5660b / PTB 5650b, The Responsible Conduct of Research Barbara Ehrlich
Organized to foster discussion, the course is taught by faculty in the Pharmacology, Pathology, and Physiology departments and two or three senior graduate students. Each session is based on case studies from primary literature, reviews, and two texts: Francis Macrina's *Scientific Integrity* and Kathy Barker's *At the Bench*. Each week, students are required to submit a reaction paper discussing the reading assignment. Students take turns leading the class discussion; a final short paper on a hot topic in bioethics is required.

Philosophy

Connecticut Hall, 203.432.1665
http://philosophy.yale.edu
M.A., Ph.D.

Chair
Paul Franks

Director of Graduate Studies
Zoltán Szabó (zoltan.szabo@yale.edu)

Professors Stephen Darwall, Michael Della Rocca, Keith DeRose, Paul Franks, Tamar Gendler, Robert Gooding-Williams, Daniel Greco, Verity Harte, Brad Inwood, Shelly Kagan, Joshua Knobe, Laurie Paul, Thomas Pogge, Scott Shapiro, Sun-Joo Shin, Steven Smith, Jason Stanley, Zoltán Szabó, Gideon Yaffe

Associate Professors Tim Clarke, Robin Dembroff, John Pittard

Assistant Professors Tyler Brooke-Williams, Claudia Dumitru, Lily Hu, Jacob McNulty

FIELDS OF STUDY

The department offers a wide range of courses in various traditions of philosophy, with strengths and a well-established reputation in the history of philosophy, ethics, philosophy of law, epistemology, philosophy of language, and philosophy of religion as well as other central topics.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

1. In the first two years all students must complete a total of twelve term courses. Graduate courses are grouped: (1) metaphysics, theory of knowledge, philosophy of mind, philosophy of language, philosophy of science; (2) ethics, aesthetics, philosophy of religion, political philosophy, philosophy of law, and theory of value; (3) history of philosophy. No more than six of the twelve and no fewer than two courses may be taken in each group. At least one of the twelve courses taken must be in formal methods (unless the formal methods requirement is satisfied in some other way), and this course does not count toward the required minimum of two within any of the three categories.
2. Two qualifying papers must be submitted, one in the history of philosophy, the other in another distribution area. These papers must be more substantial and professional than an ordinary term paper.
3. Approval of the dissertation prospectus is expected before the end of the sixth term. Upon completion of all predissertation requirements, including the prospectus, students are admitted to candidacy for the Ph.D. Admission to candidacy must take place by the end of the third year of study.
4. Students in Philosophy typically teach in the third, fourth, and sixth years.
5. To receive the Ph.D., students must also meet a "skills" requirement relevant to their research, and in consultation with the committee and approved by the director of graduate studies, by taking one additional class outside of Philosophy and

beyond the twelve-course requirement or otherwise demonstrating proficiency in a skill that is relevant to their research.

6. The dissertation is expected to be submitted in the end of the fifth to sixth year.

CLASSICS AND PHILOSOPHY COMBINED PH.D. PROGRAM

The Classics and Philosophy Program is a combined program, offered by the Departments of Classics and Philosophy at Yale, for students wishing to pursue graduate study in ancient philosophy. Suitably qualified students may apply for entry to the program either through the Classics department for the Classics track or through the Philosophy department for the Philosophy track.

Applicants for the Classics track of the combined program must satisfy the general requirements for admission to the Classics graduate program, in addition to the requirements of the Classics track of the combined program. Details of the Classics track of the program are available online at https://classics.yale.edu/research/ancient-philosophy/classics-and-philosophy-joint-program.

Applicants for the Philosophy track of the combined program must satisfy the general requirements for admission to the Philosophy graduate program, in addition to the requirements of the Philosophy track of the combined program. Details of the Philosophy track of the program are available online at https://philosophy.yale.edu/graduates/the-philosophy-program/classics-and-philosophy-combined-phd-program.

The combined program is overseen by an interdepartmental committee currently consisting of Verity Harte and Brad Inwood together with the director of graduate studies (DGS) for Classics and the DGS for Philosophy.

PHILOSOPHY AND PSYCHOLOGY COMBINED PH.D. PROGRAM

The Philosophy and Psychology Program is a combined program, offered by the Departments of Philosophy and Psychology at Yale. Students enrolled in the program complete a series of courses in each discipline as well as an interdisciplinary dissertation that falls at the intersection of the two. On completing these requirements, students are awarded a Ph.D. either in Philosophy and Psychology, or in Psychology and Philosophy.

Students can be admitted into the combined program either through the Psychology department or through the Philosophy department. Students must be accepted into one of these departments (the "home department") through the standard admissions process, and both departments must then agree to accept the student into the combined program.

Students can be accepted into the combined program either (a) at the time they initially apply for admission to their home department, or (b) after having already competed some course work within the home department. In either case, students must be accepted into the combined program by each department.

Students in the combined program complete two-thirds of the course requirements of each of the two disciplines, then write a qualifying paper and a dissertation that are fully interdisciplinary. For more details about the program requirements, see https://

philosophy.yale.edu/graduates/the-philosophy-program/philosophy-and-psychology-combined-phd-program.

MASTER'S DEGREE

M.A. Students who successfully complete the course requirements of their program with an average grade of High Pass will be awarded the M.A. degree.

Please see the Philosophy website for information on the program: http://philosophy.yale.edu.

COURSES

PHIL 5523a / GMAN 5030a, The Frankfurt School Jacob McNulty and Rahel Jaeggi

The Frankfurt School of Critical Theory was (is) a group of eclectic interdisciplinary Marxist philosophers and social scientists, active from the 1920s to the present. Most were German Jews born around the turn of the twentieth century. The Frankfurt School were a group of thinkers in almost perpetual exile. Simultaneously critical of American capitalism and of Soviet communism, they were expelled from their native Germany in the wake of Hitler's rise to power. They also often lacked any intellectual safe haven, finding themselves at odds much philosophical and social-scientific orthodoxy (positivism, neo-Kantianism, "value-free" social science etc.). The critical theorists of the Frankfurt School sought to re-actualize ideas from the philosophical tradition, especially from Kant and Hegel, in order to address the complex realities of modern society: mass culture; fascism, totalitarianism, and authoritarianism; world war; imperialism; secularization; irrationality, sexuality, and aggression; and so on. This class looks at critical theory from a philosophical perspective, focusing on its claim to fuse traditional philosophy and radical social science. We begin with Max Horkheimer's "Traditional and Critical Theory," the school's founding document which announces a break with the received "objectifying" approach to science and philosophy and inaugurates another based on the conviction that knowledge-production is continuous with economic production. We then consider the elusive worldview of Walter Benjamin, a fusion of religious mysticism and historical Marxism which would be so influential for the school. During the bulk of the course, we read two landmark works of first-generation critical theory. The first, Adorno and Horkheimer's *Dialectic of Enlightenment* develops a universal history and fundamental anthropology that understands the human being as seeking relief from fear by assimilating the unfamiliar to the unfamiliar. It places the legacy of the Enlightenment in question laying responsibility for the horrors of the twentieth century at its door. We also read Adorno's *Minima Moralia*, a more personal, reflective work which foregrounds other less overtly political preoccupations of the institutes, e.g. modernism in literature and the arts; subjectivity, consciousness, and erotic desire; childhood, the family, and self-formation. We conclude by taking up Habermas's attempt to revive the Enlightenment project together with a version of Kant's transcendental project based on "the linguistic turn." In this unit, we focus on selections from *Structural Transformation of the Public Sphere* and *Theory of Communicative Action*. Prerequisite: at least one prior course in philosophy, preferably in Kant or political philosophy.

PHIL 5567b, Mathematical Logic Sun-Joo Shin
An introduction to the metatheory of first-order logic, up to and including the completeness theorem for the first-order calculus. An introduction to the basic concepts of set theory is included.

PHIL 5570a, Epistemology Daniel Greco
Introduction to current topics in the theory of knowledge. The analysis of knowledge, justified belief, rationality, certainty, and evidence.

PHIL 6233a, Growing Up, Growing Old: Philosophy of Age and Aging Robin Dembroff
This course examines the philosophical dimensions of age and aging, exploring questions of identity, justice, and the passage of time. How do we understand childhood, adulthood, and old age? What role do social norms play in shaping our experiences and perceptions of aging? Is aging a mere biological process, or does it have deeper ethical and existential significance? Drawing from metaphysics, ethics, feminist philosophy, and critical age studies, we interrogate the ways age structures power, personhood, and our understanding of a life well lived.

PHIL 6251a or b / LING 7910a or b, Topics in Semantics: Questions in American Sign Language Staff
This course bridges introductory courses (LING 2630, LING 2640) and advanced seminars in semantics. It explores selected topics in some detail, allowing students to appreciate the nuances of semantic argumentation while at the same time emphasizing the foundational issues involved. The goal of this course is to allow students, within a structured format, to become comfortable engaging with open-ended problems and to gain confidence in proposing original solutions to such problems. Topics vary across semesters. Prerequisite: LING 2630/LING 6630 or permission of instructor.

PHIL 6340b, Philosophy of Hobbes Claudia Dumitru
This is a seminar on Hobbes's theoretical and practical philosophy. We discuss his wider metaphysical and methodological commitments, his account of mind and human nature, and classic themes from his political philosophy. Particular attention is devoted to Hobbes's conception of a science of politics against the backdrop of his general theory of science. Prerequisite: two courses in philosophy (preferably one in the history of philosophy).

PHIL 6605a, Racial Inequality, Racial Injustice Stephen Darwall and Robert Gooding-Williams
In this seminar we examine several contemporary, philosophical approaches to the themes of racial inequality and racial injustice, focusing on the relations between racial inequality and the metaphysics of race; between racial injustice and racial integration; between racial inequality and intimate injustice; and between racial inequality and the operations of caste and class hierarchies. Readings include writings by Sally Haslanger, Elizabeth Anderson, Tommie Shelby, Andrew Valls, Shatema Threadcraft, Stephen Darwall, Lionel McPherson, and Adolph Reed. Prerequisite: at least one previous course in philosophy, preferably in moral, social, or political philosophy.

PHIL 6616b, Philosophy of Spinoza Michael Della Rocca
An in-depth study of Spinoza's philosophy with attention to his major work, the *Ethics,* as well as his political writings, the *Treatise on the Emendation of the Intellect,* the letters, and other writings. Focus not only on Spinoza's metaphysics, but also on his views on

philosophy of mind, teleology, action, and emotion. Some attention also to competing methods for interpreting works in the history of philosophy.

PHIL 6625b, Topics in Epistemology Keith DeRose
A survey of some recent work in epistemology, with an emphasis on connections between formal approaches to epistemology and traditional epistemological questions. We explore the power and limitations of Bayesian approaches to epistemology; the relationship between credence on the one hand, and belief and knowledge on the other; higher-order knowledge and probability; and other topics.

PHIL 6626b, Cognitive Science of Morality Joshua Knobe
Introduction to the emerging field of moral cognition. Focus on questions about the philosophical significance of psychological findings. Topics include the role of emotion in moral judgment; the significance of character traits in virtue ethics and personality psychology; the reliability of intuitions and the psychological processes that underlie them.

PHIL 6627b, Computability and Logic Sun-Joo Shin
A technical exposition of Gödel's first and second incompleteness theorems and of some of their main consequences in proof theory and model theory, such as Löb's theorem, Tarski's undefinability of truth, provability logic, and nonstandard models of arithmetic.

PHIL 6650b, The Problem of Evil Keith DeRose
The evils of our world can seem to present strong reasons for disbelieving in the existence of God. This course examines the main forms that this problem for theism takes, and some of the proposed ways of solving, or at least mitigating, the problem.

PHIL 6655b, Normative Ethics Shelly Kagan
A systematic examination of normative ethics, the part of moral philosophy that attempts to articulate and defend the basic principles of morality. The bulk of the course surveys and explores some of the main normative factors relevant in determining the moral status of a given act or policy (features that help make a given act right or wrong). Brief consideration of some of the main views about the foundations of normative ethics (the ultimate basis or ground for the various moral principles).

PHIL 6657b / PLSC 6110, Recent Work on Justice Thomas Pogge
In-depth study of one contemporary book, author, or debate in political philosophy, political theory, or normative economics. Depending on student interest, this might be a ground-breaking new book, the life's work of a prominent author, or an important theme in contemporary political thought.

PHIL 6664a, Justice, Taxes, and Global Financial Integrity Thomas Pogge
This seminar studies the formulation, interpretation, and enforcement of national and international tax rules from the perspective of national and global economic justice.

PHIL 6668b, Metaethics Stephen Darwall
A study of moral theorizing and moral discourse. The linguistic role of words like good, bad, right, and wrong; whether propositions that use these terms can be true or false. What ethical claims mean, if anything, and what kinds of reasoning or evidence might justify such claims.

PHIL 6669b / LING 6750b, Pragmatics Simon Charlow
Context-dependent aspects of meaning and inference. Speech act theory, presupposition, implicature. Role of pragmatics in the lexicon and in meaning change. The semantics-pragmatics distinction from different perspectives; the position of pragmatics in linguistic theory.

PHIL 6683b / CLSS 7909b, Plato's Metaphysics Tim Clarke
A broad look at central topics in Plato's metaphysics followed by in-depth study of the conception of reality underlying the classificatory method at work in his *Sophist*, *Statesman*, and *Philebus*. Prerequisite: previous study of ancient philosophy, Plato's philosophy.

PHIL 7705a, First-Year Seminar Michael Della Rocca and Jacob McNulty
Required of and limited to first-year students in the Philosophy Ph.D. program. Topic varies from year to year. Preparation for graduate work. Reading, writing, and presentation skills.

PHIL 7706b, Work in Progress I Lily Hu
In consultation with the instructor, each student presents a significant work in progress, e.g., a revised version of an advanced seminar paper or a dissertation chapter. Upon completion of the writing, the student presents the work in a mock colloquium format, including a formal question-and-answer period.

PHIL 7718b, Political Philosophy and Race Robert Gooding-Williams
This course is a graduate seminar in political philosophy and race devoted to the study of several already influential, field-shaping books by contemporary political philosophers and political theorists. Very roughly, the course comprises six two-week modules, with each module devoted to the work of one contemporary theorist. During the first week of a given module, seminar discussion focuses on a particular theorist's book, and on supplementary writings relating to that book's central arguments. During the second week, the seminar hosts the author of the book we discussed the previous week, so that we can continue our discussion with them. The six philosophers and theorists that are discussed are Shatema Threadcraft, Tommie Shelby, Derrick Darby, Lionel McPherson, Ron Sundstrom, and Juliet Hooker. Prerequisite: previous courses in philosophy.

PHIL 7719a, Faith and the Will John Pittard
An investigation of questions concerning the nature of religious faith, the relationship of faith to the will and to desire, and the merits of various prudential, moral, and existential arguments for and against religious faith. Questions to be treated include: Is faith in some sense "meritorious" (to use Aquinas's language)? Do the commitments of faith essentially involve believing propositions? Can belief be voluntary? Can trust or hope be voluntary? Should we hold religious beliefs to the same epistemic standards that apply to more mundane beliefs? Or should we persist in faith even if these beliefs do not meet conventional rational standards? We explore these questions through writings by Aquinas, Pascal, Kierkegaard, Nietzsche, James, Freud, Wittgenstein, and various contemporary philosophers.

PHIL 7731b, Theological Predication and Divine Attributes John Pittard
An exploration of philosophical debates concerning the nature of theological language and the nature of God. Topics include theories of analogical predication, divine simplicity, God's relation to time, divine impassibility, the nature of God's love, divine

freedom, the compatibility of foreknowledge and human freedom, and theories of providence.

PHIL 7750a, Tutorial Staff
By arrangement with faculty.

PHIL 8850a, Prospectus Tutorial Staff
Prospectus tutorial for Philosophy Ph.D. students.

PHIL 8886a / CLSS 7923a, Aristotle: Physics 2 Brad Inwood and Tim Clarke
The class reads and discusses the Greek text of Aristotle's *Physics* book 2, which sets out the foundational concepts of his natural philosophy, with particular focus on his theory of causal explanation. This book is also important for its discussion of the nature of chance or luck and teleology. This is a core course for the combined Ph.D. program in Classics and Philosophy. It is open to all graduate students in Philosophy or Classics who have suitable preparation in Attic Greek and some prior knowledge of ancient philosophy. Others interested in taking or attending the class must have prior permission of the instructors.

Physics

35 Sloane Physics Laboratory, 203.432.3650
http://physics.yale.edu
M.S., M.Phil., Ph.D.

Chair
Sarah Demers

Director of Graduate Studies
Helen Caines (helen.caines@yale.edu)

Professors Charles Ahn (*Applied Physics*), Yoram Alhassid, Thomas Appelquist, Charles Bailyn (*Astronomy*), O. Keith Baker, Charles Baltay (*Emeritus*), Sean Barrett, Joerg Bewersdorf (*Cell Biology*), Helen Caines, Hui Cao (*Applied Physics*), Richard Casten (*Emeritus*), Flavio Cavanna (*Adjunct*), Paolo Coppi (*Astronomy*), Sarah Demers, Thierry Emonet (*Molecular, Cellular, and Developmental Biology*), Paul Fleury (*Emeritus*), Marla Geha (*Astronomy*), Steven Girvin, Larry Gladney, Leonid Glazman, Walter Goldberger, Jack Harris, John Harris (*Emeritus*), Karsten Heeger, Victor Henrich (*Emeritus*), Jonathon Howard (*Molecular Biophysics and Biochemistry*), Francesco Iachello (*Emeritus*), Sohrab Ismaill-Beigi (*Applied Physics*), Steve Lamoreaux, Konrad Lehnert, Andre Levchenko (*Biomedical Engineering*), Reina Maruyama, Simon Mochrie, Vincent Moncrief, Daisuke Nagai, Priyamvada Natarajan (*Astronomy*), Andrew Neitzke (*Mathematics*), Corey O'Hern (*Mechanical Engineering and Materials Science*), Vidvus Ozolins (*Applied Physics*), Ornella Palamara (*Adjunct*), Peter Parker (*Emeritus*), Daniel Prober (*Applied Physics*), Nicholas Read, Robert Schoelkopf (*Applied Physics*), John Schotland (*Mathematics*), Jurgen Schukraft (*Adjunct*), Ramamurti Shankar, Witold Skiba, A. Douglas Stone (*Applied Physics*), Hong Tang (*Engineering*), Paul Tipton, Thomas Ullrich (*Adjunct*), C. Megan Urry, Frank van den Bosch (*Astronomy*), Pieter van Dokkum (*Astronomy*), John Wettlaufer (*Earth and Planetary Sciences*), Robert Wheeler (*Emeritus*), Werner Wolf (*Emeritus*), Michael Zeller (*Emeritus*)

Associate Professors Damon Clark (*Molecular, Cellular, and Developmental Biology*), David C. Moore, Michael Murrell (*Biomedical Engineering*), Nir Navon, Laura Newburgh, Nikhil Padmanabhan, David Poland, Peter Rakich (*Applied Physics*), Alison Sweeney

Assistant Professors Charles Brown, Meng Cheng, Eduardo da Silva Neto, Laura Havener, Yu He (*Applied Physics*), Christopher Lynn, Benjamin Machta, Owen Miller (*Applied Physics*), Chiara Mingarelli, Ian Moult, Shruti Puri (*Applied Physics*), Diana Qiu (*Mechanical Engineering and Materials Science*)

Lecturers Mehdi Ghiassi-Nejad, Caitlin Hansen, Stephen Irons, Steven Konezny, Rona Ramos, Adriane Steinacker

FIELDS OF STUDY

Fields include Astrophysics and Cosmology; Atomic, Molecular and Optical Physics; Biological Physics; Condensed Matter; Gravitational Physics; Nuclear Physics; Particle Physics; Quantum Physics; and other areas in collaboration with the School of Engineering & Applied Science and the departments of Applied Physics; Astronomy;

Chemistry; Earth and Planetary Sciences; Molecular Biophysics and Biochemistry; and Molecular, Cellular, and Developmental Biology.

INTEGRATED GRADUATE PROGRAM IN PHYSICAL AND ENGINEERING BIOLOGY (PEB)

Students applying to the Ph.D. program in Physics with a concentration in Biological Physics may also apply to the PEB program. See the description under Non-Degree-Granting Programs, Councils, and Research Institutes for course requirements and https://peb.yale.edu for more information about the benefits of this program and application instructions.

QUANTUM MATERIALS SCIENCE AND ENGINEERING CERTIFICATE (QMSE)

Students applying to the Ph.D. program in Physics with a concentration in quantum materials can apply to the Quantum Materials Science and Engineering (QMSE) certificate program. See the description under Non-Degree-Granting Programs, Councils, and Research Institutes for course requirements and https://qmse.yale.edu for more information about the benefits of the program and application instructions.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

To complete the course requirements, students are expected to take one research course, two seminar courses, and a set of seven credit-hour courses: six foundational courses and one elective.

Six Core Courses

PHYS 5000	Advanced Classical Mechanics	1
PHYS 5020	Electromagnetic Theory I	1
PHYS 5060	Mathematical Methods of Physics	1
PHYS 5080	Quantum Mechanics I	1
PHYS 5100	Quantum Mechanics II	1
PHYS 5120	Statistical Physics I	1

These six courses serve to complete a student's undergraduate core training in classical and quantum physics. For the seventh course, students may select from the list of graduate elective courses offered by the Departments of Physics or Applied Physics. Courses offered by other departments may also qualify as advanced electives, with the approval of the director of graduate studies (DGS).

Students entering the program with a prior master's degree may waive core course requirements. Students without a previous master's can take a core course pass-out exam at the start of the course's term. Those who successfully demonstrate knowledge of the course topics are excused from taking that core course but must replace the credit hours with an approved advanced elective.

In addition to the core courses, all students must engage in a PHYS 9900, Special Investigations, research project by the end of their second year of study. Incoming students are also required to take PHYS 5150, Topics in Modern Physics Research, in

the fall, and PHYS 5900, Responsible Conduct in Research for Physical Scientists in the spring.

By the end of a student's third year, they must participate in a two-part qualifying event. Part one is a Research Qualifying Event (RQE) consisting of an oral presentation on research completed during their required PHYS 9900, Special Investigation course. Students will present their research and be evaluated on their presentation by the DGS and their research adviser. Part two is a Written Qualifying Event (WQE) consisting of four written components on classical mechanics, electromagnetic theory, statistical mechanics, and quantum mechanics. Each portion of the WQE should be completed after the student has taken, or passed out of, the relevant courses. Students will receive feedback after each portion of the qualifying event. The RQE and WQE are not graded but rather serve as learning milestones. Students may take the qualifying events in any order.

Before starting their fourth year of study, students must submit their thesis prospectus, as presented to and approved by their core thesis committee. Students who have completed their required course credits with satisfactory grades (two Honors and an overall High Pass average), taken the qualifying events, and submitted an acceptable thesis prospectus are recommended for advancement to candidacy and to receive their M.S. and M.Phil en route. Students entering the program with a master's degree in physics or a related field may waive equivalent graduate-level core courses with approval from the DGS without the requirement of replacing course credits. Students who have waived courses will advance to candidacy but will not receive an M.S. en route from the department.

The teaching experience is regarded as an integral part of the graduate training program. Students are expected to serve four terms as teaching fellows during their studies, usually in the first two years. Students needing additional funding support from the graduate school may be required to teach additional terms. Students who have completed their teaching requirements may also volunteer to teach for additional pay with prior approval from their primary adviser and the DGS.

There is no foreign language requirement in the physics program. However, non-native English speakers who received a score of 25 or below on the TOEFL Speaking section or a 7.5 or below on the IELTS Speaking section are required to participate in a Summer English Language program at Yale in August before matriculation. These students are required to demonstrate English proficiency before they are permitted to teach.

Formal association with a dissertation adviser typically begins after the second year, once the qualifying events have been passed and the required coursework completed. An adviser from a department other than Physics can be chosen in consultation with the DGS, provided the dissertation topic is deemed suitable for a physics Ph.D.

MASTER'S DEGREES

M.Phil. Students who have successfully presented their prospectus and advanced to candidacy qualify for the M.Phil. degree.

M.S. Terminal M.S. degrees are only awarded to students withdrawing from the Ph.D. program after meeting the course requirements but before submitting a thesis prospectus. Requirements for the terminal M.S. are the successful completion of all six

core courses listed above, in addition to completing either Special Investigations or an advanced elective (all with a satisfactory record). Students receiving their M.S. en route must have completed all coursework, including PHYS 9900 and an advanced elective. Unless otherwise requested, M.S. en route degrees are awarded once the student has advanced to candidacy.

Additional program information can be found on the Physics website under Academics —Graduate Studies.

COURSES

PHYS 5000a, Advanced Classical Mechanics Jack Harris
Newtonian dynamics, Lagrangian dynamics, and Hamiltonian dynamics. Rigid bodies and Euler equations. Oscillations and eigenvalue equations. Classical chaos. Introduction to dynamics of continuous systems.

PHYS 5020b, Electromagnetic Theory I Staff
Classical electromagnetic theory including boundary-value problems and applications of Maxwell equations. Macroscopic description of electric and magnetic materials. Wave propagation.

PHYS 5060a, Mathematical Methods of Physics Simon Mochrie
Survey of mathematical techniques useful in physics. Includes vector and tensor analysis, group theory, complex analysis (residue calculus, method of steepest descent), differential equations and Green's functions, and selected advanced topics.

PHYS 5080a, Quantum Mechanics I Steve Lamoreaux
The principles of quantum mechanics with application to simple systems. Canonical formalism, solutions of Schrödinger's equation, angular momentum, and spin.

PHYS 5100b, Quantum Mechanics II Staff
Approximation methods, scattering theory, and the role of symmetries. Relativistic wave equations. Second quantized treatment of identical particles. Elementary introduction to quantized fields.

PHYS 5120b, Statistical Physics I Staff
Review of thermodynamics, the fundamental principles of classical and quantum statistical mechanics, canonical and grand canonical ensembles, identical particles, Bose and Fermi statistics, phase transitions and critical phenomena, enormalization group, irreversible processes, fluctuations.

PHYS 5150a, Topics in Modern Physics Research Staff
A comprehensive introduction to the various fields of physics research carried out in the department and a formal introduction to scientific reading, writing, and presenting.

PHYS 5170b / ENAS 5170b / MB&B 5170b / MCDB 5170b, Methods and Logic in Interdisciplinary Research Corey O'Hern and Emma Carley
This full PEB class is intended to introduce students to integrated approaches to research. Each week, the first of two sessions is student-led, while the second session is led by faculty with complementary expertise and discusses papers that use different approaches to the same topic (for example, physical and biological or experiment and theory).

PHYS 5220b, Introduction to Atomic Physics Staff
The course is intended to develop basic theoretical tools needed to understand current research trends in the field of atomic physics. Emphasis is given to laser-spectroscopic methods including laser cooling and trapping. Experimental techniques discussed when appropriate.

PHYS 5380a, Introduction to Relativistic Astrophysics and General Relativity Walter Goldberger
Basic concepts of differential geometry (manifolds, metrics, connections, geodesics, curvature); Einstein's equations and their application to such areas as cosmology, gravitational waves, black holes.

PHYS 5420b, Introduction to Elementary Particle Physics Staff
An overview of particle physics, including an introduction to the standard model, experimental techniques, symmetries, conservation laws, the quark-parton model, and open questions in particle physics.

PHYS 5450Lb, Modern Physics Measurements Staff
A laboratory course with experiments and data analysis in soft and hard condensed matter, nuclear and elementary particle physics.

PHYS 5480a / APHY 5480a, Solid State Physics I Yu He
A two-term sequence (with APHY 549) covering the principles underlying the electrical, thermal, magnetic, and optical properties of solids, including crystal structures, phonons, energy bands, semiconductors, Fermi surfaces, magnetic resonance, phase transitions, and superconductivity.

PHYS 5490b / APHY 5490b / ENAS 851, Solid State Physics II Vidvuds Ozolins
A two-term sequence (with APHY 548) covering the principles underlying the electrical, thermal, magnetic, and optical properties of solids, including crystal structures, phonons, energy bands, semiconductors, Fermi surfaces, magnetic resonance, phase transitions, and superconductivity.

PHYS 5610a / MB&B 5310a / MCDB 5310a, Modeling Biological Systems I Thierry Emonet and Kathryn Miller-Jensen
Biological systems make sophisticated decisions at many levels. This course explores the molecular and computational underpinnings of how these decisions are made, with a focus on modeling static and dynamic processes in example biological systems. This course is aimed at biology students and teaches the analytic and computational methods needed to model genetic networks and protein signaling pathways. Students present and discuss original papers in class. They learn to model using MatLab in a series of in-class hackathons that illustrate the biological examples discussed in the lectures. Biological systems and processes that are modeled include: (1) gene expression, including the kinetics of RNA and protein synthesis and degradation; (2) activators and repressors; (3) the lysogeny/lysis switch of lambda phage; (4) network motifs and how they shape response dynamics; (5) cell signaling, MAP kinase networks and cell fate decisions; and (6) noise in gene expression. Prerequisites: MATH 115 or 116, BIOL 101–104, or with permission of instructors. This course also benefits students who have taken more advanced biology courses (e.g. MCDB 200, MCDB 310, MB&B 300/301).

PHYS 5620b / AMTH 765b / CB&B 5620b / ENAS 5620b / INP 562b / INP 7562b / MB&B 5620b, Modeling Biological Systems II Thierry Emonet, Jing Yan, and Damon Clark

This course covers advanced topics in computational biology. How do cells compute, how do they count and tell time, how do they oscillate and generate spatial patterns? Topics include time-dependent dynamics in regulatory, signal-transduction, and neuronal networks; fluctuations, growth, and form; mechanics of cell shape and motion; spatially heterogeneous processes; diffusion. This year, the course spends roughly half its time on mechanical systems at the cellular and tissue level, and half on models of neurons and neural systems in computational neuroscience. Prerequisite: a 200-level biology course or permission of the instructor.

PHYS 5700b / ASTR 5700b / PHYS 570, High-Energy Astrophysics Paolo Coppi

A survey of current topics in high-energy astrophysics, including accreting black hole and neutron star systems in our galaxy, pulsars, active galactic nuclei and relativistic jets, gamma-ray bursts, and ultra-high-energy cosmic rays. The basic physical processes underlying the observed high-energy phenomena are also covered.

PHYS 5710b / ENAS 5710b / MB&B 5910b / MCDB 5910b, Integrated Workshop Corey O'Hern

This required course for students in the PEB graduate program involves a series of modules, co-taught by faculty, in which students from different academic backgrounds and research skills collaborate on projects at the interface of physics, engineering, and biology. The modules cover a broad range of PEB research areas and skills. The course starts with an introduction to MATLAB, which is used throughout the course for analysis, simulations, and modeling.

PHYS 5900b / APHY 5900b, Responsible Conduct in Research for Physical Scientists Staff

A review and discussion of best practices of conduct in research including scientific integrity and misconduct; mentorship; data management; and diversity, equity, and inclusion in science.

PHYS 6000b / ASTR 6000b, Cosmology Nikhil Padmanabhan

A comprehensive introduction to cosmology at the graduate level. The standard paradigm for the formation, growth, and evolution of structure in the universe is covered in detail. Topics include the inflationary origin of density fluctuations; the thermodynamics of the early universe; assembly of structure at late times and current status of observations. The basics of general relativity required to understand essential topics in cosmology are covered. Advanced undergraduates may register for the course with permission of the instructor.

PHYS 6010a / APHY 6600a, Quantum Information and Computation Shruti Puri

This course focuses on the theory of quantum information and computation. We cover the following tentative list of topics: overview of postulates of quantum mechanics and measurements, quantum circuits, physical implementation of quantum operations, introduction to computational complexity, quantum algorithms (DJ, Shor's, Grover's, and others as time permits), decoherence and noisy quantum channels, quantum error-correction and fault-tolerance, stabilizer formalism, error-correcting codes (Shor, Steane, surface-code, and others as time permits), quantum key distribution, quantum Shannon theory, entropy, and data compression.

PHYS 6100a / APHY 6100a, Quantum Many-Body Theory Yoram Alhassid
Identical particles and second quantization. Electron tunneling and spectral function. General linear response theory. Approximate methods of quantum many-body theory. Dielectric response, screening of long-range interactions, electric conductance, collective modes, and photon absorption spectra. Fermi liquid; Cooper and Stoner instabilities; notions of superconductivity and magnetism. BCS theory, Josephson effect, and Majorana fermions in condensed matter; superconducting qubits. Bose-Einstein condensation; Bogoliubov quasiparticles and solitons.

PHYS 6120a / APHY 6280a, Statistical Physics II Nicholas Read
An advanced course in statistical mechanics. Topics may include mean field theory of and fluctuations at continuous phase transitions; critical phenomena, scaling, and introduction to the renormalization group ideas; topological phase transitions; dynamic correlation functions and linear response theory; quantum phase transitions; superfluid and superconducting phase transitions; cooperative phenomena in low-dimensional systems.

PHYS 6200a, Relativistic Field Theory I Thomas Appelquist
The fundamental principles of quantum field theory. Interacting theories and the Feynman graph expansion. Quantum electrodynamics including lowest order processes, one-loop corrections, and the elements of renormalization theory.

PHYS 6300b, Relativistic Field Theory II Staff
An introduction to non-Abelian gauge field theories, spontaneous symmetry breakdown, and unified theories of weak and electromagnetic interactions. Renormalization group methods, quantum chromodynamics, and nonperturbative approaches to quantum field theory.

PHYS 6330b / APHY 6330b, Introduction to Superconductivity Yu He
The fundamentals of superconductivity, including both theoretical understandings of basic mechanism and description of major applications. Topics include historical overview, Ginzburg-Landau (mean field) theory, critical currents and fields of type II superconductors, BCS theory, Josephson junctions and microelectronic and quantum-bit devices, and high-Tc oxide superconductors.

PHYS 6750a / APHY 6750a, Principles of Optics with Applications Hui Cao
Introduction to the principles of optics and electromagnetic wave phenomena with applications to microscopy, optical fibers, laser spectroscopy, nanophotonics, plasmonics, and metamaterials. Topics include propagation of light, reflection and refraction, guiding light, polarization, interference, diffraction, scattering, Fourier optics, and optical coherence.

PHYS 6760a / APHY 6760a, Introduction to Light-Matter Interactions Peter Rakich
Optical properties of materials and a variety of coherent light-matter interactions are explored through the classical and quantum treatments. The role of electronic, phononic, and plasmonic interactions in shaping the optical properties of materials is examined using generalized quantum and classical coupled-mode theories. The dynamic response of media to strain, magnetic, and electric fields is also treated. Modern topics are explored, including optical forces, photonic crystals, and metamaterials; multi-photon absorption; and parametric processes resulting from electronic, optomechanical, and Raman interactions.

PHYS 6780b, Computing for Scientific Research Staff
This hands-on lab course introduces students to essential computational and data analysis methods, tools, and techniques and their applications to solve problems in physics. The course introduces some of the most important and useful skills, concepts, methods, tools, and relevant knowledge to get started in scientific research broadly defined, including theoretical, computational, and experimental research. Students learn basic programming in Python, data analysis, statistical tools, modeling, simulations, machine learning, high-performance computing, and their applications to problems in physics and beyond.

PHYS 6790b / APHY 6790b, Nonlinear Optics and Lasers Logan Wright
Properties and origins of the nonlinear susceptibility; Sum-freq, diff-freq and 2nd-harmonic generation; Intensity-dependent refractive index; Optical phase conjugation; Self-focusing, self-phase modulation, solitons; Stimulated light scattering; Fixed points, bifurcations; Amplification; Rate equations; Relaxation oscillations, frequency pulling; Hole burning; Q-switching; Semiconductor and DFB lasers; Mode-locking; Injection-locking; Intense-field NLO and QM laser theory (time permitting)

PHYS 7460a / ASTR 7460a / MATH 7460a, Global Properties of Nonlinear Relativistic Fields Vincent Moncrief
Many relativistic field equations of interest in mathematical physics, astrophysics and cosmology are intrinsically nonlinear. Notable examples are various nonlinear wave equations, the Maxwell-Klein-Gordon equations, the Yang-Mills-Higgs equations and the Einstein field equations of general relativity. Techniques for analyzing their global solutions on various manifolds include (higher order) energy estimates and so-called light-cone estimates. An interesting question for the Einstein equations is whether the so-called "cosmological principle," according to which only the very special manifolds admitting (spatially) homogeneous and isotropic metrics need be considered for cosmology, is firmly established or whether this principle can be relaxed to allow for much more general manifolds and still be consistent with observations. Another issue is how the Thurston geometrization theorem, established by Hamilton and Perlman via Ricci flow, relates to the "cosmic censorship conjecture" of Roger Penrose, often regarded as the main open mathematical problem of general relativity.

PHYS 9900a or b, Special Investigations Staff
Directed research by arrangement with individual faculty members and approved by the DGS in a student's second year. Students are expected to propose and complete a term-long research project. The culmination of the project is a presentation that fulfills the departmental requirement for the research qualifying event.

Political Science

Rosenkranz Hall, 203.432.5241
http://politicalscience.yale.edu
M.A., M.Phil., Ph.D.

Chair
Gerard Padró i Miquel

Director of Graduate Studies
Hélène Landemore

Professors Bruce Ackerman, Akhil Amar (*Law*), Jennifer Gandhi, Bryan Garsten, Alan Gerber, Jacob Hacker, Gregory Huber, Hélène Landemore, Isabela Mares, Adam Meirowitz, Gerard Padró i Miquel, Nicholas Sambanis, Jasjeet Sekhon, Ian Shapiro, Stephen Skowronek, Steven Smith, Milan Svolik, Steven Wilkinson, Elisabeth Wood

Associate Professors P. Aronow, Katharine Baldwin, Ana De La O Torres, Alexandre Debs, Daniel Mattingly

Assistant Professors Kevin DeLuca, Allison Harris, Melody Huang, Joshua Kalla, Christina Kinane, Shiro Kuriwaki, Egor Lazarev, Soyoung Lee, Charles McClean, Mellissa Miesels, Giulia Oskian, Elizabeth Parker-Magyar, Didac Queralt, Noam Reich, Lucia Rubinelli, Emily Sellars, Nazmul Sultan, Ian Turner

FIELDS OF STUDY

Fields include American politics, comparative politics, international relations, political economy, political theory, quantitative empirical methods, qualitative and archival methods, and formal theory.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Students are required to pass fourteen term courses by the end of their fourth term in the program, to receive a grade of Honors in at least two political science courses, and to maintain an overall High Pass or above average (for purposes of calculating this average, Honors=3, High Pass=2, Pass=1, and Fail=0). To remain in good standing throughout their time in the Ph.D. program, students are expected to actively participate in classes and workshops, produce high-quality written work, and demonstrate regular progress toward completion of the dissertation. The department regularly offers about sixty term courses for graduate students each year. Courses are conducted as seminars and typically have small enrollments. Students may count up to four courses outside the Department of Political Science toward the degree without prior approval from the director of graduate studies (DGS). Of these, up to two may be advanced language courses, subject to DGS approval. With the DGS's permission, students may take up to two additional outside courses, for a maximum of six non-political-science courses counted toward the degree.

Each student must demonstrate elementary reading competence in one foreign language. Such competence is usually demonstrated by taking, or having completed, two years of undergraduate course work or by examination. Alternatively, the language requirement can be satisfied by successfully completing two terms of formal theory or

two terms of statistical methods at the graduate level (beyond the introductory course in statistical methods offered in the department).

Courses are offered in five substantive fields—political theory, international relations, comparative politics, American politics, and political economy—and three methods fields: quantitative empirical methods, qualitative and archival methods, and formal theory. Courses taken must include one each in at least three of the department's substantive fields. Courses cannot be counted in more than one field. Each student must demonstrate competence in two fields (one of which must be a substantive field) before the start of the fifth term. Certification in the primary subfield must be by exam. Certification in the nonprimary subfield can be in any route allowed by the subfield. The fields of formal theory and quantitative empirical methods offer certification only through examination. Students who do not pass an exam on the second try cannot certify in that subfield. The department offers exams twice a year, in late August and in early January. Students are expected to pass their comprehensive examinations by August of their second year. Each examination is based on a reading list compiled by the faculty within the field and updated each year. Each list offers an introduction and framework for study in the field and preparation for the examination. A committee of faculty within the field grades the exams as Distinguished, Satisfactory, or Unsatisfactory.

Students who successfully complete the Ph.D. in Political Science will often join the faculties of colleges and universities. For that reason, learning what is involved in teaching and gaining teaching experience are also essential components of graduate education. The department normally expects students to devote themselves exclusively to course work and comprehensive examinations in their first two years in the Ph.D. program. Students in Political Science typically teach in their third and fourth years.

During each year in residence, graduate students are expected to participate actively and regularly in one or more of the many research workshops run by the department. Students beyond their fourth term are required to enroll in at least one of the workshops for credit, and all workshops are graded on a Satisfactory/Unsatisfactory basis. (At the discretion of the DGS, this requirement may be waived for a term for students whose situations make participation temporarily unfeasible.) All students are expected to present a research paper of their own at one of these workshops before the end of their fourth year. Workshop participation does not count toward the requirement of fourteen term courses.

Prior to Registration for the Second Year

1. Students must have taken and passed at least six courses and maintained an overall High Pass average. At least five of these courses must be graduate courses in political science. While only six courses are required, students are normally expected to complete seven courses in the first year to be on track to complete fourteen courses by the end of the second year.
2. Students are strongly encouraged to complete at least one field certification prior to the beginning of their second year.
3. Students are strongly encouraged to attend one of the subfield weekly workshops. (Note that these workshops do not count toward the required number of completed courses.)

Prior to Registration for the Third Year

1. Students must have taken at least fourteen term courses and have received a grade of at least Pass in each of them, including PLSC 5400, the one-term required Research and Writing course (PLSC 5410 for second-year students). Research and Writing is devoted to the preparation of a manuscript based on original research on a topic of the student's choice and will count as one of the fourteen credits needed to advance to candidacy.
2. Students must have received a grade of Honors in at least two political science courses and maintained an overall High Pass average.
3. Students must have completed certification in two fields by the end of their second year. (For purposes of fulfilling this requirement, students registered for the August exams are assumed to have passed those exams when determining eligibility for enrollment in the third year.) At the discretion of the DGS, students who fail an exam may be granted a one-term extension (to January of the third year) for obtaining certification.
4. Students are strongly encouraged to attend one of the required subfield weekly workshops. (Note that these workshops do not count toward the required number of completed courses.)

Admission to Candidacy Students must be admitted to candidacy prior to registration for the fourth year of study. Students are recommended to the graduate school for admission to candidacy by the Department of Political Science after having completed departmental requirements listed above and the graduate school's prospectus requirement. As part of admission to candidacy, a student must have a prospectus approved by a dissertation director and two other members of the faculty. This must occur no later than May 1 of the student's third year of study. Students who do not have an approved prospectus by May 15 will be placed on academic probation by the DGS.

Submitting the Dissertation A student's dissertation research is guided by a committee of no fewer than three faculty members, at least two of whom must be members of the Department of Political Science. One of the committee members is designated as chair, and the chair of the committee must be a full member of the department with voting rights. When a dissertation is completed, the student will select two members to write written reports on the final dissertation, at least one of whom must be a member of the Department of Political Science. The DGS will also appoint one additional member of the department to write an additional evaluation.

COMBINED PH.D. PROGRAMS

Political Science and Black Studies

The graduate school offers a combined degree in political science and black studies. For details, see Black Studies in this bulletin.

Political Science and Statistics and Data Science

The Department of Political Science also offers, in conjunction with the Department of Statistics and Data Science, a combined Ph.D. degree in political science and statistics and data science. The requirements are designed to emphasize the interdisciplinary

nature of the combined-degree program. Unless otherwise noted, students are required to complete all program requirements in each department's regular Ph.D. program.

Coursework Students must take at least fourteen graduate-level courses.

Students must complete at least seven courses in the Department of Political Science before the start of the seventh term and three courses in quantitative methods: PLSC 5000, PLSC 5030, and PLSC 5080 (or a suitable equivalent, as approved by the Political Science DGS). In addition to these three courses, students must also take at least two courses each in two other fields (American politics, comparative politics, international relations, political theory, and political economy). Two of these seven courses may be courses outside the department that appropriately build the student's substantive interests. Students may optionally take Research and Writing in year two or three, but this sequence does not count toward the seven-course requirement.

Students must also complete at least seven courses in the Statistics and Data Science department before the start of the seventh term, with the specific course schedule subject to approval by the Statistics and Data Science DGS. A typical course plan would likely include S&DS 5410 (taken in the first term), S&DS 5420 and S&DS 6610 (taken in the second term), S&DS 6120 and S&DS 6250 (taken in the third term), and S&DS 6260 (taken in the fourth term).

In the event course requirements as written cannot be met due to restrictions on course offerings, etc., the DGSs of each program, in consultation with one another, may mutually agree on course substitutions consistent with the intellectual goals of this program.

Qualifying Examination There are separate comprehensive exam requirements in each department. In Political Science, students must certify in two fields, and one of these fields must be quantitative methods, which is certified by examination. The other subfield can be drawn from American politics, comparative politics, international relations, political theory, and political economy. For rules about certification in these fields, please see the Political Science department's solo Ph.D. requirements. Students must complete all of these certifications prior to the start of the sixth term, and it is expected that students will complete their first two certifications the summer after their second term. Students satisfy the Political Science language requirement by certifying in quantitative methods.

In Statistics and Data Science, students will complete the Probability Theory Comprehensive Exam, the Statistical Theory Comprehensive Exam, Practical Exam, and Oral Exam before the start of the fifth term. Please see the Statistics and Data Science department's solo Ph.D. requirements (https://statistics.yale.edu/academics/graduate-programs/phd-program/qualifying-exams).

Teaching The teaching requirement of students admitted in the combined program will be split between the two departments (i.e., the student will be serving as a teaching fellow for an equal number of courses in both departments).

Prospectus and Dissertation Requirements For the dissertation, not later than the fifth term, a student shall select a primary adviser from one department, a coadviser from the other department, and a third faculty member from either department who serves as a reader along with the advisers. The dissertation prospectus is due not later

than the middle of the sixth term (mid-March for students whose sixth term is a spring term). Subsequently, and not later than the end of classes in the sixth term (usually the end of April for students whose sixth term is a spring term), there is to be an oral presentation of the prospectus by the prospective candidate, followed by a meeting of a faculty committee consisting of the advisers and at least one DGS for prospectus approval. Admission to candidacy for the combined Ph.D. requires DGS signature of prospectus approval from both departments following adviser approval in both departments. In Political Science, this requires all three committee members to attest that the prospectus is approved. Combined dissertations will take a form suitable for both disciplines. We anticipate that many students will write dissertations composed of three papers.

Advising Beginning in the first term of the Ph.D. program, a student shall select an adviser from each department, with one adviser designated as the primary adviser. We strongly suggest the student meet jointly with both advisers to discuss navigating the combined Ph.D. program.

Transfer Admissions Process Students admitted to either Political Science or Statistics and Data Science may apply to transfer to the combined Ph.D. program with the approval of the DGS in both programs. Transfer applications are expected to take place no later than the third term in the Ph.D. program.

Exit from the Combined Program A student admitted into the combined program may elect to exit the combined program and instead pursue a regular Ph.D. in either of the two departments. This election must take place before the start of the sixth term.

JOINT DEGREE

Students may also pursue a joint degree with Yale Law School.

MASTER'S DEGREES

M.Phil. The academic requirements for the M.Phil. degree are the same as for the Ph.D. degree except for the completion of the prospectus and dissertation.

M.A. Students who withdraw from the Ph.D. program may be eligible to receive the M.A. degree if they have met the requirements and have not already received the M.Phil. degree. For the M.A., students must successfully complete a full year of course work in the program (at least seven term courses) with an average of High Pass. The courses must include at least five listed in the Department of Political Science and one each in at least two of the department's substantive fields. Language requirements are the same as for the Ph.D. degree.

Students enrolled in the Ph.D. program in political science may qualify for the M.A. in history, rather than an M.A. in political science, upon completion of a minimum of six graduate term courses in history at Yale, of which two must have earned Honors grades and the other four courses must average High Pass overall. A student must include in the six courses completed at least two research seminars in the Department of History.

Candidates in combined programs will be awarded the M.A. only when the master's degree requirements for both programs have been met.

COURSES

PLSC 5000a, Foundations of Statistical Inference Melody Huang
This course provides an intensive introduction to statistical theory for quantitative empirical inquiry in the social sciences. Topics include foundations of probability theory, statistical inference from random samples, estimation theory, linear regression, maximum likelihood estimation, and a brief introduction to identification.

PLSC 5030b / S&DS 6140b, Causal Inference Melody Huang
This course provides an intensive introduction to the statistical theory and practice of causal inference. Topics include: the potential outcomes framework, experimental design, selection on observables, instrumental variables, difference-in-differences, and panel data. Prerequisite: PLSC 500 or equivalent. Students are expected to come in with prior knowledge about statistical inference, regression/linear models, and statistical computing in R.

PLSC 5050b / SOCY 5750b, Qualitative Field Research Egor Lazarev
In this seminar we discuss and practice qualitative field research methods. The course covers the basic techniques for collecting, interpreting, and analyzing ethnographic data, with an emphasis on the core ethnographic techniques of participant observation and in-depth interviewing. All participants carry out a local research project. Open to undergraduates with permission of the instructor.

PLSC 5100a, Introduction to the Study of Politics Didac Queralt
The course introduces students to some of the major controversies in political science. We focus on the five substantive themes that make up the Yale Initiative: Order, Conflict, and Violence; Representation and Popular Rule; Crafting and Operating Institutions; Identities, Affiliations, and Allegiances; and Distributive Politics. We divide our time between discussing readings on these subjects and conversations with different members of the faculty who specialize in them. There is also some attention to methodological controversies within the discipline. Requirements: an annotated bibliography of one of the substantive themes and a take-home final exam.

PLSC 5110b / S&DS 6170b, Advances in Large Language Models: Theory and Applications Jas Sekhon
This seminar explores recent advances in foundational language models (LLMs), with an emphasis on practical techniques to enhance their reasoning abilities. Students gain hands-on experience experimenting with frontier LLMs and post-inference algorithms to improve these models' reasoning capabilities. We also cover multiple cutting-edge papers on LLMs to provide a deeper understanding of the latest research and developments in this field. It is assumed that students come with a background in machine learning. A good background would be provided by S&DS 265/565, 365/665, or equivalent, plus some experience with applications and statistical computing. Some prior experience with deep learning will be assumed. Highly motivated undergraduates are very welcome and encouraged to apply to join the course.

PLSC 5180a, Introduction to Game Theory Adam Meirowitz
This course offers a rigorous introduction to noncooperative game theory. The course covers normal and extensive form games of perfect information and normal and extensive form games of imperfect information. We end with a brief introduction to mechanism design. Through lectures and problem sets students gain familiarity with creating and analyzing models of political phenomena. Applications are drawn from a

broad set of topics in political science and students are pushed to think about how game theoretic analysis connects with empirical work in political science. A capstone project pushes students to create and analyze a novel model of politics in their own research area. Students are assumed to have mathematical knowledge at the level of the Political Science Math Camp.

PLSC 5190b, Introduction to Formal Political Economy Emily Sellars
This course surveys key applications of game theory and related methods to the study of politics and political economy. Topics include electoral competition, political accountability, special interest politics, delegation, political agency, legislative bargaining, collective action, and regime chance. Prerequisite: PLSC 518 or an equivalent course in game theory.

PLSC 5200a, Advanced Models of Political Economy Ian Turner
This is a second course in Ph.D.-level game theory. The course builds on skills developed in PLSC 518 and focuses on the transition from consumers to producers of theoretical models. Possible topics to be covered include comparative statics, dynamic games, mechanism design, global games, and models of information transmission and persuasion. The course consists of learning new technical skills as well as in-depth study of substantive applications in political economy. Prerequisite: PLSC 518.

PLSC 5220a / SOCY 5850a, Archival Methods and Historical Approaches in the Social Sciences Jonny Steinberg
The aim of the course is to equip students to navigate different sorts of archives, to interpret archival material, and to survey debates in the social sciences about using historical material and theory to build arguments.

PLSC 5230b, Mixed Methods Research Staff
This course trains students to design and critique a range of quantitative, qualitative, and experimental research methods. The course begins with a discussion of concept formation, defining quantities of interest, and the advantages and disadvantages of bringing descriptive vs. causal evidence to bear. We then analyze the strengths and weaknesses of quantitative tests, experimental designs, case-based approaches (case studies, case selections, and cross-case comparisons), and interpretive methods such as process tracing. Next, the course discusses the research design choices of two award-winning books using mixed methods research; it then evaluates the qualitative and quantitative data in isolation and in combination. The final assignment builds on the course material to produce a mixed method research design proposal.

PLSC 5280a, Design-Based Inference for the Social Sciences P Aronow
Introduction to design-based statistical approaches to survey sampling and causal inference. Design and analysis of complex survey samples and randomized experiments, including model-assisted approaches. Discussion of recent advances in this paradigm, including inference in network settings. Prerequisite: knowledge of statistical theory at the level of PLSC 500 is assumed, with familiarity with probability and estimation theory. Alternative prerequisite courses include S&DS 542 or ECON 550.

PLSC 5300b / S&DS 5300a or b, Data Exploration and Analysis Jonathan Reuning-Scherer
Survey of statistical methods: plots, transformations, regression, analysis of variance, clustering, principal components, contingency tables, and time series analysis. The R computing language and web data sources are used.

PLSC 5330a, Formal Models of International Relations Alex Debs
This course offers a survey of game-theoretic models of international relations. Students learn how to evaluate and present existing models and how to develop their own research projects. Topics covered include nuclear deterrence theory, war duration, the democratic peace, militarization and war, mediation, and mutual optimism. Prerequisites: PLSC 5180 and PLSC 5190 or the equivalent.

PLSC 5360a, Applied Quantitative Research Design Shiro Kuriwaki
Research designs are strategies to obtain empirical answers to theoretical questions. This class trains students with the best practices for implementing and communicating rigorous quantitative social science research. We cover econometrics techniques of causal inference, prediction, and missing data. These include fixed effects, time series, instrumental variables, survey weighting, and shrinkage. This is a hands-on, application-oriented class. Students practice programming, statistics, and data visualizations used in exemplary quantitative social science articles. Formal section enrollment is not required but highly encouraged. Prerequisite: Statistics, econometrics, or data science courses that teach ordinary least squares regression and p-values, such as S&DS 2300. Some past or concurrent experience with R/Stata/Python is also presumed. This class is designed for juniors, seniors, master's students, and Ph.D. students. Ph.D. students in political science can join without a prerequisite.

PLSC 5400a and PLSC 5410b, Research and Writing Helene Landemore-Jelaca and Emily Sellars
This is a required course for all second-year students. It meets for the first six weeks of the fall term and the first six weeks of the spring term. The fall meetings are devoted to discussion of research design as well as individual student projects. The spring meetings are devoted to discussion of drafts of student papers. The work of the spring-term seminar includes criticism of the organization, arguments, data evaluation, and writing in each student's paper by the instructors and the other students. Using this criticism, and under the supervision of the instructors, each student conducts additional research, if necessary, rewrites the paper as required, and prepares a final paper representing the best work of which the student is capable. Students must submit a one-page outline of the proposed project for the first fall-term meeting and a complete draft of the paper at the first meeting in the spring.

PLSC 5460b, Prospectus Writing Workshop Alex Debs
A non-credit workshop for third-year Ph.D. students in the Political Science department, in which they develop, revise, and present their prospectus. o Course cr

PLSC 5650a, Democracy and Distribution Ian Shapiro
An examination of relations between democracy and the distribution of income and wealth. The central focus is on ways in which different groups and coalitions affect, and are affected by, democratic distributive politics. This course also examines the variation among democracies in the provision of education, social and health insurance, and policies designed to ameliorate inequalities.

PLSC 5820b, Politics and the Passions Giulia Oskian
This seminar explores different paradigms in political psychology. Classical political theory, since Plato and Aristotle, observed that any set of political institutions needs to be supported by corresponding public ethics, and, conversely, promotes, orients, or inhibits certain emotions. What people are afraid of, angry at, indignant about,

or hopeful for varies according to political circumstances so that, as Montesquieu and Tocqueville noticed, the passions of a democratic citizen are inevitably different from those of someone living in a hierarchical society. However, more recent political theory tends either to disregard the relation between shared emotions and political institutions or to view it as a social pathology. On the one hand, emotional phenomena are simply dismissed as mere deviations from the behavior expected from the highly abstract ideal of a rational citizen; on the other hand, when appreciated, the impact of emotions on political life is most often interpreted as a pathological feature of current democracies. Departing from both these strands of theory, this seminar explores the emotional foundations of public ethics, political practices, and institutions, as well as the political potential of psychological realism. Focusing on moments of political mobilization, social conflict, and institutional change, which bring to the foreground the emotional component of politics, we retrace emotional transformations together with the evolution of the psychological and moral discourses: How are our emotional experiences related to social expectations? In what way can political movements induce us to reorient our feelings and find new objects for our anger, indignation, fear, or hope? The seminar is structured in three parts. An introductory part compares different methods in the study of emotions and their political relevance. In the second part we study the psychological conditions for the emergence of authoritarianism in 1920s–1930s continental Europe. Based on readings by Theodor Adorno and Erich Fromm we discuss questions such as: Is there such a thing as an authoritarian personality? What social conditions foster its development? How can people come to desire to escape from freedom? The third part explores the emancipatory potential of psychological realism: we discuss militant texts from classical feminist (Simone de Beauvoir, Carol Gilligan) and black (James Baldwin, Audre Lorde) political thought, which relate the possibility of a deep and lasting social reform to a transformation of the emotional disposition of the citizenry.

PLSC 5900a, Introduction to Advanced Political Theory Ian Shapiro
This course is designed to introduce advanced students to contemporary debates in political theory. It is organized around several themes, including power, authority and legitimacy, freedom and equality, theories of justice, democracy, and republicanism. Particular emphasis is given to the ways in which the preoccupations of political theorists should be informed by and inform the empirical study of politics. Prerequisites: at least four courses in Political Science, one of which is a course in political theory or political philosophy.

PLSC 6235a, Genealogies of the Modern State Nazmul Sultan
This seminar traces the historical and conceptual formation of the modern state, from its formative theoretical articulations in early modern Europe to its globalization in the twentieth century. The course begins by exploring how the emergence of the idea of the sovereign state in seventeenth-century Europe inaugurated a new way of thinking about the problems of political authority and legitimacy. This vision would mature over the eighteenth century, while also triggering numerous skeptical rejoinders that arguably culminated in pluralist critiques in the early twentieth century. While this story forms one strand of the seminar, its main focus is on the transformation of the modern state in the nineteenth and twentieth centuries. We examine how the rise of the social imbued the idea of the state with new purposes and how an expanded conception of administrative power facilitated a powerful reconceptualization of the state-society

relationship. We explore these problems against the backdrop of the rise of democracy in the nineteenth century. The course also considers the globalization of the state-form in the wake of decolonization and postwar international order—asking how the modern state became the global standard, and with what tensions and contradictions. We analyze the intellectual formation of the developmental state, focusing especially on the expanded vision of executive power that propelled postcolonial founding projects across Asia and Africa. Readings include canonical texts in political thought (Hobbes, Tocqueville, Weber, Laski, Nehru), as well as more recent studies in the intellectual history of the modern state. The seminar approaches the problem of the modern state from a global perspective, engaging historiographies from both European and non-European contexts.

PLSC 6400a / HIST 6610a, Advanced Topics in Modern Political Philosophy Giulia Oskian

This seminar explores key concepts in modern political philosophy at a level appropriate for graduate students (to help prepare for the political theory field exam) and for advanced undergraduates who have completed substantial course work in intellectual history and/or political theory.

PLSC 6450a, Machiavelli and Machiavellianism Steven Smith

Machiavelli remains one of the most widely discussed and debated figures in the Western political canon. This course will explore Machiavelli's Florentine context before delving into a close reading of his two major treatises, *The Prince* and *The Discourses on Livy*. We then consider influential interpreters of Machiavelli from Montesquieu, Rousseau and Hegel to modern readers like Gramsci, Strauss, and Isaiah Berlin as well as exploring Machiavelli's influence in a wider global context. Our aim will be to examine the extraordinary resilience and adaptability of the writings of this great Florentine.

PLSC 6670a, Domestic Politics in International Relations Soyoung Lee

This class explores the interplay between domestic politics and international relations. We examine questions such as how does domestic politics affect the foreign policy choices of leaders and states? Who are the key domestic actors and what do the actors want? How do domestic actors form their preferences? Do domestic political institutions matter, and if so, how? Topics include rallying and diversionary conflict, war and the fate of leaders, domestic interest groups and sectoral politics, elite messaging and propaganda, democratic peace, and the rise of populism and nationalism. Students also have a chance to develop their own research skills by writing and presenting a research paper outline. Assignments also include writing practice referee reports and response papers. This class is aimed at political science Ph.D. students interested in international relations.

PLSC 6720a / EMST 5210a / ENGL 6721a, Edmund Burke and the Age of Empire David Bromwich

A partial survey of the political writings of Burke in the context of the theory of empire and of revolution. We emphasize his writings on India and France, which reveal a common theme: innovation—sudden change in a way of life—always depends on violence, whether its agents are internal or external to the society. We touch on a wider subject: the birth of modern ideology, from the demand for systematic excuses to justify empire and revolution.

PLSC 6840a / EAST 5521a, China's International Relations Feng Zhang
This course examines China's international relations with a focus on both historical context and contemporary developments. Beginning with imperial China's traditional foreign relations and the "century of humiliation," the course traces the evolution of Chinese foreign policy through the Cold War period to the present day. Students analyze China's relationships with major powers and regions, including the United States, Russia, Northeast Asia, Southeast Asia, and India, while exploring critical issues such as the Taiwan question, territorial disputes in the South China Sea, and China's growing role in global governance. Special attention is paid to understanding the drivers of China's recent assertive turn in foreign policy under Xi Jinping, theories of international relations as applied to China's rise, and the implications of China's increasing power for the international order. Through engagement with scholarly works and contemporary policy debates, the course provides students with a comprehensive understanding of China's foreign relations and its emergence as a global power.

PLSC 6850b / EAST 5520b, Chinese Thinking on International Relations Feng Zhang
How have the Chinese thought about international relations and their country's role in the world? How has such thinking influenced China's foreign relations past and present? This advanced seminar canvasses Chinese thinking on international relations from the imperial epoch to the present, focusing on the post-1949 era of the People's Republic of China. It is structured around three core engagements: the historical background of Chinese thinking; policy thinking of the successive PRC leaderships; and new strands of thinking at present. It examines both the evolutionary process of thinking and a body of prominent ideas and doctrines. Throughout the course, students have the opportunity to place China's foreign policy in a broader and deeper intellectual context than is often the case.

PLSC 6910a, Identity and Conflict Lab Nicholas Sambanis
The Identity and Conflict Lab (ICL), led by Professor Nicholas Sambanis, is launching a new graduate-level course focusing on the politics of intergroup conflict broadly conceived. The lab's research is motivated by major problems of our time, such as civil war, ethnic violence, racial prejudice, and religious intolerance. The lab sponsors research on all these areas, with a particular focus on identity politics: how social identities shape individual behavior, how conflict affects identities, and what interventions are effective in reducing conflict. The ICL course reviews the state of the debate on key topics in which the ICL has active research and identifies new research questions that lab affiliates can address by collecting new data and applying cutting edge analysis in a collaborative setting. The lab involves affiliated faculty at Yale and other universities, post-doctoral fellows, and students. The lab promotes an interdisciplinary, multimethod approach to the study of conflict. Students affiliated with the lab must attend workshops and meetings biweekly and are expected to complete reading assignments, comment on lab affiliates' work in progress, and present their own work to the lab on suitable topics decided in consultation with the lab director. Students taking this course have opportunities to join ongoing lab projects depending on their interests and skills. For more information, please send inquiries to nicholas.sambanis@yale.edu. Open to graduate students only. ½ Course cr

PLSC 6950a, International Security Noam Reich
This course covers the main theories and problems in international security, including the causes of war; crisis bargaining; diplomacy and coercion; war termination; and civil wars. Students acquire broad familiarity with the canonical literature in international security and learn how to identify opportunities for new research. The course is designed for Ph.D. students in political science.

PLSC 6980b, International Political Economy Didac Queralt
This course examines how domestic and international politics influence the economic relations between states. It addresses the major theoretical debates in the field and introduces the chief methodological approaches used in contemporary analyses. We focus attention on four types of cross-border flows and the policies and international institutions that regulate them: the flow of goods (trade policy), the flow of capital (financial and exchange rate policy), the flow and location of production (foreign investment policy), and the flow of people (immigration policy).

PLSC 7090a, Comparative Constitutional Law Bruce Ackerman
An effort to define the key concepts adequate for an evaluation of the worldwide development of modern constitutionalism since the Second World War. Enrollment limited. Follows Law School academic calendar.

PLSC 7200a, Sexual Violence and War Elisabeth Wood
Analysis of patterns of sexual violence in war. Assessment of how well scholars in various disciplines and policy analysts account for these patterns.

PLSC 7210b / ECON 5548b, Political Economy of Development Rohini Pande and Gerard Padro
This course analyzes empirically and theoretically the political, institutional, and social underpinnings of economic development. We cover an array of topics ranging from power structures to corruption, state capacity, social capital, conflict, democratization, and democratic backsliding. We focus on recent advances to identify open areas for further research.

PLSC 7340a / SOCY 6100a, Comparative Research Workshop Rene Almeling and Alka Menon
This weekly workshop is dedicated to group discussion of work-in-progress by visiting scholars, Yale graduate students, and in-house faculty from Sociology and affiliated disciplines. Papers are distributed a week ahead of time and also posted on the website of the Center for Comparative Research (http://ccr.yale.edu). Students who are enrolled for credit are expected to present a paper-in-progress.

PLSC 7560a, The European Union David Cameron
Origins and development of the European Community and Union over the past fifty years; ways in which the often-conflicting ambitions of its member states have shaped the EU; relations between member states and the EU's supranational institutions and politics; and economic, political, and geopolitical challenges.

PLSC 7770b, Comparative Politics I: Research Design Katharine Baldwin
This course is part of a two-term course series designed to introduce students to the study of comparative politics. This half of the sequence focuses on issues related to research design and methodology in comparative politics. Although there are a handful of weeks devoted entirely to methodological debates, most of our weekly discussions are focused around one book as an exemplar of a particularly interesting or important

research design. The course is helpful for students who plan to take the comparative politics field exam.

PLSC 7780a, Comparative Politics II Jennifer Gandhi
This survey course provides a general introduction to the field of comparative politics, with an emphasis on the most important theories and research themes. Topics include the foundations of political regimes, state formation, identity and nationalism, party development, electoral reforms, programmatic and clientelistic linkages, and social policy development. At the same time, the course seeks to strengthen students' analytical skills in evaluating comparative research and prepare students to take the examination in comparative politics.

PLSC 7830a, Democratic Backsliding Milan Svolik
This class examines the process of democratic backsliding, including its causes and consequences. Our analysis builds on prominent contemporary and historical cases of democratic backsliding, especially Hungary, India, Poland, Russia, and Venezuela. Implications for democratic stability in the United States are considered.

PLSC 8000a, Introduction to American Politics Shiro Kuriwaki
This course is an introduction to American politics for students pursuing graduate work in political science. It surveys current research paired with several classics. Topics and approaches given consideration include institutional design, historical political development, mass attitudes, ideology, econometrics of elections, rational actors, urban politics, interest groups, and political economy. This class, PLSC 8100 (behavior, fall), and PLSC 8030 (institutions, spring) form the sequence that Ph.D. students are recommended to take for the examination in American politics.

PLSC 8030b, American Politics III: Institutions Gregory Huber
A graduate-level course, open to undergraduates, designed to introduce students to research on American political institutions. We examine different explanations for and models of the sources of institutions, discuss their internal organization and governance, and consider the effects of institutions on outcomes of interest. Topics include alternatives to institutions, agenda-setting models, influences on bureaucratic decisions, the size of government and state building, congressional organization, the presidency, policy feedback and path dependence, and interest groups. Course work includes reading and writing assignments.

PLSC 8100a, Political Preferences and American Political Behavior Joshua Kalla
Introduction to research methods and topics in American political behavior. Focus on decision-making from the perspective of ordinary citizens. Topics include utility theory, heuristics and biases, political participation, retrospective voting, the consequences of political ignorance, the effects of campaigns, and the ability of voters to hold politicians accountable for their actions.

PLSC 8120a / AMST 7752a, American Progressivism and Its Critics Stephen Skowronek
The progressive reform tradition in American politics. The tradition's conceptual underpinnings, social supports, practical manifestations in policy and in new governmental arrangements, and conservative critics. Emphasis on the origins of progressivism in the early decades of the twentieth century, with attention to latter-day manifestations and to changes in the progressive impulse over time.

PLSC 8390a, Congress in the Light of History David Mayhew
A critical investigation of the United States Congress, the primary democratic institution in the American political system. Focus on individual members of Congress, institutional features, and the role of Congress within the larger separation-of-powers system.

PLSC 9300a, American Politics Workshop Staff
The course meets throughout the year in conjunction with the ISPS American Politics Workshop. It serves as a forum for graduate students in American politics to discuss current research in the field as presented by outside speakers and current graduate students. Open only to graduate students in the Political Science department. Can be taken as Satisfactory/Unsatisfactory only.

PLSC 9320a, Comparative Politics Workshop Egor Lazarev
A forum for the presentation of ongoing research by Yale graduate students, Yale faculty, and invited external speakers in a rigorous and critical environment. The workshop's methodological and substantive range is broad, covering the entire range of comparative politics. There are no formal presentations. Papers are read in advance by participants; a graduate student critically discusses the week's paper, the presenter responds, and discussion ensues. Detailed information can be found at https://campuspress.yale.edu/cpworkshop. Open only to graduate students in the Political Science department. Can be taken as Satisfactory/Unsatisfactory only.

PLSC 9340a, Political Theory Workshop Staff
An interdisciplinary forum that focuses on theoretical and philosophical approaches to the study of politics. The workshop seeks to engage with (and expose students to) a broad range of current scholarship in political theory and political philosophy, including work in the history of political thought; theoretical investigations of contemporary political phenomena; philosophical analyses of key political concepts; conceptual issues in ethics, law, and public policy; and contributions to normative political theory. The workshop features ongoing research by Yale faculty members, visiting scholars, invited guests, and advanced graduate students. Papers are distributed and read in advance, and discussions are opened by a graduate student commentator. Detailed information can be found at http://politicaltheory.yale.edu. Open only to graduate students in the Political Science department. Can be taken as Satisfactory/Unsatisfactory only.

PLSC 9380a, Leitner Political Economy Seminar Series Staff
This seminar series engages research on the interaction between economics and politics as well as research that employs the methods of political economists to study a wide range of social phenomena. The workshop serves as a forum for graduate students and faculty to present their own work and to discuss current research in the field as presented by outside speakers, faculty, and students. Detailed information can be found at http://leitner.yale.edu/seminars. Open only to graduate students in the Political Science department. Can be taken as Satisfactory/Unsatisfactory only.

PLSC 9400a, International Relations Workshop Soyoung Lee and Noam Reich
This workshop engages work in the fields of international security, international political economy, and international institutions. The forum attracts outside speakers, Yale faculty, and graduate students. It provides a venue to develop ideas, polish work in progress, or showcase completed projects. Typically, the speaker would prepare a 35- to

40-minute presentation, followed by a question-and-answer session. More information can be found at http://irworkshop.yale.edu. Open only to graduate students in the Political Science department. Can be taken as Satisfactory/Unsatisfactory only.

PLSC 9420a, Political Violence and Its Legacies Workshop Staff
The MacMillan Political Violence and Its Legacies (PVL) workshop is an interdisciplinary forum for work in progress by Yale faculty and graduate students, as well as scholars from other universities. PVL is designed to foster a wide-ranging conversation at Yale and beyond about political violence and its effects that transcends narrow disciplinary and methodological divisions. The workshop's interdisciplinary nature attracts faculty and graduate students from Anthropology, African American Studies, American Studies, History, Sociology, and Political Science, among others. There are no formal presentations. Papers are distributed one week prior to the workshop and are read in advance by attendees. A discussant introduces the manuscript and raises questions for the subsequent discussion period. To help facilitate a lively and productive discussion, we ban laptops and cellphones for the workshop's duration. If you are affiliated with Yale University and would like to join the mailing list, please send an e-mail to julia.bleckner@yale.edu with "PVL Subscribe" in the subject line.

PLSC 9900a or b, Directed Reading Staff
By arrangement with individual faculty.

Psychology

100 College Street, 14th Floor, 203.432.4500
http://psychology.yale.edu
M.S., M.Phil., Ph.D.

Chair
Jutta Joormann (203.432.4545, jutta.joormann@yale.edu)

Director of Graduate Studies
Melissa Ferguson (203.432.4518, melissa.ferguson@yale.edu)

Professors Woo-kyoung Ahn, John Bargh (*Emeritus*), Arielle Baskin-Sommers, Paul Bloom (*Emeritus*), Thomas Brown (*Emeritus*), Tyrone Cannon, Marvin Chun, Margaret Clark, John Dovidio (*Emeritus*), Yarrow Dunham, Melissa Ferguson, Dylan Gee, Edmund Gordon (*Emeritus*), Marcia Johnson (*Emerita*), Jutta Joormann, Alan Kazdin (*Emeritus*), Frank Keil, Joshua Knobe (*Philosophy*), Marianne LaFrance (*Emerita*), Gregory McCarthy, Jennifer Richeson, Peter Salovey, Laurie Santos, Brian Scholl, Nicholas Turk-Browne, Tom Tyler (*Law School*), Karen Wynn (*Emerita*)

Associate Professors Steve Chang, Julian Jara-Ettinger

Assistant Professors Maria Gendron, Randolph Helfrich, Julia Leonard, Samuel McDougle, Robert Rutledge, David Silverman (incoming July 2026), Lauren Whitehurst (incoming January 2026), Ilker Yildirim

Lecturers Richard Aslin (*Senior Lecturer*), Gabor Brody, Stephanie Lazzaro (*Senior Lecturer*), Kristi Lockhart (*Emerita*), Mary O'Brien (Senior Lecturer), Samuel Paskewitz, Faith Prelli

Affiliated Faculty Alan Anticevic (*Psychiatry*), Amy Arnsten (*Neuroscience*), Christopher Benjamin (*Neurology*), Philip Corlett (*Psychiatry*), Maggie Davis (*Psychiatry*), Ravi Dhar (*School of Management*), Irina Esterlis (*Psychiatry*), Tamar Gendler (*Philosophy*), Phillip Atiba Goff (*African American Studies*), Elizabeth Goldfarb (*Psychiatry*), Carlos Grilo (*Psychiatry*), Ilan Harpaz-Rotem (Psychiatry), Jeannette R. Ickovics (*Public Health*), Robert Kerns (*Veterans Administration Medical Center*), Hedy Kober (*Psychiatry*), Michael Kraus (*School of Management*), John Krystal (*Psychiatry*), Daeyeol Lee (*Neurobiology*), Becca Levy (*Public Health*), Ifat Levy (*Neuroscience*), David Lewkowicz (*Child Study Center*), Linda Mayes (*Child Study Center*), Carolyn Mazure (*Psychiatry*), James McPartland (*Child Study Center*), Nathan Novemsky (*School of Management*), Laurie Paul (*Philosophy*), Christopher Pittenger (*Psychiatry*), Al Powers (*Psychiatry*), Helena Rutherford (*Child Study Center*), Wendy Silverman (*Child Study Center*), Dana Small (*Psychiatry*), Jane Taylor (*Psychiatry*), Tom Tyler (*Law School*), Fred Volkmar (*Child Study Center*), Gideon Yaffe (*Law School*)

FIELDS OF STUDY

Fields include clinical psychology; cognitive psychology; developmental psychology; neuroscience; and social/personality psychology.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

In order to allow students to be trained in accordance with their own interests and career goals, the general requirements of the department are kept to a minimum. The formal requirements are:

1. Students must take PSYC 5000, PSYC 5010, PSYC 5180, and then any 5000-level course with adviser approval before the end of their second year. Students must attain an Honors grade in at least two term courses by the end of the second year of study. Students must also take a second 5000- or 6000-level course in statistics or methods with adviser approval (this can be taken at any point in the program).
2. Students are required to assist in teaching four courses by the end of their fourth year.
3. Completion of a first-year research project and two semesters of PSYC 9200 due by May 1 of the second term.
4. Completion of a pre-dissertation research project and two semesters of PSYC 9300 to be initiated not later than the second term and due by May 10 of the second year. Certification of this research project as well as performance in course work and other evidence of scholarly work at a level commensurate with doctoral study, as judged by the faculty, are necessary for continuation beyond the second year.
5. Submission of a dissertation prospectus, and a theme essay that demonstrates the candidate's comprehensive knowledge and understanding of the area of concentration. Certification of the theme essay completes the qualifying examination. The theme essay and the dissertation prospectus are completed during the third year. Students are then formally admitted to Ph.D. candidacy.
6. Approval of the dissertation by an advisory committee and the passing of an oral examination on the dissertation and its general scientific implications. There are no language requirements.

The faculty considers teaching to be an essential element of the professional preparation of graduate students in Psychology. For this reason, participation in the Teaching Fellow Program is a degree requirement for all doctoral students. They are expected to serve as teaching fellows (level 20) for four terms over the course of the second and third years in the program. Opportunities for teaching are matched as closely as possible with students' academic interests.

CLINICAL GRADUATE STUDENT INTERNSHIPS

Registered students undertaking their required clinical internships (usually in their sixth year) are typically not eligible for graduate school stipend funding, since these are paid internships. However, clinical internship stipends for sixth-year students that fall below the current year's Psychology stipend will be topped up to the current year's Psychology stipend. Students will be considered to have fulfilled the final requirement for the degree after successfully completing their internship (typically in July) and will be awarded degrees the following December. They will not be registered in the graduate school during the fall term in which their degrees are conferred.

COMBINED PH.D. PROGRAMS

Psychology offers a combined Ph.D. degree program with the Department of Black Studies. For the combined program with Black Studies, students must apply to the Department of Black Studies, with Psychology indicated as the secondary department.

Psychology also offers a combined Ph.D. degree program with Philosophy. Students interested in this combined degree can apply to the Philosophy department or the Psychology department. Students must be accepted into one of these departments (the "home department") through the standard admissions process, and both departments must then agree to accept the student into the combined program. If a student applies to the Philosophy department for the combined degree program, that student should also contact one or more Psychology faculty members with compatible interests so that a suitable adviser in Psychology can be identified prior to an admissions decision. Students enrolled in the combined program complete a series of courses in each discipline as well as an interdisciplinary dissertation that falls at the intersection of the two. On completing these requirements, students are awarded a Ph.D. either in Philosophy and Psychology, or in Psychology and Philosophy.

Questions about the combined degree programs may be directed to the directors of graduate studies in the participating departments prior to application.

MASTER'S DEGREES

M.Phil. The academic requirements for the M.Phil. degree are the same as for the Ph.D. degree except for the submission of a prospectus, and the completion and defense of a dissertation, which define the Ph.D.

M.S. (en route to the Ph.D.) The M.S. degree is awarded upon satisfactory completion of a first-year research project, a predissertation research project, and the four required courses completed by the end of the second year. A satisfactory grade must be achieved in the predissertation research project.

The Department of Psychology does not admit students for a terminal master's degree. If, however, a student admitted to the Ph.D. program leaves the program prior to completion of the doctoral degree, the student may be eligible to receive a master's degree upon completion of the academic requirements as stated above.

Program materials are available online at http://psychology.yale.edu.

COURSES

PSYC 5000a, Foundations of Psychology I: Cognitive Psychology and Neuroscience
Samuel McDougle
An introduction to graduate-level cognitive psychology and the biological bases of human behavior for first-year graduate students in psychology. Topics include decision making, learning, memory, perception, and attention. Topics also include neuroanatomy, neuronal signaling, and neuronal encoding. This course serves as the foundation for further study in more advanced graduate courses on specific topics. This course is required for all Psychology PhD students.

PSYC 5010b, Foundations of Psychology II: Social, Developmental, and Clinical Psychology Samuel McDougle
An introduction to graduate-level social, developmental, affective, and clinical psychology for first-year graduate students in psychology. Topics include theories of cognitive development, development of social cognition, and development of concepts and categories. Topics also include attitudes and persuasion, intergroup relations, stereotypes and prejudice, and cultural variation. Topics also include emotions, emotion regulation, models of psychopathology, and psychology and the law. This course serves as the foundation for further study in more advanced graduate courses on specific topics. This course is required for all Psychology Ph.D. students.

PSYC 5180a, Multivariate Statistics Julian Jara-Ettinger
Students learn both practical data analysis and the basic underlying theory. There is a slightly higher emphasis on probability theory than in many applied statistics courses, with the goal of making concepts such as confidence intervals and p-values easier to understand. However, care is taken to make this material accessible by providing numerous psychology-relevant examples and avoiding unnecessary mathematical details. To promote deeper understanding, commonly used statistical models and tests (t-tests, ANOVA, simple linear regression, multiple regression, ANCOVA) are explained as special cases of linear regression rather than separate procedures. Other topics include mixed effects models and generalized linear models (e.g. logistic regression) besides other material depending on time and student interest. Alongside statistical theory, students learn to use R, a computer programming language specialized for data analysis.

PSYC 5460a, Factor Analysis and Other Latent Variable Models Samuel Paskewitz
Introduces factor analysis, latent class analysis, and structural equation models. The focus is on applications rather than mathematical foundations. Prerequisites: a basic graduate level statistics course such as PSYC 518 and proficiency with R (the programming language/data analysis software).

PSYC 5540a / MGMT 7302a, Behavioral Decision-Making II: Judgment Staff
This seminar examines research on the psychology of judgment. We focus on identifying factors that influence various judgments and compare them to which factors individuals want and expect to drive their judgments. Topics of discussion include judgment heuristics and biases, confidence and calibration, issues of well-being including predictions and experiences, regret and counterfactuals. The goal is threefold: to foster a critical appreciation of existing research on individual judgment, to develop the students' skills in identifying and testing interesting research ideas, and to explore research opportunities for adding to existing knowledge. Students generally enroll from a variety of disciplines, including cognitive and social psychology, behavioral economics, finance, marketing, political science, medicine, and public health.

PSYC 5590a, Communicating Psychological Science Laurie Santos
Examination of best practices in the communication of psychology. The course explores strategies for communicating psychological findings to varying audiences (e.g., policy makers, popular media) and in varying formats (op-eds, long-form articles, podcasts, short videos) with the goal of gaining the skill and confidence necessary to give psychological science its broadest possible reach. Students choose specific psychological topics based to cover in their communication projects and explore current challenges within psychology communication (e.g., the ethics of psychology

communication, exploring the issue of replication in the field of psychological science). Readings include examples of different forms of psychology communication along with the published empirical papers associated with those readings. Seminar discussions include a workshop component where students provide feedback on other students' creative writing/communication projects. Graded assignments include both group-based creative projects (short videos and podcast clips) and individual written work, including weekly directed writing exercises.

PSYC 5610a, Algorithms of the Mind Ilker Yildirim
This course introduces computational theories of psychological processes with a pedagogical focus on perception and high-level cognition. Each week students learn about new computational methods grounded in neurocognitive phenomena. Lectures introduce these topics conceptually; lab sections provide hands-on instruction with programming assignments and review of mathematical concepts. Lectures cover a range of computational methods sampling across the fields of computational statistics, artificial intelligence, and machine learning, including probabilistic programming, neural networks, and differentiable programming. Prerequisites: Students must have a programming background, ideally in a high-level programming language such as Python, Julia, or Matlab. Students must also have college-level calculus. The course substantially uses Julia and Python. o Course cr

PSYC 6250b, Social Perception Brian Scholl
When exploring the structure of the mind, we typically think of visual perception as among the earliest and most basic of our cognitive processes, while we think of social cognition as among the most advanced forms of higher-level cognition. In this seminar we explore how these two aspects of the mind connect. Specific topics include the perception of animacy, agency, and goal-directedness; biological motion; face perception (including the perception of facial attractiveness); gaze processing and social attention; thin-slicing and perceptual stereotypes; and social and cultural influences on perception.

PSYC 6790b, Computational Basis of Seeing and Thinking Ilker Yildirim
The goal of this seminar is to discuss the computational basis of seeing and thinking in the mind and brain. We are especially concerned with the question of how perception gets us to cognition: How is it that perception transforms raw, unprocessed, unorganized, incoming sensory signals arising from our physical environments—for example, the light that bounces off surfaces and arrives at your retina, raw audio waves hitting your ears, or the vibro-tactile sensations you feel at your fingertips when you touch a surface—into things like objects and people, into things that we can think about? We somewhat prioritize the field of scene perception, where many fundamental questions about the nature of seeing and aspects of cognition arise prominently, and much of those questions remain open to this date. We draw upon readings and classroom discussions to find out where the literature stands, including behavioral, neural, and computational studies, all in the context of searching for a mechanistic, functional account of how the brain produces percepts and thoughts about objects, scenes, and people.

PSYC 6840a, Introduction to Psychotherapy: Technique Mary O'Brien
The focus of the seminar is on formulating and conceptualizing psychological problems from a cognitive-behavioral perspective. Special consideration is paid to individual and cultural diversity in conceptualizing cases and planning treatment. Also discussed are

ways in which cognitive-behavioral perspectives can be integrated with other theoretical orientations (e.g., interpersonal theory, experiential therapy).

PSYC 6890a, Psychopathology and Diagnostic Assessment Mary O'Brien
Didactic practicum for first-year clinical students. Main emphasis is initial assessment. Treatment planning and evaluation of progress also covered. Students first observe and then perform initial interviews. Applicable ethics and local laws reviewed.

PSYC 7020a, Current Work in Cognition Staff
A weekly seminar in which students, staff, and guests report on their research in cognition and information processing.

PSYC 7040a, Current Works in Human Neuroscience Kia Nobre
Examination of the current status of research and scientific knowledge bearing on issues of behavior, genetics, and neuroscience. Weekly speakers present research, which is examined methodologically; recent significant journal articles or technical books are also reviewed.

PSYC 7080a, Current Work in Developmental Psychology Julia Leonard
A luncheon meeting of the faculty and graduate students in developmental psychology for reports of current research and discussion on topics of general interest.

PSYC 7100a, Current Work in Social Psychology and Personality Wendy Berry Mendes
Faculty and students in personality/social psychology meet during lunchtime to hear about and discuss the work of a local or visiting speaker.

PSYC 7190a or b, History and Systems in Psychology Arielle Baskin-Sommers
Basic and applied current research on the history and systems in psychology is presented by faculty, visiting scientists, and graduate students and examined in terms of theory, methodology, and ethical and professional implications. Students cannot simultaneously enroll in PSYC 720. Open to clinical psychology graduate students only.

PSYC 7200a, Current Work in Clinical Psychology Tyrone Cannon
Basic and applied current research in clinical psychology that focuses on the cognitive, affective, social, biological, and developmental aspects of psychopathology and its treatment is presented by faculty, visiting scientists, and graduate students. This research is examined in terms of theory, methodology, and ethical and professional implications. Students cannot simultaneously enroll in PSYC 718 or 719.

PSYC 7240a, Research Topics in Cognition, Emotion, and Psychopathology Jutta Joormann
This weekly seminar focuses on the role of cognition and emotion in psychopathology. We discuss recent research on basic mechanisms that underlie risk for psychopathology such as cognitive biases, cognitive control, and biological aspects of psychological disorders. The seminar also focuses on the interaction of cognition and emotion, on the construct of emotion regulation, and on implications for psychopathology.

PSYC 7270a, Research Topics in Clinical Neuroscience Tyrone Cannon
Current research into the biological bases of schizophrenia and bipolar disorder, including topics related to etiology, treatment, and prevention.

PSYC 7280a / AFAM 7978a, Research Topics in Racial Justice in Public Safety Phillip Atiba Solomon
In this seminar, graduate students and postdoctoral fellows have a chance to present their research, and undergraduate research assistants learn about how to conduct interdisciplinary quantitative social science research on racial justice in public safety. The course consists of weekly presentations by members and occasional discussions of readings that are handed out in advance. The course is designed to be entirely *synchronous*. Presenters may request a video recording if they can benefit from seeing themselves present (e.g., for a practice talk). This course is intended for graduate students, postdocs, and undergraduates interested in conducting original quantitative social science research about race and public safety. Permission of the instructor is required.

PSYC 7310a, Research Topics in Cognition and Development Frank Keil
A weekly seminar discussing research topics concerning cognition and development. Primary focus on high-level cognition, including such issues as the nature of intuitive or folk theories, conceptual change, relations between word meaning and conceptual structure, understandings of divisions of cognitive labor, and reasoning about causal patterns.

PSYC 7320a, Research Topics in Cognitive and Computational Human Neuroscience Marvin Chun
Examines recent research in human cognitive neuroscience. Topics include attention, visual perception, working memory, long-term memory, and cognitive control.

PSYC 7330a, Research Topics in Social Cognitive Development Yarrow Dunham
Investigation of various topics in developmental social cognition. Particular focus on the development of representations of self and other, social groups, and attitudes and stereotypes.

PSYC 7350a, Research Topics in Thinking and Reasoning Woo-Kyoung Ahn
In this lab students explore how people learn and represent concepts. Weekly discussions include proposed and ongoing research projects. Some topics include computational models of concept acquisition, levels of concepts, natural kinds and artifacts, and applications of some of the issues.

PSYC 7390a, Research Topics in Autism and Related Disorders Fred Volkmar
Focus on research approaches in the study of autism and related conditions including both psychological and neurobiological processes. The seminar emphasizes the importance of understanding mechanisms in the developmental psychopathology of autism and related conditions.

PSYC 7410a, Research Topics in Emotion and Relationships Margaret Clark
Members of this laboratory read, discuss, and critique current theoretical and empirical articles on relationships and on emotion (especially those relevant to the functions emotions serve within relationships). In addition, ongoing research on these topics is discussed along with designs for future research.

PSYC 7420a, Research Topics in Computation and Cognition Julian Jara-Ettinger
Seminar-style discussion of recently published and unpublished researched in cognitive development and computational models of cognition.

PSYC 7440a, Research Topics in Philosophical Psychology Joshua Knobe
The lab group focuses on topics in the philosophical aspects of psychology.

PSYC 7450a, Research Topics in Disinhibitory Psychopathology Arielle Baskin-Sommers
This laboratory course focuses on the study of cognitive and affective mechanisms contributing to disinhibition. We discuss various forms of disinhibition from trait (e.g., impulsivity, low constraint, externalizing) to disorder (e.g., antisocial personality disorder, psychopathy, substance use disorders), diverse methods (e.g., psychophysiology, self-report, neuroimaging, interventions), and multiple levels of analyses (e.g., neural, environmental, social). Members of this laboratory read and critique current articles, discuss ongoing research, and plan future studies.

PSYC 7520a, Research Topics in Social Neuroscience Steve Chang
This weekly seminar discusses recent advances in neuroscience of social behavior. We discuss recent progress in research projects by the lab members as well as go over recently published papers in depth. Primary topics include neural basis of social decision-making, social preference formation, and social information processing. Our lab studies these topics by combining neurophysiological and neuropharmacological techniques in nonhuman animals.

PSYC 7530a, Research Topics in Legal Psychology Tom Tyler
This seminar is built around student research projects. Students propose, conduct, and analyze empirical research relevant to law and psychology. Grades are based upon final papers. Permission of the instructor required.

PSYC 7540a, Research Topics in Clinical Affective Neuroscience and Development Dylan Gee
This weekly seminar focuses on current research related to the developmental neurobiology of child and adolescent psychopathology. Topics include typical and atypical neurodevelopmental trajectories, the development of fear learning and emotion regulation, effects of early life stress and trauma, environmental and genetic influences associated with risk and resilience, and interventions for anxiety and stress-related disorders in youth.

PSYC 7550a, Research Topics in Intergroup Relations Jennifer Richeson
This laboratory course is intended to support the training and development of PhD students who are currently conducting experimental, social-psychological research in the broad topic of intergroup relations. Classic theoretical work in social psychology and some sociology will be examined, but the primary focus of the course will be on methodological techniques relevant to the experimental study of attitudes, cognition, and behavior regarding members of different socio-cultural groups. Enrollment is limited and permission of the instructor is required.

PSYC 7580a, Research Topics in Cognitive Neuroscience Nick Turk-Browne
Seminar-style discussion of recent research in cognitive neuroscience, covering both recent studies from the literature and ongoing research at Yale.

PSYC 7590a, Research Topics in Affective Science and Culture Maria Gendron
A seminar-style discussion of recent research and theory in affective science and culture. The lab group focuses on the social and cultural shaping of emotions. We also discuss the biological constraints on variation and consistency in emotion as revealed by

physiological research on emotion (in both the central and peripheral nervous system). Some discussion of current and planned research in the lab group also takes place.

PSYC 7600a, Research Topics in Cognitive and Neural Computation Ilker Yildirim
Lab meetings of the Cognitive & Neural Computation Laboratory at Yale.

PSYC 7610a, Research Topics in Computational Decision and Affective Neuroscience Robb Rutledge
Seminar focusing on ongoing research projects in computational approaches to clinical, cognitive, and affective neuroscience.

PSYC 7620a, Research Topics in Skill Learning Samuel McDougle
This weekly seminar covers various themes in human learning, with an emphasis on motor learning, motor memory, reinforcement learning, and decision-making. We discuss recently published and ongoing research on these topics, with special attention to behavioral studies, computational models of learning, and neural correlates.

PSYC 7630a, Research Topics in Implicit Social Cognition Melissa Ferguson
Weekly seminar on contemporary research projects in implicit social cognition, with a special focus on the topics of changing minds, prejudice, and self-control. Permission of the instructor required.

PSYC 7640a, Research Topics in Children's Learning and Motivation Julia Leonard
This weekly seminar covers cutting-edge research in cognitive science, developmental psychology, and neuroscience on young children's learning and motivation. We discuss how theoretically and empirically grounded science can be applied to the real world. Permission of the instructor required.

PSYC 7650a, Research Topics in Philosophy and Cognitive Science Laurie Paul
A weekly meeting to discuss relevant philosophical and psychological topics. Permission of the instructor required.

PSYC 7660a, Research Topics in Perception and Cognition Brian Scholl
Seminar-style discussion of recent research in perception and cognition, covering both recent studies from the literature and the ongoing research in the Yale Perception and Cognition Laboratory.

PSYC 7750a, Research Topics in Animal Cognition Laurie Santos
Investigation of various topics in animal cognition, including what nonhuman primates know about tools and foods; how nonhuman primates represent objects and number; whether nonhuman primates possess a theory of mind. Prerequisite: permission of the instructor.

PSYC 7830a, Reserach Topics in Logical Cognition and the Infant Mind Nicolò Cesana-Arlotti
This weekly seminar discusses research topics concerning logical cognition and the infant mind. The seminar focus on the emergence of logical computations in different domains of human cognition and the origins of logical and abstract thought in the mind of infants and non-human cognition.

PSYC 7840a, Research Topics in Proactive Cognition Kia Nobre
This weekly seminar discusses research topics concerning the psychological and brain mechanisms for controlling the flexible and proactive control of adaptive human behavior. None

PSYC 7850a, Research Topics in Emotion, Health, and Psychophysiology Wendy Berry Mendes
This weekly seminar discusses research topics at the intersection of social psychology, affective science, biological psychology, and health. The seminar examines how the mind and body interact, emphasizing research in stress and health, emotions and psychophysiology, racial health disparities, and physiologic synchrony in dyads and groups.

PSYC 8010a, Clinical Internship (Child) Mary O'Brien
Advanced training in clinical psychology with children. Adapted to meet individual needs with location at a suitable APA-approved internship setting.

PSYC 8020a, Clinical Internship (Adult) Mary O'Brien
Advanced training in clinical psychology with adults. Adapted to meet individual needs with location at a suitable APA-approved internship setting.

PSYC 8110a, Mood and Anxiety Disorders Practicum Mary O'Brien
This is a course for graduate students in clinical psychology. Group supervision of therapy provided at the Yale Psychology Department Clinic.

PSYC 8170a, Other Clinical Practica Mary O'Brien
For credit under this course number, clinical students register for practicum experiences other than those listed elsewhere in clinical psychology, so that transcripts reflect accurately the various practicum experiences completed.

PSYC 9200a, First-Year Research Staff
By arrangement with faculty.

PSYC 9230a, Individual Study: Theme Essay Staff
By arrangement with faculty.

PSYC 9300a, Predissertation Research Staff
By arrangement with faculty.

Public Health

60 College Street, 203.785.6383
http://publichealth.yale.edu
M.S., M.Phil., Ph.D.

Dean
Megan Ranney

Director of Graduate Studies
Andrew DeWan (203.785.6383)

Professors Serap Aksoy, Heather Allore (*Internal Medicine*), Frederick Altice (*Internal Medicine*), Paul Anastas, Michelle Bell (*School of the Environment*), Cynthia Brandt (*Emergency Medicine*), Richard Bucala (*Internal Medicine*), Susan Busch, Michael Cappello, Kei-Hoi Cheung (*Emergency Medicine*), Elizabeth Claus, Theodore Cohen, Louise Dembry (*Internal Medicine*), Mayur Desai, Vincent DeVita (*Internal Medicine*), Michaela Dinan, James Dziura (*Emergency Medicine*), Denise Esserman, David Fiellin (*Internal Medicine*), Erol Fikrig (*Internal Medicine*), Howard Forman (*Radiology and Biomedical Imaging*), Alison Galvani, Alan Gerber (*Political Science*), Thomas Gill (*Internal Medicine*), Peter Glazer (*Therapeutic Radiology*), Cary Gross (*Internal Medicine*), Robert Heimer, Jason Hockenberry, Jeannette Ickovics, Melinda Irwin, Akiko Iwasaki (*Immunobiology*), Amy Justice (*Internal Medicine*), Edward Kaplan (*School of Management*), Danya Keene, Trace Kershaw, Jaehong Kim (*Chemical and Environmental Engineering*), Marissa King (*School of Management*), Albert Ko, Suchitra Krishnan-Sarin (*Psychiatry*), Harlan Krumholz (*Internal Medicine*), Ann Kurth (*Nursing*), Becca Levy, Judith Lichtman, Shuangge (Steven) Ma, Xiaomei Ma, I. George Miller (*Pediatrics*), Joan Monin, Ruth Montgomery (*Rheumatology*), Bhramar Mukherjee, Chima Ndumele, Linda Niccolai, Marcella Nunez-Smith (*Internal Medicine*), John Pachankis, Elijah Paintsil (*Pediatrics*), A. David Paltiel, Catherine Panter-Brick (*Anthropology*), Sunil Parikh, Rafael Pérez-Escamilla, Robert Pietrzak (*Psychiatry*), Edieal Pinker (*School of Management*), Virginia Pitzer, Jeffrey Powell (*Ecology and Evolutionary Biology*), Megan Ranney, Carrie Redlich (*Occupational Medicine*), Robert Rosenheck (*Psychiatry*), Joseph Ross (*Internal Medicine*), Mark Russi (*Internal Medicine*), Peter Salovey (*Psychology*), Mark Schlesinger, Fiona Scott-Morton (*School of Management*), Eugene Shapiro (*Pediatrics*), Andre Sofair (*Internal Medicine*), Donna Spiegelman, Jacob Tebes (*Psychiatry*), Jeanette Tetrault (*General Medicine*), Jeffrey Townsend, Christian Tschudi, Prathibha Varkey (*General Medicine*), Vasilis Vasiliou, Joseph Vinetz (*Internal Medicine*), David Vlahov (*Nursing*), Emily Wang (*General Medicine*), Zuoheng (Anita) Wang, Joshua Warren, Daniel Weinberger, Marney White, David Yanez (*Anesthesiology*), Kimberly Yonkers (*Psychiatry*), Heping Zhang, Hongyu Zhao, Julie Zimmerman (*Chemical and Environmental Engineering*)

Associate Professors Rene Almeling (*Sociology*), Hamad Altalib (*Neurology*), Peter Aronow (*Political Science*), Amy Bei, Deepa Camenga (*Emergency Medicine*), Kai Chen, Xi Chen, Zack Cooper, J. Lucian Davis, Andrew Dewan, Nicole Deziel, Kathleen Duffany, Jennifer Edelman (*General Medicine*), Laura Forastiere, Abigail Friedman, Gregg Gonsalves, Nathan Grubaugh, Leying Guan, Ashley Hagaman, Nicola Hawley, Josephine Hoh, Caroline Johnson, Manisha Juthanki-Mehta (*Infectious Diseases*),

Kaveh Khoshnood, Zeyan Liew, Sarah Lowe, Edward Melnick (*Emergency Medicine*), Jamie Meyer (*Infectious Diseases*), Ijeoma Opara, Robert Pietrzak (*Psychiatry*), Krystal Pollitt, Yusof Ransome, Eric Schneider (*Surgery*), Jason Schwartz, Veronika Shabanova (*Pediatrics*), Jodi Sherman (*Anesthesiology*), Erica Spatz (*Internal Medicine*), Katie Wang, Jacob Wallace, Melissa Weimer (*General Medicine*), Inci Yildirim (*Infectious Diseases*), Yize Zhao

Assistant Professors Colin Carlson, Drew Cameron, Daniel Carrión, Chelsey Carter, Jen-hwa Chu (*Internal Medicine*), Rachel Dreyer (*Emergency Medicine*), Leah Ferrucci, Julie Gaither (*Pediatrics*), Kevin Hall (*Cardiology*), George Hauser (*Laboratory Medicine*), Kathryn Hawk (*Emergency Medicine*), Evelyn Hsieh (*Internal Medicine*), Yuan Huang, Samah Fodeh-Jarad (*Emergency Medicine*), Skyler Jackson, Olivia Kachingwe, Lee Kennedy-Shaffer, Tassos Kyriakides, Michael Leapman (*Urology*), Morgan Levine (*Pathology*), Fan (Frank) Li, Qiao Liu, Terika McCall, Robert McDougal, Ryan McNeil (*General Medicine*), Carol Oladele (*Internal Medicine*), Carlos Oliveira (*Pediatrics*),Harsh Parikh, Kendra Plourde, Brita Roy (*General Medicine*), Wade Schultz (*Laboratory Medicine*), Sheela Shenoi (*Internal Medicine*), Chantal Vogels, Brian Wahl, Karen Wang (*General Medicine*), Shannon Whirledge (*Obstetrics, Gynecology, and Reproductive Sciences*), Xiting Yan (*Internal Medicine*), Emma Zang (*Sociology*), Xin Zhou

FIELDS OF STUDY

Programs of study are offered in the areas of biostatistics, chronic disease epidemiology, environmental health sciences, epidemiology of infectious diseases, epidemiology of microbial diseases, health informatics, health policy and management, and social and behavioral sciences.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Generally the first two years of the Ph.D. program are devoted primarily to coursework and rotations for students in some areas. All doctoral students are required to successfully complete a minimum of ten graduate-level courses and must satisfy the individual departmental requirements, detailed below. Courses such as Dissertation Research, Preparing for Qualifying Exams, Research Ethics and Responsibility, and Seminar do not count toward the course requirements. However, students must register for these courses in order for them to appear on the transcript.

All first-year Ph.D. students must enroll in and complete training in Research Ethics and Responsibility (PUBH 600). This course introduces and prepares students for responsible conduct in research, including data acquisition and management, mentor/trainee responsibilities, publication practices and authorship standards, scientific misconduct, and conflict of interest. Research Ethics and Responsibility is offered annually and is graded Satisfactory/Unsatisfactory. Additionally, all first-year students must participate in a Public Health Primer online course the summer before their first term.

The graduate school uses grades of Honors, High Pass, Pass, or Fail. Students are required to earn a grade of Honors in at least two full-term courses and must achieve a High Pass average. (This applies to courses taken after matriculation in the graduate school and during the nine-month academic year.)

Teaching and research experiences are regarded as an integral aspect of the graduate training program. All students are required to serve as teaching fellows for two terms at the TF level 10 or 20, typically during years two and three. However, depending on the level of support available to individual research groups, some students may teach for additional terms. In no instance will a student teach for more than five terms during their first five years of study. Further, depending on how the students' Ph.D. position is being funded, they may be required to work up to nineteen hours per week as a research assistant (which may or may not be directly related to their dissertation research). However, in no single term will the student be required to act as a research assistant (on matters unrelated to their dissertation) and/or teach more than a combined total of nineteen hours per week. In these situations teaching responsibilities will be limited to ten hours per week. During the first term of teaching, students must attend a training session conducted by the Poorvu Center for Teaching and Learning. First-year students are encouraged to focus their efforts on coursework and are not permitted to serve as teaching fellows.

At the end of years one and two, advisers will be asked to complete a progress report for each student evaluating the student's academic progress and describing the student's readiness for teaching and/or conducting research. This is then discussed with the student and reviewed by the DGS. Students who have not progressed adequately will be asked to meet with the director of graduate studies (DGS) to address the situation.

The qualifying exam is typically taken by the end of the second full academic year. With the assistance of the faculty adviser, generally after qualifying exams, each student requests appropriate faculty members to join a dissertation advisory committee (DAC). The DAC reviews and approves the prospectus as developed by the student and submits it to the DGS and the Graduate Studies Executive Committee (GSEC) for approval. The dissertation prospectus must be approved by the end of the third year.

To be admitted to candidacy, students must: (1) satisfactorily complete the course requirements for their department as outlined below, achieve grades of Honors in at least two full-term courses, and achieve an overall High Pass average; (2) obtain an average grade of High Pass on the qualifying exam; and (3) have the dissertation prospectus approved by the GSEC. Students who have been admitted to candidacy are required by the graduate school to complete an annual Dissertation Progress Report.

Each DAC is required to meet as a group at least twice each year, and more frequently if necessary. The student schedules meetings of the DAC. The chair/adviser of the DAC produces a summary evaluation of progress and plans for the next six months. The student and the DGS receive a copy of the final document. The DAC reviews the progress of the dissertation research and decides when the dissertation is ready to be submitted to the readers. This decision is based on a closed defense of the dissertation, which involves a formal oral presentation by the student to the DAC. (At the adviser's discretion, other invited faculty may be present.) Upon completion of the closed defense, the chair/adviser of the DAC submits the recommendation to the DGS along with the names of three appropriate readers.

Doctoral dissertations originating in Public Health must also be presented in a public seminar. This presentation is scheduled after the submission of the dissertation to the readers and preferably prior to the receipt and consideration of the readers' reports. At

least one member of the DAC supervising the dissertation and at least one member of the GSEC are required to attend the presentation.

Required Coursework

BIOSTATISTICS

Ph.D. students in biostatistics (BIS) have the choice of two pathways: the *Biostatistics Standard Pathway* and the *Biostatistics Implementation and Prevention Science Methods Pathway.* Students in the Biostatistics Standard Pathway are required to take a minimum of sixteen courses and students in the Implementation and Prevention Science Methods Pathway are required to take a minimum of fifteen courses (not including BIS 525, BIS 526, BIS 699, and PUBH 600). Course substitutions must be identified and approved by the student's adviser and the DGS. Students funded by specific fellowships may be subject to additional requirements and should discuss this with their adviser. Additionally, all first-year students must participate in an online Public Health Primer course the summer before their first term.

Core Requirements for Both Pathways

BIS 525	Seminar in Biostatistics and Journal Club [1]	0
BIS 526	Seminar in Biostatistics and Journal Club [1]	0
BIS 610	Applied Area Readings for Qualifying Exams	1
BIS 623	Advanced Regression Models	1
or S&DS 6120	Linear Models	
BIS 628	Longitudinal and Multilevel Data Analysis	1
BIS 643	Theory of Survival Analysis	1
BIS 691	Theory of Generalized Linear Models	1
BIS 699	Summer Internship in Biostatistical Research [1]	0
PUBH 508	Foundations of Epidemiology and Public Health	1
PUBH 600	Research Ethics and Responsibility	0
S&DS 6100	Statistical Inference [2]	1

[1] These courses do not count toward the total number of courses required (fourteen for Implementation and Prevention Science Methods Pathway students and fifteen for Standard Pathway students).

[2] This course is offered through the Graduate School of Arts and Sciences.

Students in the *Standard Pathway* (in consultation with their academic adviser and approved by the DGS) also choose a minimum of eight additional electives that will best prepare them for their dissertation research.

Implementation and Prevention Science Methods Pathway: Additional Required Courses

BIS 537	Statistical Methods for Causal Inference	1
BIS 629	Advanced Methods for Implementation and Prevention Science	1

BIS 631	Advanced Topics in Causal Inference Methods	1
EMD 533	Implementation Science	1

Implementation and Prevention Science Methods Pathway: Suggested Electives (minimum of three)

BIS 536	Measurement Error and Missing Data	1
BIS 567	Bayesian Statistics	1
BIS 646	Nonparametric Statistical Methods and Their Applications	1
CDE 516	Principles of Epidemiology II	1
CDE 534	Applied Analytic Methods in Epidemiology	1
EMD 538	Quantitative Methods for Infectious Disease Epidemiology	1
HPM 570	Cost-Effectiveness Analysis and Decision-Making [1]	1
HPM 575	Evaluation of Global Health Policies and Programs	1
HPM 586	Microeconomics for Health Policy and Health Management	1
HPM 587	Advanced Health Economics	1
MGT 611	Policy Modeling [1]	4
SBS 541	Community Health Program Evaluation	1
SBS 574	Developing a Health Promotion and Disease Prevention Intervention	1
SBS 580	Qualitative Research Methods in Public Health [1]	1
S&DS 5410 or S&DS 6000	Probability Theory [2] Advanced Probability	1
S&DS 5650 or S&DS 6650	Introductory Machine Learning [2] Intermediate Machine Learning	1

[1] These courses are strongly recommended.

[2] These courses are offered through the Graduate School of Arts and Sciences.

CHRONIC DISEASE EPIDEMIOLOGY

Ph.D. students in chronic disease epidemiology (CDE) must complete a minimum of seventeen courses (not including PUBH 600) from the following courses or their equivalents. Course substitutions must be identified and approved by the student's adviser and the DGS. Additionally, all first-year students must participate in an online Public Health Primer course the summer before their first term.

BIS 505	Biostatistics in Public Health II	1
CDE 516	Principles of Epidemiology II	1
CDE 534	Applied Analytic Methods in Epidemiology	1
CDE 610	Applied Area Readings for Qualifying Exams	1
CDE 566	Causal Inference Methods in Public Health Research	1
CDE 617	Developing a Research Proposal [1]	1
CDE 650	Introduction to Evidence-Based Medicine and Health Care	1
EHS/CDE 502	Physiology for Public Health	1

PUBH 508	Foundations of Epidemiology and Public Health	1
PUBH 600	Research Ethics and Responsibility [2]	0

[1] CDE 617 is not required of students funded by the Yale AIDS Prevention Training Program. Those students must take an additional elective in order to meet the seventeen-course requirement.

[2] This course does not count toward the minimum of seventeen courses.

Students must also take three graduate-level course units in biostatistics. Students must consult with their academic adviser and obtain approval of alternate courses.

Students will also choose five additional electives that will best prepare them for their dissertation research.

ENVIRONMENTAL HEALTH SCIENCES

Ph.D. students in environmental health sciences (EHS) must take a minimum of twelve courses (not including EHS 525, EHS 526, and PUBH 600). However, more courses may be required by a student's adviser. Course substitutions must be identified and approved by the student's adviser and the DGS. Additionally, all first-year students must participate in an online Public Health Primer course the summer before their first term.

Required Courses

CDE 617	Developing a Research Proposal	1
EHS 503	Public Health Toxicology	1
EHS 508	Environmental and Occupational Exposure Science	1
EHS 525	Seminar and Journal Club in Environmental Health [1]	0
EHS 526	Seminar and Journal Club in Environmental Health [1]	0
EHS 560	Methods in Climate Epidemiology	1
or EHS 566	Causal Inference Methods in Public Health Research	
EHS 619	Research Rotation	1
EHS 620	Research Rotation	1
PUBH 505	Biostatistics in Public Health	1
PUBH 508	Foundations of Epidemiology and Public Health	1
PUBH 600	Research Ethics and Responsibility [1]	0

[1] These courses do not count toward the minimum of twelve courses.

Suggested Electives

A minimum of four is required.

BIS 505	Biostatistics in Public Health II	1
BIS 623	Advanced Regression Models	1
BIS 628	Longitudinal and Multilevel Data Analysis	1
CDE 516	Principles of Epidemiology II	1
CDE/EHS 520	Case-Based Learning for Genetic x Environmental Diseases in the Modern Genomic Era	1

CDE 534	Applied Analytic Methods in Epidemiology	1
EHS/CDE 502	Physiology for Public Health	1
EHS 511	Principles of Risk Assessment	1
EHS 530	Our Air, Our Health	1
EHS/EMD 537	Water, Sanitation, and Global Health	1
EHS 547	Climate Change and Public Health	1
EHS 560	Methods in Climate Epidemiology [1]	1
EHS/CDE 563	Biomarkers of Exposure, Effect, and Susceptibility in the Epidemiology of Noncommunicable Disease	1
EHS/CDE 566	Causal Inference Methods in Public Health Research [1]	1
EHS 567	Fundamentals of Green Chemistry and Green Engineering	1
EHS 568	Introduction to GIS for Public Health	1
EHS 581	Public Health Emergencies: Disaster Planning and Response	1
ENV 755	Modeling Geographic Space [2]	3
ENV 756	Modeling Geographic Objects [2]	3

[1] Cannot be counted as an elective if taken as a requirement.

[2] These courses are offered in the School of the Environment.

EPIDEMIOLOGY OF MICROBIAL DISEASES

Ph.D. students in epidemiology of microbial diseases (EMD) must complete a minimum of ten courses (not including PUBH 600). Course substitutions must be identified and approved by the student's adviser and the DGS. Additionally, all first-year students must participate in an online Public Health Primer course the summer before their first term.

Courses in biostatistics, epidemiology, and microbiology are strongly recommended. The specific courses recommended depend on the background of individual students and their stated research interests. An individual program that includes courses, seminars, and research rotations is developed by the student and the student's academic adviser. All students are required to complete three distinct research rotations. These are done in the fall and spring terms and in the summer between the first and second years. These research rotations (EMD 670, EMD 671, and EMD 672) are graded and account for three of the required ten courses.

Required Courses

CDE 617	Developing a Research Proposal	1
EMD 670	Advanced Research Laboratories	1
EMD 671	Advanced Research Laboratories	1
EMD 672	Advanced Research Laboratories	1
PUBH 508	Foundations of Epidemiology and Public Health	1
or CDE 516	Principles of Epidemiology II	
PUBH 600	Research Ethics and Responsibility [1]	0

[1] This course does not count toward the minimum of ten courses.

The following courses are suggested as appropriate for Ph.D. students in EMD to choose. Students must choose five of these suggested courses. However, in consultation with the student's adviser, other courses in the School of Public Health or in other departments may also be appropriate.

BIS 537	Statistical Methods for Causal Inference	1
BIS 567	Bayesian Statistics	1
CDE/EHS 566	Causal Inference Methods in Public Health Research	1
EHS 568	Introduction to GIS for Public Health	1
EMD 531	Genomic Epidemiology of Infectious Diseases	1
EMD 533	Implementation Science	1
EMD 538	Quantitative Methods for Infectious Disease Epidemiology	1
EMD 539	Introduction to the Analysis and Interpretation of Public Health Surveillance Data	1
EMD 546	Vaccines and Vaccine-Preventable Diseases	1
EMD 550	Epidemiology and Control of Vector Borne Diseases	1
EMD 553	Transmission Dynamic Models for Understanding Infectious Diseases	1
EMD 567	Tackling the Big Three: Malaria, TB, and HIV in Resource-Limited Settings	1
EMD 582	Political Epidemiology	1
HPM 570	Cost-Effectiveness Analysis and Decision-Making	1
S&DS 5300	Data Exploration and Analysis [1]	1
S&DS 5380	Probability and Statistics [1]	1
S&DS 5630	Multivariate Statistical Methods for the Social Sciences [1]	1

[1] These courses are offered in through the Graduate School of Arts and Sciences.

HEALTH POLICY AND MANAGEMENT

Ph.D. students in health policy and management (HPM) are required to develop expertise in one of three areas of specialization: *Economics*; *Organizational Theory and Management*; or *Political and Policy Analysis*.

Students are required to complete the following coursework (or the equivalent in the topic areas covered in these courses). This course listing represents a suggested general program of study, but the specifics of course requirements are adapted to the particular interests and professional aspirations of each student. The standard number of courses taken is twelve (excluding PUBH 600, HPM 617, and HPM 618), with the option of obtaining credits for previous courses. With the approval of the academic adviser and the DGS, alternative courses that better suit the needs of the student may satisfy the coursework requirement. The departmental representative to the GSEC, in conjunction with the student's adviser, is responsible for determining if core course requirements have been satisfied by previous coursework or alternative courses. If so, the student should apply for a course waiver through the graduate school. HPM students can only waive up to three of the twelve courses. Additionally, all first-year students must participate in an online Public Health Primer course the summer before their first term.

Core Requirements (All Students)

HPM 610	Applied Area Readings	1
HPM 617	Colloquium in Health Services Research [1]	0
HPM 618	Colloquium in Health Services Research [1]	0
PUBH 508	Foundations of Epidemiology and Public Health	1
PUBH 600	Research Ethics and Responsibility [1]	0

[1] These courses do not count toward the required twelve courses.

Methods and Statistics: Suggested Courses

A minimum of four is required.

BIS 623	Advanced Regression Models	1
BIS 628	Longitudinal and Multilevel Data Analysis	1
ECON 5556	Topics in Empirical Economics and Public Policy [1]	1
ECON 5558	Econometrics [1]	1
MGMT 7202	Applied Empirical Methods [1]	1
PLSC 5000	Foundations of Statistical Inference [1]	1
PLSC 5030	Causal Inference [1]	1
PLSC 5120	The Design and Analysis of Randomized Field Experiments in Political Science	1
PLSC 5270	From Concept to Measure: Empirical Inquiry in Social Science [1]	1
S&DS 5630	Multivariate Statistical Methods for the Social Sciences [1]	1
S&DS 5650	Introductory Machine Learning [1]	1
SOCY 5610	Introduction to Methods in Quantitative Sociology [1]	1
SOCY 5620	Intermediate Methods in Quantitative Sociology [1]	1
SOCY 5670	AI in Social Science Methods [1]	1
SOCY 5900	Mixed Methods Research [1]	1

[1] These courses are offered through the Graduate School of Arts and Sciences.

Health Policy and Management: Suggested Courses

The following course, with Ph.D. readings, is required.

HPM 514	Health Politics, Governance, and Policy	1

Area of Specialization Course Requirements

A minimum of four courses, all with Ph.D. readings, is required in the student's area of specialization.

Economics: Required Courses

ECON 5545	Microeconomics [1]	1
ECON 5558	Econometrics [1, 2]	1

[1] These courses are offered through the Graduate School of Arts and Sciences.

[2] ECON 5558 may count as a methods/statistics course or as a specialization course, but not both.

Students are also required to take a year-long sequence in econometrics, selected in consultation with the student's adviser (this will count towards the required Methods and Statistics courses). In addition, students take *two* field courses in a concentration area in which they plan to develop expertise. Sets of courses across topics can be selected to meet research interests.

Economics: Concentration Areas and Courses

Other courses may be substituted in consultation with the student's adviser.

Behavioral Economics		
MGMT 7304	Foundations of Behavioral Economics [1]	1
PSYC 5530	Behavioral Decision-Making I: Choice [1]	1
Industrial Organization		
ECON 6600	Industrial Organization I [1]	1
ECON 6601	Industrial Organization II [1]	1
Labor Economics		
ECON 6630	Labor Economics [1]	1
ECON 6631	Labor Economics [1]	1
Public Finance		
ECON 5556	Topics in Empirical Economics and Public Policy [1]	1
ECON 6680	Public Finance I [1]	1
ECON 6681	Public Finance II [1]	1

[1] These courses are offered through the Graduate School of Arts and Sciences.

Organizational Theory and Management

Four courses are required, selected in consultation with the student's adviser.

Political and Policy Analysis: Suggested Courses

Four courses are required, selected in consultation with the student's adviser. Suggested courses are listed below. In consultation with the student's adviser other courses can be taken.

PLSC 8000	Introduction to American Politics [1]	1
PLSC 8010	Political Preferences and American Political Behavior [1]	1
PLSC 8030	American Politics III: Institutions [1]	1
PLSC 8100	Political Preferences and American Political Behavior [1]	1
PLSC 8240	American Political Thought [1]	1
PLSC 8410	Democracy and Bureaucracy [1]	1
PLSC 8650	Policy Making under Separation of Powers [1]	1
PLSC 8690	Current Topics in American Politics [1]	1

Students will also choose one additional elective that will best prepare them for their dissertation research.

[1] These courses are offered through the Graduate School of Arts and Sciences.

SOCIAL AND BEHAVIORAL SCIENCES

Ph.D. students in social and behavioral sciences (SBS) or the Maternal Child Health Promotion Pathway must complete a minimum of fifteen courses (not including PUBH 600) from the following courses or their equivalents. Course substitutions must be identified and approved by the student's adviser and the DGS. Additionally, all first-year students must participate in an online Public Health Primer course the summer before their first term.

Core Requirements (All Students)

CDE 617	Developing a Research Proposal [1]	1
PUBH 508	Foundations of Epidemiology and Public Health	1
PUBH 600	Research Ethics and Responsibility [2]	0
SBS 574	Developing a Health Promotion and Disease Prevention Intervention	1
or SBS 541	Community Health Program Evaluation	
or SBS 593	Community-Based Participatory Research in Public Health	
SBS 580	Qualitative Research Methods in Public Health	1
SBS 610	Applied Area Readings for Qualifying Exams	1
SBS 699	Advanced Topics in Social and Behavioral Sciences	1

[1] CDE 617 is not required of students funded by the Yale AIDS Prevention Training Program. Those students must take an additional elective in order to meet the fifteen-course requirement.

[2] This course does not count toward the minimum of fifteen courses.

In consultation with their dissertation adviser, SBS students (not in the Maternal and Child Health Promotion Pathway) will choose three advanced-level statistics or methods courses from Biostatistics, Psychology, Political Science, Sociology, Anthropology, or Statistics and Data Science. Two of these courses must be from the following list:

BIS 621	Regression Models for Public Health	1
or BIS 623	Advanced Regression Models	
CDE 566	Causal Inference Methods in Public Health Research	1
or BIS 537	Statistical Methods for Causal Inference	
EMD 582	Political Epidemiology	1
or BIS 628	Longitudinal and Multilevel Data Analysis	
or S&DS 5630	Multivariate Statistical Methods for the Social Sciences	

One additional statistics or methods course can be chosen in consultation with the dissertation adviser based on the student's research plans.

Students must also take six additional electives that will best prepare them for their dissertation research.

Maternal and Child Health (MCH) Promotion Pathway: Required Courses

These are in addition to SBS core requirements listed above.

EMD 533	Implementation Science	1
SBS 560	Sexual and Reproductive Health	1
SBS 594	Maternal-Child Public Health Nutrition	1

MCH Promotion Pathway: Required Electives

Any *three* from this list and *three* additional electives chosen in consultation with the student's adviser.

BIS 505	Biostatistics in Public Health II	1
BIS 621	Regression Models for Public Health	1
or BIS 623	Advanced Regression Models	
BIS 628	Longitudinal and Multilevel Data Analysis	1
BIS 630	Applied Survival Analysis	1
CDE 516	Principles of Epidemiology II	1
CDE 566	Causal Inference Methods in Public Health Research	1
or EMD 582	Political Epidemiology	
HPM 575	Evaluation of Global Health Policies and Programs	1
PUBH 505	Biostatistics in Public Health	1
S&DS 5630	Multivariate Statistical Methods for the Social Sciences	1

M.D.-PH.D. PROGRAM REQUIREMENTS FOR PUBLIC HEALTH

All M.D.-Ph.D. students must meet with DGS in Public Health, if they are considering affiliating with Public Health. Students in this program are expected to meet the guidelines listed below in the time frame outlined. The DGS must approve any variations to these requirements.

Teaching

One term of teaching is required. Depending on the level of support available to individual research groups, some students may teach for additional terms. In no instance will a student teach for more than five terms during their first five years of study. Further, depending on how the student's Ph.D. position is being funded, they may be required to work up to nineteen hours per week as a research assistant (which may or may not be directly related to their dissertation research). However, in no single term will they be required to act as a research assistant (on matters unrelated to their dissertation) and/or teach more than a combined total of nineteen hours per week. In these situations, teaching responsibilities will be limited to ten hours per week.

Rotations/Internships

Students should do two rotations/internships with potential advisers in Public Health. The purpose of these rotations/internships is to learn research approaches and methodologies and/or to allow the student time to determine if the faculty's research interests are compatible with the student's research interests. These rotations/internships are usually done during the summer between the first and second years of medical school. In some cases, students may need to defer this requirement until the summer after the second year after taking certain courses and/or completing readings in order to possess the background necessary for a successful rotation/internship.

Required Coursework

M.D.-Ph.D. students are generally expected to take the same courses as traditional Ph.D. students. Departmental requirements vary; therefore, students should confer with the DGS and their Ph.D. adviser.

Timeline for Qualifying Exam

Students generally will take medical school courses in years one and two. Students can take public health courses or other appropriate courses during this time, if scheduling allows. Once affiliated with the public health program, students will complete all course requirements for the department. This generally takes a minimum of two terms but can take up to four terms after affiliating with public health. The qualifying exam is commonly completed after the fourth term of affiliation with the Ph.D. program in public health, but it can be done earlier with approval of the Ph.D. adviser and the DGS.

Prospectus Timeline

Following completion of the qualifying exam, students should focus on the prospectus, which must be approved by the Public Health Graduate Studies Executive Committee (GSEC) before the end of the student's sixth term as an affiliated Ph.D. student in public health.

Admission to Candidacy

To be admitted to candidacy, students must: (1) satisfactorily complete the course requirements for their department as outlined above, achieve grades of Honors in at least two full-term courses, and achieve an overall High Pass average; (2) obtain an average grade of High Pass on the qualifying exam; and (3) have the dissertation prospectus approved by the GSEC. All M.D.-Ph.D. students must be admitted to candidacy before the start of their fourth year in the Ph.D. program (i.e., before the start of the seventh term).

MASTER'S DEGREES

M.Phil. The M.Phil. is awarded to doctoral students who have advanced to candidacy. When students advance to candidacy, the registrar's office automatically submits a petition for the awarding of the M.Phil. degree.

Terminal Master's Degree Program The school offers a terminal master's degree program leading to an M.S. in public health in four concentrations: biostatistics (a two-

year program), chronic disease epidemiology (a one-year program), epidemiology of infectious diseases (a one-year program), and health informatics (a two-year program). All students must fulfill both the departmental and graduate school requirements for a terminal M.S. degree.

Students must have an overall grade average of High Pass, including a grade of Honors in at least one full-term graduate course (for students enrolled in the one-year programs in chronic disease epidemiology and epidemiology of infectious diseases) or in at least two full-term graduate courses (for students enrolled in the two-year programs in biostatistics and health informatics). In order to maintain the minimum average of High Pass, each grade of Pass must be balanced by one grade of Honors. For more details, please see Course and Honors Requirements under Policies and Regulations.

A biostatistics, chronic disease epidemiology, or epidemiology of microbial diseases student who is withdrawing from the Ph.D. program, and has successfully completed all required coursework for the terminal M.S. degree (described below), may apply and be recommended for the M.S. in public health. In the other departments, students must have successfully completed (prior to withdrawal) at least ten courses in the doctoral program and a capstone experience, achieving a minimum of two Honors grades and an overall High Pass average. Students who withdraw after qualifying or receiving the M.Phil. are not eligible for an M.S. degree.

Fields of Study

TERMINAL M.S. WITH CONCENTRATION IN BIOSTATISTICS

The M.S. with a concentration in biostatistics is a two-year program that provides training in clinical trials, epidemiologic methodology, implementation science, data science, statistical genetics, and mathematical models for infectious diseases. Students have a choice of three pathways: the *Biostatistics Standard Pathway,* the *Biostatistics Implementation and Prevention Science Methods Pathway,* and the *Biostatistics Data Science Pathway*. In contrast to the more general M.P.H. degree, the M.S. degree emphasizes the mastery of biostatistical skills from the beginning of the plan of study. While graduates of this program may apply to the Ph.D. degree program, the M.S. degree is itself quite marketable as a terminal degree. Part-time enrollment is permitted.

Degree Requirements

The biostatistics concentration requires the completion of fourteen required and elective courses for the Standard Pathway and the Implementation and Prevention Sciences Pathway. Fifteen required and elective courses must be completed for the Data Science Pathway. These requirements exclude the Seminar, BIS 525/BIS 526; the Summer Internship, BIS 695; PUBH 100; and PUBH 101. Additionally, all first-year students must participate in an online Public Health Primer course the summer before their first term. This does not count towards the required courses.

NOTE: Half-term courses cannot count as an elective unless an additional half-term course is taken and the Biostatistics faculty have approved both courses as an elective.

The graduate school requires an overall grade average of High Pass, including grades of Honors in at least two full-term graduate courses for students enrolled in a two-year program. In order to maintain the minimum average of High Pass, each grade of Pass

on the student's transcript must be balanced by one grade of Honors. Each grade of Fail must be balanced by two grades of Honors. If a student retakes a course in which the student has received a failing grade, only the newer grade will be considered in calculating this average. The initial grade of Fail, however, will remain on the student's transcript. A grade awarded at the conclusion of a full-year course in which no grade is awarded at the end of the first term would be counted twice in calculating this average.

Curriculum

Required Courses for All Pathways (or substitutions approved by the student's adviser and the DGS)

BIS 525	Seminar in Biostatistics and Journal Club [1]	0
BIS 526	Seminar in Biostatistics and Journal Club [1]	0
BIS 623	Advanced Regression Models	1
or S&DS 6120	Linear Models	
BIS 628	Longitudinal and Multilevel Data Analysis	1
BIS 630	Applied Survival Analysis	1
or BIS 643	Theory of Survival Analysis	
BIS 678	Statistical Practice I	1
BIS 695	Summer Internship in Biostatistics [1]	0
PUBH 100	Professional Skills Series [1]	0
PUBH 101	Professional Skills Series [1]	0
PUBH 508	Foundations of Epidemiology and Public Health	1
S&DS 5410	Probability Theory	1
or S&DS 5510	Stochastic Processes	
or S&DS 6000	Advanced Probability	
S&DS 5420	Theory of Statistics	1
or S&DS 6100	Statistical Inference	

[1] These courses do not count as a credit.

Additional Required Courses: Standard Pathway

BIS 679	Advanced Statistical Programming in SAS and R	1
BIS 681	Statistical Practice II [1]	1
or BIS 649	Master's Thesis Research	
or BIS 650	Master's Thesis Research	

A minimum of two of the following Biostatistics electives:

BIS 536	Measurement Error and Missing Data	1
BIS 537	Statistical Methods for Causal Inference	1
BIS 540	Fundamentals of Clinical Trials	1
BIS 550	Topics in Biomedical Informatics and Data Science	1
BIS 555	Machine Learning with Biomedical Data	1
BIS 560	Introduction to Clinical and Translational Informatics	1
BIS 567	Bayesian Statistics	1

BIS 568	Applied Artificial Intelligence in Healthcare	1
BIS 629	Advanced Methods for Implementation and Prevention Science	1
BIS 631	Advanced Topics in Causal Inference Methods	1
BIS 633	Population and Public Health Informatics	1
BIS 634	Computational Methods for Informatics	1
BIS 638	Clinical Database Management Systems and Ontologies	1
BIS 640	User-Centered Design of Digital Health Tools	1
BIS 643	Theory of Survival Analysis[2]	1
BIS 645	Statistical Methods in Human Genetics	1
BIS 646	Nonparametric Statistical Methods and Their Applications	1
BIS 691	Theory of Generalized Linear Models	1
Additional electives must be approved by the Standard Pathway faculty liaison		

[1] M.S. Biostatistics (Standard Pathway) students are required to complete a two-semester capstone experience in the second year. This requirement can be fulfilled by:

- Taking two semesters of the capstone course: BIS 678 (fall) and BIS 681 (spring); *or*
- Taking the fall semester capstone course BIS 678 and completing a thesis. The thesis is a yearlong project. Students who plan to complete a thesis should register for BIS 649 (fall; 1 credit) and BIS 650 (spring; 1 credit).

All students who complete a thesis will be required to present their research during a public seminar to the Biostatistics faculty and students in order to graduate.

[2] Cannot fulfill elective if substituted for BIS 630.

A minimum of three electives must be taken from either the Biostatistics electives list or the list below:

BENG 5450	Biomedical Image Processing and Analysis	1
CDE 566	Causal Inference Methods in Public Health Research	1
CDE 634	Advanced Applied Analytic Methods in Epidemiology and Public Health	1
CPSC 5371	Database Design and Implementation	1
CPSC 5460	Data and Information Visualization	1
CPSC 5520/ CB&B 6663	Deep Learning Theory and Applications	1
CPSC 5700	Artificial Intelligence	1
CPSC 5710	Trustworthy Deep Learning	1
CPSC 5770	Natural Language Processing	1
CPSC 5820	Current Topics in Applied Machine Learning	1
CPSC 5830	Deep Learning on Graph-Structured Data	1
CPSC 6400	Topics in Numerical Computation	1
CPSC 6700	Topics in Natural Language Processing	1

CPSC/CB&B/MB&B 7520	Biomedical Data Science: Mining and Modeling	1
CPSC 7760	Topics in Industrial AI Applications	1
ECON 5554	Econometrics V	1
EMD 553	Transmission Dynamic Models for Understanding Infectious Diseases	1
HPM 583	Methods in Health Services Research	1
INP 7599	Statistics and Data Analysis in Neuroscience	1
MGT 803	Decision Making with Data [1]	2
PSYC 5580	Computational Methods in Human Neuroscience	1
S&DS 5170	Applied Machine Learning and Causal Inference	1
S&DS 5510	Stochastic Processes [3]	1
S&DS 5620	Computational Tools for Data Science	1
S&DS 5630/ENV 758	Multivariate Statistical Methods for the Social Sciences	1
S&DS 5650	Introductory Machine Learning	1
S&DS 5660	Deep Learning for Scientists and Engineers	1
S&DS 5690	Numerical Linear Algebra: Deterministic and Randomized Algorithms	1
S&DS 5800	Neural Data Analysis	1
S&DS 6000	Advanced Probability [3]	1
S&DS 6100	Statistical Inference [4]	1
S&DS 6110	Selected Topics in Statistical Decision Theory	1
S&DS 6120	Linear Models [2]	1
S&DS 6180	Asymptotic Statistics	1
S&DS 6310	Optimization and Computation	1
S&DS 6320	Advanced Optimization Techniques	1
S&DS 6610	Data Analysis	1
S&DS 6620	Statistical Computing	1
S&DS 6630	Computational Mathematics Situational Awareness and Survival Skills	1
S&DS 6640	Information Theory	1
S&DS 6650	Intermediate Machine Learning	1
S&DS 6740/ ENV 781	Applied Spatial Statistics	1
S&DS 6850	Theory of Reinforcement Learning	1

Additional electives must be approved by the Standard Pathway faculty liaison

[1] This course is offered in the School of Management

[2] Cannot fulfill elective credit if substituted for S&DS 5410

[3] Cannot fulfill elective credit if substituted for S&DS 5420

[4] Cannot fulfill elective credit if substituted for BIS 623.

Students wishing to complete a thesis may enroll in BIS 649 and BIS 650, Master's Thesis Research. This would be an additional requirement and cannot replace any of the required courses noted above. All students who complete a thesis will be required to present their research during a public seminar to the Biostatistics faculty and students in order to graduate.

Additional Required Courses: Implementation and Prevention Science Methods Pathway

BIS 629	Advanced Methods for Implementation and Prevention Science	1
BIS 679	Advanced Statistical Programming in SAS and R	1
BIS 681	Statistical Practice II [1]	1
or BIS 649	Master's Thesis Research	
or BIS 650	Master's Thesis Research	
EMD 533	Implementation Science	1

[1] M.S. Biostatistics (Implementation Science Pathway) students are required to complete a two-semester capstone experience in the second year. This requirement can be fulfilled by:

- Taking two semesters of the capstone course: BIS 678 (fall) and BIS 681 (spring); *or*
- Taking the fall semester capstone course BIS 678 and completing a thesis. The thesis is a yearlong project. Students who plan to complete a thesis should register for: BIS 649 (fall; 1 credit) and BIS 650 (spring; 1 credit).

Students in this pathway are strongly encouraged to complete a thesis. All students who complete a thesis will be required to present their research during a public seminar to the Biostatistics faculty and students in order to graduate.

At least one of the following:

BIS 536	Measurement Error and Missing Data	1
BIS 537	Statistical Methods for Causal Inference	1
BIS 631	Advanced Topics in Causal Inference Methods	1

At least two of the following:

CDE 516	Principles of Epidemiology II	1
CDE 534	Applied Analytic Methods in Epidemiology	1
EMD 538	Quantitative Methods for Infectious Disease Epidemiology	1
HPM 570	Cost-Effectiveness Analysis and Decision-Making [1]	1
HPM 575	Evaluation of Global Health Policies and Programs	1
HPM 586	Microeconomics for Health Policy and Health Management	1
HPM 587	Advanced Health Economics	1
MGT 611	Policy Modeling	2
SBS 541	Community Health Program Evaluation [1]	1
SBS 574	Developing a Health Promotion and Disease Prevention Intervention	1

SBS 580	Qualitative Research Methods in Public Health [1]	1
S&DS 5650	Introductory Machine Learning	1
Alternative electives must be approved by the Implementation Science Pathway director.		

[1] These courses are highly recommended.

Additional Required Courses: Data Science Pathway

BIS 678	Statistical Practice I	1
BIS 681	Statistical Practice II [1]	1
or BIS 649	Master's Thesis Research	
or BIS 650	Master's Thesis Research	

[1] M.S. Biostatistics (Data Science Pathway) students are required to complete a two-semester capstone experience in the second year. This requirement can be fulfilled by:

- Taking two semesters of the capstone course: BIS 678 (fall) and BIS 681 (spring); *or*
- Taking the fall semester capstone course BIS 678 and completing a thesis. The thesis is a yearlong project. Students who plan to complete a thesis should register for BIS 649 (fall; 1 credit) and BIS 650 (spring; 1 credit).

All students who complete a thesis will be required to present their research during a public seminar to the Biostatistics faculty and students in order to graduate.

Two of the following biostatistics, computer science, or statistical methods courses

BENG 5440	Fundamentals of Medical Imaging	1
BIS 536	Measurement Error and Missing Data	1
BIS 537	Statistical Methods for Causal Inference	1
BIS 540	Fundamentals of Clinical Trials	1
BIS 550	Topics in Biomedical Informatics and Data Science	1
BIS 555	Machine Learning with Biomedical Data [1]	1
BIS 567	Bayesian Statistics	1
BIS 629	Advanced Methods for Implementation and Prevention Science	1
BIS 634	Computational Methods for Informatics [1]	1
BIS 645	Statistical Methods in Human Genetics	1
BIS 646	Nonparametric Statistical Methods and Their Applications	1
CB&B 5620	Modeling Biological Systems II	1
CB&B 7520	Biomedical Data Science: Mining and Modeling	1
CPSC 5150	Law and Large Language Models	1
CPSC 5190	Full Stack Web Programming	1
CPSC 5260	Building Distributed Systems	1
CPSC 5390	Software Engineering	1
CPSC 5650	Theory of Distributed Systems	1
CPSC 5770	Natural Language Processing	1

CPSC 5880	AI Foundation Models	1
CPSC 6400	Topics in Numerical Computation	1
CPSC 6420	Modern Challenges in Statistics: A Computational Perspective	1
EMD 553	Transmission Dynamic Models for Understanding Infectious Diseases	1
MCDB 5000	Biochemistry	1
S&DS 5410	Probability Theory [1]	1
S&DS 5510	Stochastic Processes [1,2]	1
S&DS 5660	Deep Learning for Scientists and Engineers	1
S&DS 6110	Selected Topics in Statistical Decision Theory	1
S&DS 6450	Statistical Methods in Computational Biology	1
S&DS 6610	Data Analysis	1
S&DS 6640	Information Theory	1

Additional electives must be approved by the Data Science Pathway director

One of the following Machine Learning courses:

BIS 555	Machine Learning with Biomedical Data [1]	1
BIS 568	Applied Artificial Intelligence in Healthcare	1
BIS 634	Computational Methods for Informatics [1]	1
BIS 691	Theory of Generalized Linear Models	1
CB&B 5555/ AMTH 5530/CPSC 5530	Unsupervised Learning for Big Data	1
CB&B 6663/ CPSC 5520	Deep Learning Theory and Applications	1
CPSC 5690	Randomized Algorithms	1
CPSC 5710	Trustworthy Deep Learning	1
CPSC 5830	Deep Learning on Graph-Structured Data	1
CPSC 6440	Geometric and Topological Methods in Machine Learning	1
CPSC 6700	Topics in Natural Language Processing	1
S&DS 5170	Applied Machine Learning and Causal Inference	1
S&DS 5620	Computational Tools for Data Science	1
S&DS 5650	Introductory Machine Learning	1
S&DS 5690	Numerical Linear Algebra: Deterministic and Randomized Algorithms	1
S&DS 6310	Optimization and Computation	1
S&DS 6320	Advanced Optimization Techniques	1
S&DS 6650	Intermediate Machine Learning	1
S&DS 6740	Applied Spatial Statistics	1
S&DS 6840	Statistical Inference on Graphs	1
S&DS 6850	Theory of Reinforcement Learning	1

S&DS 6860	High-Dimensional Phenomena in Statistics and Learning	1
Additional electives must be approved by the Data Science Pathway director		

One of the following Database courses:

BIS 550	Topics in Biomedical Informatics and Data Science [1]	1
BIS 638	Clinical Database Management Systems and Ontologies	1
BIS 679	Advanced Statistical Programming in SAS and R	1
CPSC 5370	Database Systems	1
MGT 656	Management of Software Development [3]	4
MGT 660	Advanced Management of Software Development [3]	4
Additional electives must be approved by the Data Science Pathway director		

[1] This course can only be counted to fulfill the requirement of one category; they cannot be counted twice.

[2] Cannot fulfill elective if taken as a substitute for S&DS 5410.

[3] These courses are offered at the School of Management.

Two additional electives are required from the biostatistics, machine learning, or database list. Other courses from public health or other departments must be approved by the Data Science Pathway faculty liaison.

Competencies

Upon receiving an M.S. in the biostatistics concentration of public health, the student will be able to:

- Select from a variety of analytical tools to test statistical hypotheses, interpret results of statistical analyses, and use these results to make relevant inferences from data.
- Design efficient computer programs for study management, statistical analysis, as well as presentation using R, SAS, and other programming languages.
- Demonstrate oral and written communication and presentation skills to effectively communicate and disseminate results to professional audiences.

TERMINAL M.S. WITH CONCENTRATION IN CHRONIC DISEASE EPIDEMIOLOGY

This one-year program is designed for medical and health care professionals (e.g., M.D., Ph.D., D.V.M., D.D.S., D.M.D.) or others seeking the skills necessary to conduct epidemiological research in their professional practice. Part-time enrollment is permitted.

Degree Requirements

The chronic disease epidemiology concentration consists of required and elective coursework and satisfactory completion of the capstone experience. A total of ten courses is required (excluding the Seminar, CDE 525/CDE 526). It is expected that this program will be completed during a single academic year when a student enrolls full-time. Written permission of the DGS is required prior to enrolling in substitute courses. Additionally, all first-year students must participate in an online Public Health Primer course the summer before their first term.

The graduate school requires an overall grade average of High Pass, including a grade of Honors in at least one full-term graduate course for students enrolled in a one-year program. In order to maintain the minimum average of High Pass, each grade of Pass on the student's transcript must be balanced by one grade of Honors. Each grade of Fail must be balanced by two grades of Honors. If a student retakes a course in which the student has received a failing grade, only the newer grade will be considered in calculating this average. The initial grade of Fail, however, will remain on the student's transcript. A grade awarded at the conclusion of a full-year course in which no grade is awarded at the end of the first term would be counted twice in calculating this average.

Curriculum

Required Courses (or approved substitutions)

CDE 516	Principles of Epidemiology II	1
CDE 525	Seminar in Chronic Disease Epidemiology [1]	0
CDE 526	Seminar in Chronic Disease Epidemiology [1]	0
CDE 617	Developing a Research Proposal [2]	1
or CDE 600	Independent Study or Directed Readings	
PUBH 508	Foundations of Epidemiology and Public Health	1

[1] These courses do not count toward the ten required credits.

[2] In the capstone courses (CDE 617), the student is required to develop a grant application that is deemed reasonably competitive by the instructor. An alternative to one of these capstone courses, is an individualized tutorial (CDE 600), in which the student completes a manuscript that is suitable for submission for publication in a relevant journal.

Quantitative courses (choose three from the following or an approved substitution)

BIS 536	Measurement Error and Missing Data	1
BIS 537	Statistical Methods for Causal Inference	1
BIS 621	Regression Models for Public Health	1
BIS 630	Applied Survival Analysis	1
BIS 633	Population and Public Health Informatics	1
S&DS 5300	Data Exploration and Analysis	1
S&DS 5630	Multivariate Statistical Methods for the Social Sciences	1

Chronic Disease Epidemiology (choose two of the following)

CDE 502	Physiology for Public Health	1
CDE 532	Epidemiology of Cancer	1
CDE 534	Applied Analytic Methods in Epidemiology	1
CDE 535	Epidemiology of Heart Disease and Stroke	1
CDE 551	Global Noncommunicable Disease	1
CDE 562	Nutrition and Chronic Disease	1
CDE 572	Obesity Prevention and Lifestyle Interventions	1

CDE 582	Health Outcomes Research: Matching the Right Research Question to the Right Data	1
CDE 588	Perinatal Epidemiology	1
CDE 597	Genetic Concepts in Public Health	1
CDE 650	Introduction to Evidence-Based Medicine and Health Care	1

Students must complete two additional electives, chosen in consultation with their adviser.

Competencies

Upon receiving an M.S. in the chronic disease epidemiology concentration of public health, the student will be able to:

- Evaluate the scientific merit and feasibility of epidemiologic study designs.
- Review and evaluate epidemiologic reports and research articles.
- Analyze data and draw appropriate inferences from epidemiologic studies.
- Write an epidemiologic research proposal.

TERMINAL M.S. WITH CONCENTRATION IN EPIDEMIOLOGY OF INFECTIOUS DISEASES

This one-year program offers two areas of specialization: a quantitative area aims to provide quantitatively focused research training in the epidemiology of infectious diseases, focusing on the analysis of communicable disease data as well as modeling and simulation; and a clinical area aims to provide research training for clinicians and clinical trainees interested in furthering their research expertise. Part-time enrollment is permitted. Part-time students must complete the degree requirements in two years.

Degree Requirements

The epidemiology of infectious diseases concentration requires a total of ten courses (excluding the yearlong Seminar, EMD 525/EMD 526), including satisfactory completion of the capstone course. There are two capstone course options:

Option 1 Students may elect to enroll in CDE 617, Developing a Research Proposal. Students in this course develop an NIH-style research proposal focusing on a topic related to infectious disease epidemiology. This course is taken by students in the final term of their M.S. program. Students meet as a group for cross-cutting didactic sessions on reading RFAs, NIH peer review and scoring, and effective grant writing and grantsmanship. Students work one-on-one outside of these sessions with faculty mentors to construct their grant proposals over the course of the term. They work with other students in the course to refine their projects and will do an oral presentation of their proposal at the final capstone course symposium at the end of the term.

Option 2 Students may elect to enroll in EMD 563, Laboratory and Field Studies in Infectious Diseases. This course provides students with hands-on training in laboratory or epidemiological research techniques. Students work one-on-one with faculty members on existing or new projects. Students choosing this option write-up and present their findings at the final capstone course symposium at the end of their final term.

Additionally, all first-year students must participate in an online Public Health Primer course the summer before their first term.

The graduate school requires an overall grade average of High Pass, including a grade of Honors in at least one full-term graduate course for students enrolled in a one-year program. In order to maintain the minimum average of High Pass, each grade of Pass on the student's transcript must be balanced by one grade of Honors. Each grade of Fail must be balanced by two grades of Honors. If a student retakes a course in which the student has received a failing grade, only the newer grade will be considered in calculating this average. The initial grade of Fail, however, will remain on the student's transcript. A grade awarded at the conclusion of a full-year course in which no grade is awarded at the end of the first term would be counted twice in calculating this average.

Curriculum

Required Courses: Quantitative Specialization (or substitutions approved by the student's adviser)

BIS 623	Advanced Regression Models	1
BIS 630	Applied Survival Analysis	1
CDE 617	Developing a Research Proposal	1
or EMD 563	Independent Study in Epidemiology of Microbial Diseases	
EMD 517	Principles of Infectious Diseases I	1
EMD 518	Principles of Infectious Diseases II	1
EMD 525	Seminar in Epidemiology of Microbial Diseases [1]	0
EMD 526	Seminar in Epidemiology of Microbial Diseases [1]	0
EMD 538	Quantitative Methods for Infectious Disease Epidemiology	1
EMD 553	Transmission Dynamic Models for Understanding Infectious Diseases	1
or EMD 539	Introduction to the Analysis and Interpretation of Public Health Surveillance Data	
PUBH 508	Foundations of Epidemiology and Public Health	1

[1] These courses do not count toward the ten required courses.

In addition, students must complete two elective courses (approved by the student's adviser).

Required Courses: Clinical Specialization (or substitutions approved by the student's adviser)

BIS 505	Biostatistics in Public Health II	1
or CDE 534	Applied Analytic Methods in Epidemiology	
CDE 617	Developing a Research Proposal	1
or EMD 563	Independent Study in Epidemiology of Microbial Diseases	
EMD 517	Principles of Infectious Diseases I	1
EMD 518	Principles of Infectious Diseases II	1
EMD 525	Seminar in Epidemiology of Microbial Diseases [1]	0
EMD 526	Seminar in Epidemiology of Microbial Diseases [1]	0

EMD 530	Health Care Epidemiology: Improving Health Care Quality through Infection Prevention	1
or EMD 536	Outbreak Investigations: Principles and Practice	
EMD 567	Tackling the Big Three: Malaria, TB, and HIV in Resource-Limited Settings	1
or EMD 533	Implementation Science	
PUBH 505	Biostatistics in Public Health	1
PUBH 508	Foundations of Epidemiology and Public Health	1

[1] These courses do not count toward the ten required courses.

In addition, students must complete two elective courses (approved by the student's adviser).

Suggested Electives for Both Specializations

EMD 531	Genomic Epidemiology of Infectious Diseases	1
EMD 537	Water, Sanitation, and Global Health	1
EMD 541	Health in Humanitarian Crises	1
EMD 546	Vaccines and Vaccine-Preventable Diseases	1
EMD 580	Reforming Health Systems: Using Data to Improve Health in Low- and Middle-Income Countries	1
EMD 582	Political Epidemiology	1

Alternate electives must be approved in consultation with the student's adviser.

Competencies

Upon receiving an M.S. in the epidemiology of infectious diseases concentration of public health, the student will be able to:

- Explain the role of quantitative and qualitative methods and sciences in describing and assessing a population's health (especially in terms of risk/burden of infectious diseases).
- Explain ecological perspective on the connection between human health, animal health, and ecosystem health with respect to microbial threats.
- Analyze datasets that arise in the context of outbreaks, epidemics, and endemic infectious diseases. (Quantitative specialization only)
- Design observational and/or experimental studies to study the relationship between host, microbial, or environmental factors on the occurrence or control of infectious diseases. (Clinical specialization only)

TERMINAL M.S. WITH CONCENTRATION IN HEALTH INFORMATICS

This two-year program provides well-rounded training in health informatics, with a balance of core courses from such areas as information sciences, clinical informatics, clinical research informatics, consumer health and population health informatics, and data science, and more broadly health policy, social and behavioral science, biostatistics, and epidemiology. First-year courses survey the field; the typical second-

year courses are more technical and put greater emphasis on mastering the skills in health informatics. Part-time enrollment is not permitted.

Degree Requirements

The health informatics concentration consists of a total of fourteen courses: seven required courses, five electives, and satisfactory completion and presentation of a yearlong capstone project. Students demonstrating a mastery of topics covered by the required courses may replace them with more advanced courses but must receive written permission from the DGS and their adviser prior to enrolling in the substitute courses. Additionally, all first-year students must participate in an online Public Health Primer course the summer before their first term.

The graduate school requires an overall grade average of High Pass, including grades of Honors in at least two full-term graduate courses for students enrolled in a two-year program. In order to maintain the minimum average of High Pass, each grade of Pass on the student's transcript must be balanced by one grade of Honors. Each grade of Fail must be balanced by two grades of Honors. If a student retakes a course in which the student has received a failing grade, only the newer grade will be considered in calculating this average. The initial grade of Fail, however, will remain on the student's transcript. A grade awarded at the conclusion of a full-year course in which no grade is awarded at the end of the first term would be counted twice in calculating this average.

Curriculum

Required Courses

BIS 550	Topics in Biomedical Informatics and Data Science	1
BIS 560	Introduction to Clinical and Translational Informatics	1
BIS 562	Clinical Decision Support	1
or BIS 640	User-Centered Design of Digital Health Tools	
BIS 633	Population and Public Health Informatics	1
BIS 634	Computational Methods for Informatics	1
BIS 638	Clinical Database Management Systems and Ontologies	1
BIS 685	Capstone in Health Informatics	1
BIS 686	Capstone in Health Informatics	1
PUBH 508	Foundations of Epidemiology and Public Health	1

MS Electives in Informatics, Statistics and Data Science (5 course units)

BENG 5440	Fundamentals of Medical Imaging	1
BIS 540	Fundamentals of Clinical Trials	1
BIS 567	Bayesian Statistics	1
BIS 568	Applied Artificial Intelligence in Healthcare	1
BIS 621	Regression Models for Public Health	1
BIS 623	Advanced Regression Models	1
BIS 628	Longitudinal and Multilevel Data Analysis	1
BIS 630	Applied Survival Analysis	1
BIS 645/CB&B 6470	Statistical Methods in Human Genetics	1

BIS 691	Theory of Generalized Linear Models	1
CB&B 5555	Unsupervised Learning for Big Data	1
CB&B 5670	Topics in Deep Learning: Methods and Biomedical Applications	1
CB&B 5700	Computational Biomedical Privacy	1
CB&B 5740	Biomedical Natural Language Processing: Methods and Applications	1
CB&B 5750	Bioinformatics Applications in Biomedicine	1
CB&B 5760	Foundations of Real World Data Science: Electronic Health Records	1
CB&B 5790	Distributed Artificial Intelligence on Biomedical Data	1
CB&B 6663/ CPSC 5520/ GENE 6630	Deep Learning Theory and Applications	1
CB&B/MCDB/ CPSC/MB&B 7520	Biomedical Data Science: Mining and Modeling	1
CDE 534	Applied Analytic Methods in Epidemiology	1
CDE/EHS 566	Causal Inference Methods in Public Health Research	1
CDE 582	Health Outcomes Research: Matching the Right Research Question to the Right Data	1
CPSC 5370	Database Systems	1
CPSC 5371	Database Design and Implementation	1
CPSC 5390	Software Engineering	1
CPSC 5460	Data and Information Visualization	1
CPSC 5640	Algorithms and their Societal Implications	1
CPSC 5700	Artificial Intelligence	1
CPSC 5770	Natural Language Processing	1
CPSC 5810	Introduction to Machine Learning	1
CPSC 5820	Current Topics in Applied Machine Learning	1
CPSC 5830	Deep Learning on Graph-Structured Data	1
CPSC 6700	Topics in Natural Language Processing	1
EMD 533	Implementation Science	1
EMD 538	Quantitative Methods for Infectious Disease Epidemiology	1
EMD 539	Introduction to the Analysis and Interpretation of Public Health Surveillance Data	1
EMD 553	Transmission Dynamic Models for Understanding Infectious Diseases	1
EMD/HPM 580	Reforming Health Systems: Using Data to Improve Health in Low- and Middle-Income Countries	1
HPM 559	Big Data, Privacy, and Public Health Ethics	1
HPM 560	Health Economics and U.S. Health Policy	1
HPM 570	Cost-Effectiveness Analysis and Decision-Making	1

HPM 583	Methods in Health Services Research	1
HPM 595	Food and Drug Administration Law	1
IMED 5625	Principles of Clinical Research	1
INP 7560	R Stats for Neuroscience	1
MGT 525	Competitive Strategy [1]	4
MGT 534	Personal Leadership [1]	4
MGT 612	Introduction to Social Entrepreneurship [1]	4
MGT 631	Public Health Entrepreneurship & Intrapreneurship [1]	2
MGT 656	Management of Software Development [1]	4
MGT 698	Healthcare Policy, Finance, and Economics [1]	4
MGT 879	Healthcare Operations [1]	2
PUBH 510	Health Policy and Health Care Systems	1
S&DS 5170	Applied Machine Learning and Causal Inference	1
S&DS 5300	Data Exploration and Analysis	1
S&DS 5620	Computational Tools for Data Science	1
S&DS 5630	Multivariate Statistical Methods for the Social Sciences	1
S&DS 5650	Introductory Machine Learning	1
S&DS 5830	Time Series with R/Python	1
S&DS 6100	Statistical Inference	1
S&DS 6310	Optimization and Computation	1
S&DS 6450	Statistical Methods in Computational Biology	1
S&DS 6630	Computational Mathematics Situational Awareness and Survival Skills	1
S&DS 6640	Information Theory	1

[1] These courses are offered in the School of Management.

In addition, in the second year of the program, students are required to complete an independent capstone project (BIS 685/BIS 686) under the direction of a faculty member. This project may fall into one of the main areas—clinical informatics; clinical research informatics; population health informatics; and implementation of new methods and technology—and may include elements from several of these areas. Students are required to prepare a carefully written report and make an oral presentation of the work to the faculty and students. A capstone committee consisting of two faculty members and one outside reader will provide guidance to the candidate as to the suitability of the project and will monitor its progress.

Competencies

Upon receiving an M.S. in the health informatics concentration of public health, the student will be able to:

- Select informatics methods appropriate for a given public health context.
- Compare the health information system structure and function across regional, national, and international settings.

- Assess population informatics needs, assets, and capacities that affect communities' health.
- Propose strategies to identify stakeholders and build coalitions and partnerships for influencing public health informatics.
- Communicate audience-appropriate public health content, both in writing and through oral presentation.
- Apply systems thinking tools to a public health informatics issue.

Ph.D. or terminal M.S. degree program materials are available upon request to the Office of the Director of Graduate Studies (c/o M. Elliot), School of Public Health, Yale University, PO Box 208034, New Haven CT 06520-8034; 203.785.6383; email, phdms.publichealth@yale.edu.

REQUIRED COURSES

For a complete list of Public Health courses, see the School of Public Health bulletin, available online at https://bulletin.yale.edu; and Yale Course Search at https://courses.yale.edu.

All Ph.D. students are required to take the following course. All first-year students must participate in a Public Health Primer online course the summer before their first term.

PUBH 600	Research Ethics and Responsibility	0

Religious Studies

Humanities Quadrangle
http://religiousstudies.yale.edu
M.A., M.Phil., Ph.D.

Chair
Travis Zadeh

Director of Graduate Studies
Sarit Kattan Gribetz

Professors Joel Baden (*Divinity*), Stephen Davis, Carlos Eire, Paul Franks (*Philosophy*), Bruce Gordon (*Divinity*), Jennifer Herdt (*Divinity*), Hwansoo Kim, Nancy Levene, Kathryn Lofton, Ivan Marcus, Andrew McGowan (*Divinity*), Laura Nasrallah, Sally Promey (*American Studies*), Chloë Starr (*Divinity*), Gregory Sterling (*Divinity*), Elli Stern, Kathryn Tanner (*Divinity*), Miroslav Volf (*Divinity*), Tisa Wenger (*Divinity*), Travis Zadeh

Associate Professors Maria Doerfler, Eric Greene, Willie Jennings (*Divinity*), Sarit Kattan Gribetz, Noreen Khawaja, Todne Thomas, Linn Tonstad (*Divinity*)

Assistant Professors Supriya Gandhi, Sonam Kachru, Marta Sanvido

Lecturers Jimmy Daccache, Felicity Harley-McGowan (*Divinity*), Adam Ployd, Matthew Steele

FIELDS OF STUDY

Students must enroll in one of the following fields of study: American religious history, Asian religions, Early Mediterranean and West Asian religions, Hebrew Bible/Old Testament, Islamic studies, Medieval and modern Judaism, philosophy of religion, religion and modernity, religious ethics, and theology.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Students are required to take a minimum of twelve term courses that meet the graduate school Honors requirement, including RLST 5100, Method and Theory, normally taken in a student's first year. Proficiency in two modern scholarly languages must be shown, one before the end of the first year, the other before the beginning of the third; this may be done by passing an examination administered by the department, by accreditation from a Yale Summer School course designed for this purpose, or by a grade of A or B in one of Yale's intermediate language courses. In the field of American Religious History, students must demonstrate proficiency in two skilled areas. Typically, students study two foreign languages, but occasionally students study one foreign language and one technical knowledge area directly related to their proposed dissertation, such as musicology, financial accounting, or a performance art. Mastery of the languages needed in one's chosen field (e.g., Chinese, Hebrew, Greek, Japanese) is also required in certain fields of study. A set of four qualifying examinations is designed for each student, following guidelines and criteria set by each field of study; these are normally completed in the third year. The dissertation prospectus must be approved by a colloquium, and the completed dissertation by a committee of readers and the departmental faculty. Upon completion of all predissertation requirements, including

the prospectus, students are admitted to candidacy for the Ph.D. This is expected before the seventh term in American Religious History, Philosophy of Religion, Religion and Modernity, Religious Ethics, and Theology; before the eighth term in other fields. Students begin writing their dissertation in the fourth year and normally will have finished by the end of the sixth. There is no oral examination on the dissertation.

In the Department of Religious Studies, the faculty considers learning to teach to be an important and integral component of the professional training of its graduate students. Students are therefore required to teach as teaching fellows for three terms as an academic requirement and one term as a financial requirement during their graduate programs. Such teaching normally takes place during their third and fourth years, unless other arrangements are approved by the director of graduate studies.

A combined Ph.D. degree is available with Black Studies. Consult that department for details.

MASTER'S DEGREES

M.Phil. See Degree Requirements under Policies and Regulations.

M.A. Students who withdraw from the Ph.D. program may be eligible to receive the M.A. degree if they have met the requirements and have not already received the M.Phil. degree. Students in Religious Studies must take seven graduate-level courses to be eligible for the M.A.

Program materials are available online at http://religiousstudies.yale.edu.

COURSES

RLST 5100a, Method and Theory Noreen Khawaja
Required seminar for doctoral students in Religious Studies. Others admitted with instructor's permission.

RLST 5180a, Secularisms Supriya Gandhi
This seminar investigates secularism, a multidimensional and multivalent category, together with its multiple lineages. We read influential scholarly interventions tracing the European genealogies of secularism together with critiques of secularism as a form of power. We put these readings in conversation with discussions of secularism and histories of the secular in global contexts including South and West Asia and North Africa. Through these we critically examine various, sometimes conflicting, understandings of secularism. Deployments of Islam as a foil to secularism, and the question of the Islamic secular, constitute important themes of the course.

RLST 6060a, Pedagogy Kathryn Lofton
A course on how to develop pedagogical methods. Students should only register who could also attend a MW lecture course from 2:30–3:20 p.m.

RLST 6080b / HIST 6030b, Approaches to the Study of Christianity in Late Antiquity Stephen Davis
This proseminar addresses key methodological and historiographical issues in the periodization and commodification of late antiquity as a field of inquiry, focusing especially on Christianity from the rise of Constantine (313) to the Council of Chalcedon (451). Part one of the course focuses on theories and methods that have marked the study of late ancient Christianity in recent decades, including the analysis

of discourse, sexuality and gender, bodies and ritual practice, and hybridity and ethnic identities. Part two focuses on a series of case studies, including the rise of Constantine, North African ecclesiastical resistance, the role of bishops and councils, barbarians and Roman borders, monasticism, pilgrimage, and the cult of the saints. The course concludes with a consideration of early Christian archaeology. The course is designed for EMWAR students with a primary or secondary area of concentration in Early Christianity, Late Ancient Christianity, Christianity and Judaism in the Hellenistic East, and West Asian Religions of the Sasanian and Early Islamic Eras. The course also provides important historical context for students concentrating in New Testament and in Scriptures and their Interpretation in Antiquity. Students interested in completing a seminar-based exam in connection with the course are encouraged to speak with the instructor. EMWAR area of concentration designations: EarXty, LateXty, XtyJudEast, WAR.

RLST 6160b / HIST 6157b / JDST 7206b / MDVL 7157b, How the West Became Antisemitic: Jews and the Formation of Europe, 800–1500 Ivan Marcus
This seminar explores how medieval Jews and Christians interacted as religious societies between 800 and 1500.

RLST 6350a, Philosophical Fragments Nancy Levene
The point of departure for this course is Kierkegaard's 1844 work, *Philosophical Fragments, or A Fragment of Philosophy*. We read it together with some of the works it refers to and presupposes, as well as works with which it can be freely associated. Concepts taken up include truth, history, interpretation, god, person, paradox, dialectic, irony, and creativity. Prerequisite: coursework in philosophical texts.

RLST 6430a / JDST 7445a, The Global Right: From the French Revolution to the American Insurrection Elli Stern
This seminar explores the history of right-wing political thought from the late eighteenth century to the present, with an emphasis on the role played by religious and pagan traditions. This course seeks to answer the question, what constitutes the right? What are the central philosophical, religious, and pagan, principles of those groups associated with this designation? How have the core ideas of the right changed over time? We do this by examining primary tracts written by theologians, political philosophers, and social theorists as well as secondary literature written by scholars interrogating movements associated with the right in America, Europe, Middle East, and Asia. Though touching on specific national political parties, institutions, and think tanks, its focus is on mapping the intellectual overlap and differences between various right-wing ideologies. While the course is limited to the modern period, it adopts a global perspective to better understand the full scope of right-wing politics.

RLST 6520a / JDST 6500a, Introduction to Jewish Studies David Sorkin and Sarit Kattan Gribetz
In a society that is broadly ambivalent about—if not roundly antagonistic against—Jews and Judaism, how can one study Jewish texts and history? Is the study of Jews and their religion and cultures necessarily an act of apologetics or polemics? What does "objectivity" mean in this loaded context? This course examines the inception and development of the modern field of Jewish studies in nineteenth-century Germany and the ways in which the field evolved and spread from Europe to Palestine, Israel, and the United States. Ultimately, students grapple with the question of the place of Jews and Jewish studies in the modern academy. The course begins with readings of the major

practitioners of the "academic study of Judaism" (Wissenschaft des Judentums) since its inception in the nineteenth century with close examination of the ways in which those scholars read the ancient, medieval, and early modern sources that they used to construct their studies of Jews and Judaism. It then turns to the institutionalization of the field through the establishments of seminaries, large-scale publication projects (encyclopedias, anthologies), historical societies and archives, research institutes, and university programs. Finally, the course examines the intersection between the personal and professional through pairing memoirs written by scholars with the scholarship they published. Throughout, programmatic statements are combined with close analysis of the way scholars read their sources.

RLST 6600b / AMST 6627b / ENGL 5820b / FILM 6020b, Media and Religion John Peters and Kathryn Lofton

Media and religion are devices of information and agencies of order. This course proceeds from the possible synonymy of its organizing terms, using as a form of weekly debate the relationship between media and religion. Readings think about how religion and media generate meanings about human doings and their relations with ecological and economic systems while also being constitutive parts of those systems. Students develop projects that allow them to explore a relationship between concept and subject in humanistic study.

RLST 6640a, Buddhist Metaphysics: Vasubandhu's Treasury Sonam Kachru

The Buddhist philosopher Vasubandhu (fl. late fourth century C.E.) described Buddhism as a path of reasons in his massively influential *Treasury of Buddhist Thought*. This seminar explores those reasons, beginning with the argument for the salience and necessity of arguments. We explore Vasubandhu's arguments about the nature of time (do past and future exist?); atomism (physical, mental and temporal); the nature of pain and pleasure; the existence of God; intentionality and knowledge of one's own mental states; the unconscious; selves and streams of consciousness; on figuralism and the need for non-naivety in connection with our use of language. Throughout, we pay attention to meta-philosophical moments where the rationality or irrationality of certain ways of conceiving of the methods and goals of in philosophical explanation and description are entertained. We consequently pay particular attention to awareness of the different kinds of analysis on offer, and the arguments for and against reductionism and foundationalism in metaphysics.

RLST 6790b / EMST 6150b / HIST 6150b, Popular Religion in Europe, 1300–1700 Carlos Eire

Readings and discussion in recent scholarship on the history of religion in the Christian West in the late medieval and early modern periods.

RLST 6980b / AMST 7720b, Variety and Standardization Sally Promey and Jamil Drake

Variety and standardization number among Western modernity's favorite binaries, fully entangled with another sibling set of "dualities": religion and secularization. In the United States, the process of "nationing" citizens (to use Tony Bennett's term) has taken the shape and motto of a linear movement from variety to standardization: *e pluribus unum*, out of many one. Perhaps not surprisingly, given the US Constitution's stated commitment to free exercise and nonestablishment, religion invites us to explore the relationship and tension between variety and standardization in American sociopolitical life. On the one hand, religion is a site that not only accommodates

but also generates a variety of diverse identities, communities, ideals, epistemes, and practices. On the other hand, religion is a site that enforces standardization and encourages adherence and conformity to authorized ideals, knowledges, behaviors, and institutions. Under pressure of these "opposing" rubrics, variety and standardization are co-constitutive in configuring and managing racial, class, gender/sexual, and national as well as religious differences. This graduate seminar explores religion within the interstices of variety and standardization and at their intersections. Guest experts in the field(s) have been invited to present their work. Given the professors' geography of expertise, the in-class course content most closely examines variety and standardization in the context of the United States. Other geographical/chronological interest and expertise is welcome and encouraged in student projects, course readings, and class discussion.

RLST 6990a / AMST 8805a / HSAR 6720a / WGSS 7779a, Sensational Materialities: Sensory Cultures in History, Theory, and Method Sally Promey
This interdisciplinary seminar explores the sensory and material histories of (often religious) images, objects, buildings, and performances as well as the potential for the senses to spark contention in material practice. While course content focuses on United States things and religions (given the professor's areas of expertise and academic appointments), the course also considers broader geographical and categorical parameters so as to invite intellectual engagement with the most challenging and decisive developments in relevant fields, including recent literatures on material agencies. The goal is to investigate possibilities for scholarly examination of a robust human sensorium of sound, taste, touch, scent, and sight—and even "sixth senses"—the points where the senses meet material things (and vice versa) in life and practice. Topics include the cultural construction of the senses and sensory hierarchies; investigation of the sensory capacities of things; and specific episodes of sensory contention in and among various religious traditions. In addition, the course invites thinking beyond the "Western" five senses to other locations and historical possibilities for identifying the dynamics of sensing human bodies in religious practices, experience, and ideas. Course is by permission of instructor; qualified undergraduates are welcome. In order to request permission, please email the professor (sally.promey@yale.edu) with responses to the following questions: (1) Why are you interested in taking this seminar?; (2) what educational, intellectual, artistic, or other experiences do you bring to the seminar's subjects?; (3) how does the content of this course relate to your own career and/or personal aspirations?

RLST 7050a / AMST 7705a / HIST 7304a, Readings in Religion and American Society Tisa Wenger and Jamil Drake
This seminar explores intersections of religion and society in North American history from the colonial period to the present as well as methodological problems important to their study. The course is designed to give graduate students a working knowledge of the field by examining key historiographical trends and influential approaches in recent years. It is not a specialized research seminar, but it does require a basic understanding of historiography. We think together about the sources, conversation partners, methods, and key interventions of each text we read.

RLST 7210a / NELC 6580a, Introduction to Arabic and Islamic Studies Travis Zadeh
Comprehensive survey of the various subjects treated in Arabic and Islamic studies, with representative readings from each. Detailed investigation into the methods and

techniques of scholarship in the field, with emphasis on acquiring familiarity with the bibliographical and other research tools.

RLST 7540a / EMST 8185a / SPAN 7710a, The World(ing) of Tarot Todne Thomas and Nicholas Jones

This new course takes an interdisciplinary approach to the exploration of tarot. It joins together religious studies, social scientific, historical, and aesthetic approaches to teach about contexts of practice, genealogies of tarot phenomena, and its visuality. It establishes a foundational knowledge of tarot by exploring popular culture (mis)representations, tracing its longstanding eclectic history, and studying its archetypes. Conceptually, the course uses tarot as an avenue to discuss conceptual themes of materiality and aesthetics, esotericism, politics, gender, culture, and worlding. Through this guided study of tarot, we explore tarot's enduring yet contested appeal and relativize Western epistemologies, including that of the academy itself.

RLST 7730a / HIST 6229a / JDST 7261a / MDVL 7229a, Jews and the World: From the Bible through Early Modern Times Ivan Marcus

The course is a comprehensive introduction for GS students as well as YC students. It serves as a window course to pre-modern Jewish history. For YC students this can lead to taking seminars on more limited topics. For graduate students it is a good preparation for comprehensive exams and provides a model survey course to be offered later on as an instructor.

RLST 7770b / HIST 6155b / JDST 764b / MDVL 7155b, Jews in Muslim Lands from the Seventh through the Sixteenth Century Ivan Marcus

Introduction to Jewish culture and society in Muslim lands from the Prophet Muhammad to Suleiman the Magnificent. Topics include Islam and Judaism; Jerusalem as a holy site; rabbinic leadership and literature in Baghdad; Jewish courtiers, poets, and philosophers in Muslim Spain; and the Jews in the Ottoman Empire.

RLST 8190b / AMST 6630b / HSAR 6529b, Museums and Religion: The Politics of Preservation and Display Sally Promey

This interdisciplinary seminar focuses on the tangled relations of religion and museums, historically and in the present. What does it mean to "exhibit religion" in the institutional context of the museum? What practices of display might one encounter for this subject? What kinds of museums most frequently invite religious display? How is religion suited (or not) for museum exhibition and museum education? Enrollment is by permission of the instructor; qualified undergraduates are not only welcome but also encouraged to join us. There are no set prerequisites, but, assuming available seats, permission is granted on the basis of response to three questions: Why do you wish to take this course? What relevant educational or professional background/experience do you bring to the course? How does the course help you to meet your own intellectual, artistic, or career aspirations?

RLST 8331a / HIST 8831a, Psychoanalysis as Theory and Practice Omnia El Shakry

This course serves as an introduction to the psychoanalytic tradition through a reading of its foundational Freudian as well as post-Freudian texts. Centered on the "so-called Copernican revolution to which Freud himself compared his discovery," we attend primarily to the lineaments of the unconscious. Our readings will focus on Sigmund Freud and the Anglophone tradition (Klein, Winnicott, Bion, Bollas). In addition, there is special emphasis on questions of race (through Frantz Fanon and Afro-pessimism)

and religion (through new work on psychoanalysis and Islam). Throughout the seminar, we remain attuned to the elements of psychoanalysis that enable us to engage the most pressing ethical questions of our times of war and death.

RLST 8370a / SMTC 5470a, Northwest Semitic Inscriptions: Official Aramaic Jimmy Daccache
Official Aramaic is the *lingua franca* of the Persian Empire during the sixth and fourth centuries BCE. This course is designed to familiarize students with texts from Achaemenid Egypt (the abundant papyri of Elephantine and Hermopolis), Bactria, Anatolia, and Mesopotamia. The Aramaic grammar is illustrated through the texts. Prerequisite: RLST 835, or some knowledge of Aramaic or a related Semitic language.

RLST 8480a / SMTC 5230a, Intermediate Syriac I Jimmy Daccache
This two-term course is designed to enhance students' knowledge of the Syriac language by reading a selection of texts, sampling the major genres of classical Syriac literature. By the end of the year, students are familiar with non-vocalized texts and are capable of confronting specific grammatical or lexical problems. Prerequisite: RLST 839 / SMTC 5140 or knowledge of Syriac.

RLST 8740a / SMTC 5530a, Advanced Syriac I Jimmy Daccache
This course is designed for graduate students who are proficient in Syriac and is organized topically. Topics vary each term and are listed in the syllabus on Canvas.

RLST 8820b, Readings on Mind and Nature Nancy Levene
Study of works on nature, history, reason, person. Readings vary from year to year.

RLST 9050a, Theology Doctoral Seminar Kathryn Tanner
Doctoral seminar for RLST doctoral students in theology and others interested (with permission of instructor).

RLST 9550a / EALL 7530a / EMST 9600a / MDVL 9005a / NELC 5400a, Proseminar for Jobseekers in Premodern Fields Lucas Bender
This course is intended for doctoral students (particularly studying topics in the premodern humanities) in their penultimate and final years. Over the course of the semester, students work with peers as well as faculty convener to build the skills they need to present their research to others in a clear, compelling way. Topics covered include preparing application materials, interviewing, negotiating job offers, alt-ac careers, publishing, CV building, and how to succeed in postdoctoral and junior faculty positions. Weekly sessions generally include workshop time as well as presentations by the convener and visitors. This proseminar is particularly directed toward students affiliated with Archaia and medieval studies but welcomes all those with research interests in the premodern world; if space allows, students working on modern topics can also join. The broad range of primary specialties represented provides students with experience engaging with scholars outside their field, which is increasingly essential for premodernists in the modern academic world.

RLST 9800a or b, Directed Readings in Religious Studies Staff
Directed readings in religious studies.

Slavic Languages and Literatures

Humanities Quadrangle, 203.432.1300, slavic.department@yale.edu
http://slavic.yale.edu
M.A., M.Phil., Ph.D.

Chair
John MacKay (interim)

Director of Graduate Studies
Marijeta Bozovic

Professors Edyta Bojanowska, Marijeta Bozovic, John MacKay

Associate Professor Molly Brunson

Assistant Professors Jinyi Chu, Claire Roosien, Nariman Shelekpayev

Senior Lectors II Constantine Muravnik, Julia Titus

Senior Lectors I Krystyna Illakowicz, Anastasia Selemeneva, Olha Tytarenko

FIELDS OF STUDY

The graduate program of the Department of Slavic Languages and Literatures values interdisciplinary and comparative perspectives on Russian, East European, and Eurasian literatures and cultures. While maintaining a foundation in the study and teaching of language and literature, the department sees both as embedded in a global context and a broad network of cultural production. Students are encouraged to develop their primary fields of study as well as meaningful connections with other disciplines, including comparative literature, history of art, film and media studies, history and the social sciences, gender and sexuality studies, the environmental humanities, and the digital humanities.

The department's primary doctoral track is the Ph.D. in Slavic and Eurasian Literatures and Cultures, with a strong emphasis on transnational and transmedial approaches. The department also offers a combined degree in Slavic and Eurasian Literatures and Cultures and Film and Media Studies (see below). By special arrangement, the department will consider individualized ad hoc programs with other departments. Students are encouraged to complement their research and teaching interests with one of Yale's certificate programs, such as Women's, Gender, and Sexuality Studies; Film and Media Studies; Translation Studies; Environmental Humanities; or the MacMillan Center's Councils on African, European, Latin American and Iberian, and Middle East Studies.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Course Requirements All graduate students are required to take sixteen courses in their first two years of graduate study, which must include RUSS 5851, Proseminar: Theory and Methods. In addition to this one mandatory course, students must fulfill the following distributional requirements through graduate-level coursework:

- Minimum of one course on Slavic and/or Eurasian literature or culture before the eighteenth century

- Minimum of one course on eighteenth-century Slavic and/or Eurasian literature or culture
- Minimum of two courses on nineteenth-century Slavic and/or Eurasian literature or culture
- Minimum of two courses on twentieth-century Slavic and/or Eurasian literature or culture
- Minimum of one course on twenty-first-century Slavic and/or Eurasian literature or culture
- Minimum of two (but no more than four out of the required sixteen) courses outside the Slavic department.

Students who have done graduate-level coursework elsewhere may petition for up to three courses taken at another institution to count toward degree requirements, and may use any course slots freed through prior study to take additional elective courses at Yale. Language courses do not count toward the required sixteen courses.

Language Requirements Entering students are expected to have sufficient knowledge of Russian to allow for satisfactory work at the graduate level and are required to pass a departmental proficiency examination in Russian. Students must also demonstrate competence in a second foreign language, as soon as possible or by the beginning of the fifth term of study. Students may choose to pursue proficiency in a second East European or Eurasian language; in a language useful for broader access to scholarship; or in any language relevant for well-motivated comparative work. Competence in a second foreign language may be demonstrated through coursework or a reading examination.

Minor Field Students are responsible for developing a minor field of specialization in one of the following:

1. a second language or literature;
2. visual culture or one of the other arts;
3. a topic in intellectual history or a specific interdisciplinary approach; or
4. another discipline relevant to their primary interests.

To demonstrate competency in their chosen minor field, students are required to submit a minor field portfolio no later than September 1 of their third year of graduate study.

Qualifying Paper Students must submit a qualifying paper (7000–9000 words) no later than September 1 of their third year. The paper, which in many cases will be a revised version of a seminar paper, should be developed in consultation with a faculty adviser.

Comprehensive and Qualifying Examinations In early October of their third year, students will take a comprehensive examination on Russian literature and culture from the nineteenth century to the present. The comprehensive is split into two six-hour take-home exams, to be completed several days apart. This exam is meant to test the students' knowledge of the broad scope of Russian literature and culture, as well as their ability to analyze various kinds of cultural products and position specific works within their historical, cultural, and critical contexts. Students should use the

departmental reading list as a guide in preparing for this exam, but they are also welcome to draw from beyond the list in their answers. In early December of their third year, students will also take a qualifying examination based on two specialized reading lists. This exam is a one-hour oral exam with twenty-five minutes allotted to each list, evaluated by two faculty advisers and the Director of Graduate Studies. The exam is meant to test the student's knowledge of two specific areas of study, which often serve as important preparation for the development of a dissertation topic.

Pre-Prospectus Colloquium and Prospectus Presentation In early February of their third year, students will present a preliminary version of their dissertation prospectus (the pre-prospectus) at a one-hour colloquium attended by all Slavic ladder faculty. At the colloquium, students will present a brief introduction to their prospective dissertation, which will be followed by discussion and feedback. After the pre-prospectus colloquium, students will ask two faculty members to serve on their dissertation committee. These committee members will oversee the revision of the preliminary prospectus into a final draft (approximately 5000 words plus a detailed bibliography). In early April, students will present the final version of their dissertation prospectus to all students and faculty in the department. The prospectus presentation will take one hour, beginning with a brief introduction by the student and followed by discussion.

Dissertation The dissertation committee should include at least three faculty members: a chair (who must be a ladder faculty member from Slavic), one additional ladder faculty member from Slavic, and one faculty member either from Slavic, another department, or outside Yale. Students can petition to add additional committee members. Students must determine the constitution of their committee by October 1 of their fourth year. The dissertation is the culmination of the student's work in the doctoral program and an important emblem of professional competence, intellectual rigor, and academic potential. As such, it should demonstrate mastery of a defined field of research and should articulate an original and substantive contribution to knowledge. While all dissertations should have clearly defined empirical and theoretical stakes and be grounded in appropriate methodological choices, each project will approach its central questions in necessarily distinct ways: some based more heavily in archival research, others shaped more profoundly by theoretical discussions, and still others determined by entirely different disciplinary or interdisciplinary demands.

First-Chapter Talk During the spring semester of the fourth year, students will deliver a forty-five-minute talk on their first chapter to the entire department. Students will revise their chapter after the talk, submitting a final draft to their dissertation committee no later than May 1.

Teaching All graduate students are expected to teach for a minimum of four semesters, typically in the third and fourth years of study. Teaching is required to receive additional sixth-year funding. Students are usually assigned at least two semesters of language teaching and two semesters of literature/culture teaching.

Combined Ph.D. Program with Film and Media Studies

The Department of Slavic Languages and Literatures also offers, in conjunction with the Film and Media Studies Program, a combined Ph.D. in Slavic and Eurasian Literatures and Cultures and Film and Media Studies. For further details, see Film

and Media Studies in this bulletin and the department's website. Applicants to the combined program must indicate on their application that they are applying both to Film and Media Studies and to Slavic Languages and Literatures. All documentation within the application should include this information.

MASTER'S DEGREES

M.Phil. See Degree Requirements under Policies and Regulations.

M.A. The Department of Slavic Languages and Literatures does not admit students for the terminal M.A. degree, nor does it award an M.A. en route to the Ph.D. degree. If, however, a student admitted for the Ph.D. leaves the program prior to completion of the doctoral degree, the student may be eligible to receive a terminal master's degree. The student must have completed at least fifteen term courses in Slavic and/or Eurasian literature and culture, chosen in consultation with the DGS. A grade of Honors in at least two term courses and an average of High Pass in the remaining courses must be attained. Candidates must pass a departmental proficiency examination in Russian, and prove competency in a second foreign language.

More information is available on the department's website, http://slavic.yale.edu.

RUSS 5851a, Proseminar in Slavic Literature Marijeta Bozovic
Introduction to the graduate study of Russian literature. Topics include literary theory, methodology, introduction to the profession.

RUSS 6609a / CPLT 5490a, Memory and Memoir in Russian Culture Jinyi Chu
How do we remember and forget? How does memory transform into narrative? Why do we read and write memoirs and autobiography? What can they tell us about the past? How do we analyze the roles of the narrator, the author, and the protagonist? How should we understand the ideological tensions between official historiography and personal reminiscences, especially in twentieth-century Russia? This course aims to answer these questions through close readings of a few cultural celebrities' memoirs and autobiographical writings that are also widely acknowledged as the best representatives of twentieth-century Russian prose. Along the way, we read literary texts in dialogue with theories of memory, historiography, and narratology. Students acquire the theoretical apparatus that will enable them to analyze the complex ideas, e.g., cultural memory and trauma, historicity and narrativity, and fiction and nonfiction. Students acquire an in-depth knowledge of the major themes of twentieth-century Russian history—e.g., empire, revolution, war, Stalinism, and exilic experience—as well as increased skills in the analysis of literary texts. Students with knowledge of Russian are encouraged to read in the original. All readings are available in English.

RUSS 7670b / E&RS 618b, Empire in Russian Culture Edyta Bojanowska
Interdisciplinary exploration of Russia's modern imperial culture, especially of the nineteenth century. How did this culture reflect, shape, and challenge imperial reality? How did the multiethnic and multiconfessional empire figure in negotiations of Russian national identity? Other topics include versions of Russian and Soviet Orientalism and colonialism, representations of peripheral regions, relations between ethnic groups, and the role of gender and race in Russia's imperial imagination. Materials combine fiction, poetry, travel writing, painting, and film, with readings in postcolonial studies, history, political science, and anthropology. Most readings are assigned in translation, although students with a knowledge of Russian are encouraged

to read the primary texts in the original; the language of seminar discussions will be English. Students with an interest in comparative studies of empire are welcome.

SLAV 6120a / E&RS 6900a / FILM 6127a / RSEE 6120a / UKRN 6120a, Cinematic Ukraine: Culture, Identity, and Memory Olha Tytarenko

This course traces the evolution of Ukrainian cinema from the avant-garde experiments of the 1920s to the vibrant post-2014 film resurgence. Exploring themes of national identity, historical memory, and resistance to political and cultural oppression, we analyze how filmmakers have shaped Ukraine's self-conception through film. Topics include the poetic cinema of the 1960s, post-Soviet transition films, and contemporary works responding to war and cultural sovereignty. Students engage critically with cinematic language, narrative structures, and visual aesthetics while incorporating perspectives from postcolonial theory and memory studies. The course features guest lectures from Ukrainian film directors and hands-on cinematographic workshops. Weekly thematic units pair films with historical and theoretical readings, offering a dynamic exploration of Ukraine's place in global cinema and cultural history.

SLAV 6550a / E&RS 6000a / RSEE 6550a / UKRN 6550a, Reading Multicultural Ukraine Uilleam Blacker

The lands that make up today's Ukraine have, throughout history, been part of numerous empires and states, from the Romanov and Habsburg Empire to the Soviet Union via Poland, Romania, Hungary and more. These territories, where states come and go and borders shift, have been inhabited by a diverse array of peoples speaking and writing in multiple languages. Writers here wrote in Ukrainian, Russian, Yiddish, Polish, German, Crimean Tatar, and other languages. These writers are usually studied as part of separate national literatures, yet in many cases they held multiple identities, wrote in two or more languages, and belonged to more than one cultural sphere. This course views Ukraine as a richly complex region that challenges the "national literature" framework and pushes us to examine the ways in which supposedly separate literary traditions overlap and hybridize in intricate and fascinating ways. Students explore Ukraine from the Carpathians to Crimea, via Kyiv and Kharkiv, through the works of its writers, reading the work of poets at the peak of their national canons alongside forgotten and marginalized voices. All readings and class discussions are in English. Undergraduate students must obtain the permission of the instructor prior to enrolling.

Sociology

493 College Street, 203.432.3323
http://sociology.yale.edu
M.A., M.Phil., Ph.D.

Chair
Emily Erikson

Director of Graduate Studies
Jonathan Wyrtzen

Professors Julia Adams, Rene Almeling, Elijah Anderson, Scott Boorman, Nicholas Christakis, Emily Erikson, Philip Gorski, Grace Kao, Philip Smith, Jonathan Wyrtzen

Associate Professors Rourke O'Brien, Emma Zang

Assistant Professors Angel Escamilla Garcia, Yuan Hsiao, Yagmur Karakaya, Daniel Karell, David Knight, Alka Menon, Ramina Sotoudeh, j. Siguru Wahutu

FIELDS OF STUDY

Fields include comparative sociology/macrosociology; cultural sociology; economic sociology; historical sociology; life course/social stratification; mathematical sociology; medical sociology; methodology (qualitative, quantitative, computational approaches); networks; political sociology; race/gender/ethnic/minority relations; social change; social demography; social movements; theory; urban sociology.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

Qualification for admission to candidacy for the Ph.D. will take place during the student's first three years of study at Yale. A student who has not been admitted to candidacy will not be permitted to register for the seventh term of study. To qualify for candidacy the student must take twelve seminars to be completed in years one and two: four required courses (SOCY 5000, SOCY 5500, SOCY 5610, SOCY 5620) and eight electives, including at least one workshop. After completion of courses, students prepare a research paper and one field exam and defend a dissertation prospectus.

Teaching is an important part of the professional preparation of graduate students in Sociology. Students typically teach therefore in the third and fourth years of study.

COMBINED PH.D. PROGRAMS

Sociology and Black Studies

The Department of Sociology offers, in conjunction with the Department of Black Studies, a combined Ph.D. degree in sociology and Black studies.

Students accepted to the combined Ph.D. program must meet all of the requirements of the Ph.D. in sociology with the exception that, excluding the courses required, a research paper, and a field exam, combined-degree students may substitute Black studies courses for six of the twelve term courses required to qualify for the Ph.D. in sociology. For further details, see Black Studies.

Sociology and Women's, Gender, and Sexuality Studies

The Department of Sociology also offers, in conjunction with the Program in Women's, Gender, and Sexuality Studies, a combined Ph.D. in sociology and women's, gender, and sexuality studies. For further details, see Women's, Gender, and Sexuality Studies.

MASTER'S DEGREES

M.Phil. See Degree Requirements under Policies and Regulations.

M.A. Students who withdraw from the Ph.D. program may be eligible to receive the M.A. degree if they have met the requirements and have not already received the M.Phil. degree. For the M.A., students must successfully complete eight term courses, two of which must include statistics and theory. A grade of High Pass or Honors must be achieved in five of the eight required courses. Candidates in combined programs will be awarded the M.A. only when the master's degree requirements for both programs have been met.

Program materials are available at http://sociology.yale.edu.

COURSES

SOCY 5000a, Sociological Theory Emily Erikson
The course seeks to give students the conceptual tools for a constructive engagement with sociological theory and theorizing. We trace the genealogies of dominant theoretical approaches and explore the ways in which theorists contend with these approaches when confronting the central questions of both modernity and the discipline.

SOCY 5100a, Professional Seminar Jonathan Wyrtzen
This required seminar aims at introducing incoming sociology graduate students to the department and the profession. Yale Sociology faculty members are invited to discuss their research. There are minimum requirements, such as writing a book review. No grades are given; students should take for Audit. Held biweekly.

SOCY 5610a, Introduction to Methods in Quantitative Sociology Emma Zang
Introduction to methods in quantitative sociological research. Covers data description; graphical approaches; elementary probability theory; bivariate and multivariate linear regression; regression diagnostics. Includes hands-on data analysis using Stata.

SOCY 5670a, AI in Social Science Methods Daniel Karell
Social scientists have begun integrating AI technology into the designs and methods of their research projects. How are they doing so? What are the current standards and best practices? This course uses a seminar format to review, discuss, and critique how AI technologies are currently being incorporated into social science research activities. Students read recently published articles and widely discussed unpublished papers, and, through class discussion, identify the promises and pitfalls of using AI to conduct social science research. Students also learn how to justify and explain the use of AI in their own research projects. During the course, students conduct an original research project that investigates a social science topic while making use of AI in the project's design and/or methods. Prerequisite: completion of the required research methods courses in students' home program.

SOCY 5750b / PLSC 5050b, Qualitative Field Research Egor Lazarev
In this seminar we discuss and practice qualitative field research methods. The course covers the basic techniques for collecting, interpreting, and analyzing ethnographic data, with an emphasis on the core ethnographic techniques of participant observation and in-depth interviewing. All participants carry out a local research project. Open to undergraduates with permission of the instructor.

SOCY 5800a, Comparative and Historical Methods Julia Adams
This graduate seminar offers a general overview of the methodological issues and approaches that characterize comparative-historical social science research. It is also practically oriented to help students frame researchable problems, deploy comparisons to address them, work with different types of sources, and manage them as empirical materials for analysis. The course is designed for graduate students in history and the social sciences but is also open, with instructor permission, to advanced undergraduates with a strong interest in research in social science history.

SOCY 5850a / PLSC 5220a, Archival Methods and Historical Approaches in the Social Sciences Jonny Steinberg
The aim of the course is to equip students to navigate different sorts of archives, to interpret archival material, and to survey debates in the social sciences about using historical material and theory to build arguments.

SOCY 5900a, Mixed Methods Research Yuan Hsiao
Over the past decade, there has been an explosion of interest in mixed methods research, which integrates qualitative and quantitative approaches to provide a more comprehensive understanding of social phenomena. Scholars across disciplines recognize that combining these methods allows for deeper insights, richer data interpretation, and a more robust framework for addressing complex research questions. This course provides a systematic introduction to mixed methods research, covering its epistemological foundations, research design, integration strategies, and analytical techniques. Students examine the strengths and limitations of qualitative and quantitative research and explore how these approaches can be effectively combined to enhance research findings. Through the course, they gain both conceptual and practical skills for designing and evaluating mixed methods research. The course explores various mixed methods topics such as integrating epistemological concerns, different types of mixed methods designs, sampling data for mixed methods, or balancing priorities of qualitative and quantitative methods. Ultimately, students apply these concepts by designing a mixed methods research proposal that aligns with their academic interests. Open to graduate students at all levels and from any disciplinary background. This course does not require prior experience with qualitative or quantitative research, though such experience may be beneficial.

SOCY 6100a / PLSC 7340a, Comparative Research Workshop Rene Almeling and Alka Menon
This weekly workshop is dedicated to group discussion of work-in-progress by visiting scholars, Yale graduate students, and in-house faculty from Sociology and affiliated disciplines. Papers are distributed a week ahead of time and also posted on the website of the Center for Comparative Research (http://ccr.yale.edu). Students who are enrolled for credit are expected to present a paper-in-progress.

SOCY 6200a, Workshop in Cultural Sociology Philip Smith
This workshop is designed to be a continuous part of the graduate curriculum. Meeting weekly throughout both the fall and spring terms, it constitutes an ongoing, informal seminar to explore areas of mutual interest among students and faculty, both visiting and permanent. The core concern of the workshop is social meaning and its forms and processes of institutionalization. Meaning is approached as both structure and performance, drawing not only on the burgeoning area of cultural sociology but on the humanities, philosophy, and other social sciences. Discussions range widely among methodological, theoretical, empirical, and normative issues. Sessions alternate between presentations by students of their own work and by visitors. Contents of the workshop vary from term to term, and from year to year. Enrollment is open to auditors who fully participate and for credit to students who submit written work.

SOCY 6300a / AFAM 7973a, Workshop in Urban Ethnography Elijah Anderson
The ethnographic interpretation of urban life and culture. Conceptual and methodological issues are discussed. Ongoing projects of participants are presented in a workshop format, thus providing participants with critical feedback as well as the opportunity to learn from and contribute to ethnographic work in progress. Selected ethnographic works are read and assessed.

SOCY 6400a, Stratification and Inequality Workshop Daniel Karell and Rourke O'Brien
In this workshop we present and discuss ongoing empirical research work, primarily but not exclusively quantitative analyses. In addition, we address theoretical and methodological issues in the areas of the life course (education, training, labor markets, aging, as well as family demography), social inequality (class structures, stratification, and social mobility), and related topics.

SOCY 6500a, Research Topics on Human Nature and Social Networks Nicholas Christakis
This seminar focuses on ongoing research projects in human nature, behavior genetics, social interactions, and social networks.

SOCY 6900a, Workshop in Advanced Sociological Writing and Research Philip Smith
This class concerns the process of advanced writing and research that converts draft material into work ready for publication, preferably in refereed journals, or submission as a substantial grant proposal. It investigates problem definition, the craft of writing, the structure of argument and data presentation, and the nature of persuasion more generally. The aim is to teach a professional orientation that allows work that is promising to become truly polished and compelling within the full range of sociological genres. Prerequisite: permission of the instructor; participants must enter the class with suitable draft material for group analysis and discussion.

SOCY 7170a / ANTH 6841a / ENV 836a / HIST 8160a / PLSC 7790, Agrarian Societies: Culture, Society, History, and Development Louisa Lombard and Marcela Echeverri Munoz
An interdisciplinary examination of agrarian societies, contemporary and historical, Western and non-Western. Major analytical perspectives from anthropology, economics, history, political science, and environmental studies are used to develop a

meaning-centered and historically grounded account of the transformations of rural society. Team-taught.

SOCY 7201a, From Knowledge to Inaction Rene Almeling
We live in one of the wealthiest countries in the world, and yet there remain millions of Americans who do not have a home, enough food to eat, or access to health care. Academic researchers produce enormous amounts of data and knowledge about social problems like poverty, and yet the poverty rate has remained almost unchanged for fifty years. Likewise, there are reams of historical and social scientific studies about major social problems such as racism, gun violence, abortion access, and climate change. In this seminar, we examine the social processes through which all of this knowledge is ignored by policymakers and others with power to make change. How does increasing knowledge keep resulting in inaction?

SOCY 7250a, Analysis of Social Structure Scott Boorman
Emphasizing analytically integrated viewpoints, the course develops a variety of major contemporary approaches to the study of social structure and social organization. Building in part on research viewpoints articulated by Kenneth J. Arrow in *The Limits of Organization* (1974), by János Kornai in an address at the Hungarian Academy of Sciences published in 1984, and by Harrison C. White in *Identity and Control* (2nd ed., 2008), four major species of social organization are identified as focal: (1) social networks, (2) competitive markets, (3) hierarchies/bureaucracy, and (4) collective choice/legislation. This lecture course uses mathematical and computational models—and comparisons of their scientific styles and contributions—as analytical vehicles in coordinated development of the four species.

SOCY 8100a, Independent Study Jonathan Wyrtzen
By arrangement with faculty. When students register for the course online, the dropdown menu should be completed.

Spanish and Portuguese

Humanities Quadrangle, 203.432.5439, 203.432.1151
http://span-port.yale.edu
M.A., M.Phil., Ph.D.

Chair
Howard Bloch

Director of Graduate Studies
Lisa Voigt

Professors Santiago Acosta, Aníbal González-Pérez, K. David Jackson, Nicholas R. Jones, Olivia Lott, Noël Valis, Jesús Velasco, Aurélie Vialette, Lisa Voigt

Senior Lecturer II Alex Gil

Emeritus Rolena Adorno, Roberto González Echevarría

FIELDS OF STUDY

The Ph.D. program in the Department of Spanish and Portuguese explores the dynamic fields of Latin American, Luso-Brazilian, Latinx, and Iberian studies in all their rich and diverse linguistic, literary, and cultural traditions, and adopting multiple intellectual approaches. The Ph.D. program encourages students to engage with related disciplines in the humanities and social sciences, including African American Studies, Anthropology, Comparative Literature, Early Modern Studies, Film and Media Studies, History of Art, Medieval Studies, and Philosophy, as well as emerging multidisciplinary fields such as Race, Indigeneity, and Transnational Migration; Women's, Gender, and Sexuality Studies; and Digital Humanities.

The department participates in a combined Ph.D. program in Spanish and Portuguese and African American Studies offered in conjunction with the Department of African American Studies and a combined Ph.D. program in Spanish and Portuguese and Early Modern Studies offered in conjunction with the Early Modern Studies Program. Ph.D. students are also encouraged to obtain certificates from programs and areas complementary to their teaching and research interests; at Yale, such certificates exist in connection with the programs in Film and Media Studies; Public Humanities; Translation Studies; and Women's, Gender, and Sexuality Studies.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

The department requires two years of coursework, a grade of Honors in at least two of these courses each year, and a minimum grade average of High Pass. Coursework consists of fourteen elective seminars (up to four outside the department); four of the fourteen seminars as auditor (no exam or paper required), inside or outside the department; and a required course, SPAN 5000, Principles of Language Teaching and Learning. Prior to the third year, students are also expected to become proficient in two languages other than English and their primary study language (either Spanish or Portuguese); these languages could be other Romance languages, Latin, or other language families pertinent to the research interests of each student. In the third year, the student is expected to pass the qualifying examination (written and oral components) and submit and receive approval of the dissertation prospectus. Upon

completion of all predissertation requirements, including the dissertation prospectus, students are admitted to candidacy for the Ph.D.

Participation in the department's teaching and pedagogy program is a degree requirement. It consists of taking the required seminar in language pedagogy, SPAN 5000, in the second year and teaching four courses during the third and fourth years of study. Students will have the opportunity to teach beginning (L1–L2), advanced (L3–L4), and L5-level courses with supervision by the director of the language program, course directors, and department faculty members.

COMBINED PH.D. PROGRAMS

Spanish and Portuguese and Black Studies

The Department of Spanish and Portuguese also offers, in conjunction with the Department of Black Studies, a combined Ph.D. in Spanish and Portuguese and Black studies. For further details, see Black Studies.

Spanish and Portuguese and Early Modern Studies

The Department of Spanish and Portuguese also offers, in conjunction with the Early Modern Studies Program, a combined Ph.D. in Spanish and Portuguese and early modern studies. For further details, see Early Modern Studies.

MASTER'S DEGREES

M.Phil. See Degree Requirements under Policies and Regulations.

M.A. (en route to the Ph.D.) The M.A. en route is awarded upon the satisfactory completion of eight term courses and the language requirement (detailed above).

COURSES

PORT 6520a / CPLT 6570a, Clarice Lispector: The Short Stories Kenneth David Jackson

This course is a seminar on the complete short stories of Clarice Lispector (1920–1977), a master of the genre and one of the major authors of twentieth-century Brazil known for existentialism, mysticism, and feminism.

PORT 9670a, Machado de Assis: Major Novels Kenneth David Jackson

A study of the last five novels of Machado de Assis, featuring the author's world and stage of Rio de Janeiro, along with his irony and skepticism, satire, wit, narrative concision, social critiques, and encyclopedic assimilation of world literature.

SPAN 5000b / FREN 6700b / ITAL 6570b / LING 5640b, Principles of Language Teaching and Learning Staff

Introduction to the basic principles of second-language acquisition theory, focusing on current perspectives from applied linguistics, sociolinguistics, and psycholinguistics. Topics include language teaching methodology, communicative and task-based approaches, learner variables, intercultural competence, and models of assessment.

SPAN 6330a / CPLT 9013a / FILM 6900a, Third Cinema: Arts and Politics in Latin America Moira Fradinger

This seminar studies the articulation of art and politics proposed by the world renowned film movement usually identified as "Third Cinema" that took shape in

Latin America roughly between 1955 and 1982. Continental in scope, the movement has also been called "New Latin American Cinema" joining the "new waves" of the global sixties and expanding its influence throughout the countries of the Non-Aligned Movement. The seminar examines the category of "Third cinema," first formulated in Solanas's and Getino's 1969 "Manifesto Towards a Third Cinema" and opposed to "First Cinema" (Hollywood) and "Second Cinema" ("cinema d'auteur" or independent film art). The manifesto's political thinking will be framed in terms of contemporary political ideas about "the third way" or "the non-aligned third world" as well as put in dialogue with an array of film manifestos emerging at this time in the region. The seminar engages concepts such as "imperfect cinema," "urgent cinema," "cinema novo," "aesthetics of hunger," "liberation cinema"; the "camera as expropiator of image-weapons," and so forth. The seminar casts a wide net in terms of the corpus, which includes a minimum of two films per week, from countries such as Argentina, Chile, Uruguay, Brazil, Bolivia, Peru, Colombia, Venezuela, Haiti, Cuba, and Mexico. Taught in English; knowledge of Spanish and Portuguese is not required but certainly useful.

SPAN 7650a, Art and Resistance in Times of Uprising in the Global Iberian World Aurelie Vialette

This course is specifically designed to explore the relationship between the arts and the practices of resistance in times of uprising. As such, we study a corpus of texts, newspapers articles, caricatures, propaganda posters, paintings, music, photographs, movies and comic books; a corpus that helps us to think about how personal, collective and national resistance is created and constructed through culture when a conflict arises on a territory. Taught in Spanish.

SPAN 7710a / EMST 8185a / RLST 7540a, The World(ing) of Tarot Todne Thomas and Nicholas Jones

This new course takes an interdisciplinary approach to the exploration of tarot. It joins together religious studies, social scientific, historical, and aesthetic approaches to teach about contexts of practice, genealogies of tarot phenomena, and its visuality. It establishes a foundational knowledge of tarot by exploring popular culture (mis)representations, tracing its longstanding eclectic history, and studying its archetypes. Conceptually, the course uses tarot as an avenue to discuss conceptual themes of materiality and aesthetics, esotericism, politics, gender, culture, and worlding. Through this guided study of tarot, we explore tarot's enduring yet contested appeal and relativize Western epistemologies, including that of the academy itself.

SPAN 8355a / CPLT 8355a, Ciencia Ficción, Fantasía y Neogótico en la Narrativa Hispanoamericana Contemporánea Anibal González-Pérez

Graduate-level study of the speculative incorporation of scientific ideas and themes in twentieth and twenty-first century from Argentina, Bolivia, Chile, Cuba, Ecuador, Mexico, and Peru. Reading and discussion of twentieth-century precursors and founders of Spanish American science fiction, such as Jorge Luis Borges, Adolfo Bioy Casares, Hugo Correa, Angélica Gorodischer, Leopoldo Lugones, Pablo Palacio, and Clemente Palma. Followed by examples of "techno-writing," utopias, dystopias, and possible futures proposed by late twentieth and early twenty-first-century authors such as José B. Adolph, César Aira, Luis Carlos Barragán, Alberto Chimal, Liliana Colanzi, Mariana Enríquez, Yuri Herrera, Samantha Schweblin, Jorge Volpi, and Yoss, among others. Topics to be examined include posthumanism, ecofiction, and sociopolitical satire. *Taught in Spanish.*

SPAN 8595a / EMST 8336a / MDVL 7334a, Law and Humanities II: Emotions Jesus Velasco

This is the second installment of a series of graduate seminars on law and humanities. The first one dealt with the question of fiction, and this one interrogates the ways in which legal thinking and legislations are in dialogue with emotions in general, and in particular with the creation of affective spaces through specific forms of legislation and jurisprudence. During our seminar we save some time to write together and share our insights on each of the texts we read.

SPAN 9200a, Tutorial Staff

By arrangement with faculty.

SPAN 9718b / ANTH 7818b / ER&M 6606b / WGSS 7718b, Multi-Sited Ethnography: Trans-Atlantic Port Cities in Colombia and Spain Eda Pepi and Ana Ramos-Zayas

Critical to colonial, imperial, and capitalist expansion, the Atlantic offers a dynamic setting for adapting ethnographic practices to address questions around interconnected oppressions, revolts, and revolutions that are foundational to global modernity. Anchored in a Spanish and a Colombian port city, this course engages trans-Atlantic "worlding" through a multi-sited and historically grounded ethnographic lens. Las Palmas, the earliest mid-Atlantic port and Europe's first settler colony in Africa, and Cartagena, once the principal gateway connecting Spain and its American empire, illuminate urgent contemporary issues such as climate, displacement, inter-regional subjectivities, and commerce. During a spring recess field experience (March 8–16, 2026), students will immerse themselves for four nights each in Las Palmas and Cartagena, developing critical "tracking" skills that bridge ethnographic practice with cultural theory. Preparation for fieldwork includes an on-campus curriculum, organized around Cartagena and Las Palmas, and sessions with Yale Ethnography Hub faculty, covering different methodologies. As part of this broader programming, the curriculum delves as well into trans-Atlantic migrations from the Middle East, South Asia, and Africa that have transformed port cities, labor and aesthetic practices, class-making racial formations, and global geopolitics. After recess, the course shifts toward independent work, as students synthesize field-collected data and insights into a collaborative multimodal group project and individual ethnographic papers. Instructor Permission: Interested students must apply by November first via the course website. This course does not have a shopping period, but students may withdraw by the university deadlines in April. Prerequisite: Conversational and reading proficiency in Spanish. Readings are in English and Spanish, with assignments accepted in either language.

Statistics and Data Science

219 Prospect Street, 203.432.0666
http://statistics.yale.edu
M.A., M.S., Ph.D.

Chair
Yihong Wu

Directors of Graduate Studies
John Emerson (219 Prospect, john.emerson@yale.edu)
Zhou Fan (219 Prospect, zhou.fan@yale.edu)

Professors Donald Andrews (*Economics*), P.M. Aronow, Andrew Barron, Jeffrey Brock (*Mathematics*), Joseph Chang, Katarzyna Chawarska (*Child Study Center*), Xiaohong Chen (*Economics*), Yuejie Chi, Nicholas Christakis (*Sociology*), Ronald Coifman (*Mathematics*), James Duncan (*Radiology and Biomedical Imaging*), John Emerson (*Adjunct*), Alan Gerber (*Political Science*), Mark Gerstein (*Molecular Biophysics and Biochemistry*), Anna Gilbert, John Hartigan (*Emeritus*), Edward Kaplan (*School of Management*), Harlan Krumholz (*Internal Medicine*), John Lafferty, Zongming Ma, David Pollard (*Emeritus*), Nils Rudi (*School of Management*), Jasjeet Sekhon, Donna Spiegelman (*Biostatistics*), Daniel Spielman, Hemant Tagare (*Radiology and Biomedical Engineering*), Van Vu (*Mathematics*), Yihong Wu, Heping Zhang (*Biostatistics*), Hongyu Zhao (*Biostatistics*), Harrison Zhou, Xiang Zhou, Steven Zucker (*Computer Science*)

Associate Professors Forrest Crawford (*Biostatistics*, *Adjunct*), Zhou Fan, Joshua Kalla (*Political Science*), Amin Karbasi (*Electrical Engineering*), Vahideh Manshadi (*School of Management/Operations*), Sekhar Tatikonda

Assistant Professors Elisa Celis, Sinho Chewi, Melody Huang (*Political Science*), Roy Lederman, Shuangping Li, Lu Lu, Theodor Misiakiewicz, Omar Montasser, Dustin Scheinost (*Radiology and Biomedical Imaging*), Ramina Sotoudeh (*Sociology*), Andre Wibisono (*Computer Science*), Zhuoran Yang, Ilker Yildirim (*Psychology*), Ilias Zadik

FIELDS OF STUDY

Fields of study include the main areas of statistical theory (with emphasis on foundations, Bayes theory, decision theory, nonparametric statistics), probability theory (stochastic processes, asymptotics, weak convergence), information theory, bioinformatics and genetics, classification, data mining and machine learning, neural nets, network science, optimization, statistical computing, and graphical models and methods.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE IN STATISTICS AND DATA SCIENCE

There is no foreign language requirement. Students take at least twelve courses, usually during the first two years. The department requires that students take S&DS 6250, Statistical Case Studies, and S&DS 6260, Practical Work. The department strongly recommends that students take:

S&DS 6000	Advanced Probability	1
S&DS 6100	Statistical Inference	1

S&DS 6120	Linear Models	1
S&DS 6310	Optimization and Computation	1
or S&DS 6320	Advanced Optimization Techniques	
S&DS 6610	Data Analysis	1
S&DS 6650	Intermediate Machine Learning	1

Substitutions are possible with the permission of the director of graduate studies (DGS); courses from other complementary departments such as Mathematics and Computer Science are encouraged. With the permission of the DGS and under special circumstances, appropriate courses may be taken at the undergraduate level in departments outside of Statistics and Data Science to fulfill these elective requirements.

The qualifying examination consists of three parts: a written report on an analysis of a data set, one or more written examination(s), and an oral examination. The examinations are taken as scheduled by the department. All parts of the qualifying examination must be completed before the beginning of the third year. A prospectus for the dissertation should be submitted no later than the first day of spring recess in the third year. The prospectus must be accepted by the department before the end of the third year if the student is to register for a fourth year. Upon successful completion of the qualifying examination and the prospectus (and meeting of graduate school requirements), the student is admitted to candidacy.

Students normally serve as teaching fellows for several terms to acquire professional training. All students are required to be teaching fellows for a minimum of two terms, regardless of the nature of their funding. The timing of this teaching is at the discretion of the DGS.

COMBINED PH.D. PROGRAM

The Department of Statistics and Data Science also offers, in conjunction with the Department of Political Science, a combined Ph.D. in Statistics and Data Science and Political Science. For further details, see Political Science.

MASTER'S DEGREES

Three different M.A. in Statistics are offered. All require completion of eight term courses approved by the DGS; of which one must be in probability, one must be in statistical theory, and one must be in data analysis. The remaining five elective courses may include courses from other departments and, with the permission of the DGS and under special circumstances, appropriate courses may be taken at the undergraduate level in departments outside of Statistics and Data Science.

M.A. in Statistics (en route to the Ph.D. in Statistics and Data Science) This degree requires an average grade of HP or higher, and two terms of residence.

M.A. in Statistics (en route to the Ph.D. in other areas of study) Pursuit of this degree requires an application process managed by the DGS of Statistics and Data Science followed by approval from the DGSs from both programs and the cognizant Graduate School dean. All eight courses for this degree must earn grades of HP or higher. This degree also has an academic teaching fellow requirement, to be determined by the DGSs from both programs and the cognizant graduate school dean.

Terminal M.A. in Statistics Students are also admitted directly to a terminal master of arts program in Statistics. Students must earn an average grade of HP or higher and receive at least one grade of Honors. Full-time students must take a minimum of four courses per term. Part-time students are also accepted into the program. All students are expected to complete two terms of full-time tuition and residence, or the equivalent, at Yale. See Degree Requirements: Terminal M.A./M.S. Degrees, under Policies and Regulations.

Terminal M.S. in Statistics and Data Science Students are also admitted directly to a terminal master of science program in Statistics and Data Science. To qualify for the M.S., the student must successfully complete an approved program of twelve term courses with an average grade of HP or higher and receive at least two grades of Honors, chosen in consultation with the DGS. With the permission of the DGS and under special circumstances, appropriate courses may be taken at the undergraduate level in departments outside of Statistics and Data Science to fulfill elective requirements. Full-time students must take a minimum of four courses per term. Part-time students are also accepted into the program. All students are expected to complete three terms of full-time tuition and residence, or the equivalent, at Yale. See Degree Requirements: Terminal M.A./M.S. Degrees, under Policies and Regulations.

Program information is available online at http://statistics.yale.edu.

COURSES

S&DS 5000a or b, Introductory Statistics Ethan Meyers
An introduction to statistical reasoning. Topics include numerical and graphical summaries of data, data acquisition and experimental design, probability, hypothesis testing, confidence intervals, correlation and regression. Application of statistical concepts to data; analysis of real-world problems.

S&DS 5200b, Intensive Introductory Statistics Robert Wooster
An introduction to statistical reasoning designed for students with particular interest in data science and computing. Using the R language, topics include exploratory data analysis, probability, hypothesis testing, confidence intervals, regression, statistical modeling, and simulation. Computing is taught and used extensively throughout the course. Application of statistical concepts to the analysis of real-world data science problems.

S&DS 5230a or b, YData: An Introduction to Data Science Staff
Computational, programming, and statistical skills are no longer optional in our increasingly data-driven world; they are essential for opening doors to manifold research and career opportunities. This course aims to dramatically enhance students' knowledge and capabilities in fundamental ideas and skills in data science, especially computational and programming skills and inferential thinking. It emphasizes the development of these skills while providing opportunities for hands-on experience and practice. The course is designed to be accessible to students with little or no background in computing, programming, or statistics, but also engaging for more technically oriented students through extensive use of examples and hands-on data analysis. Python 3 is the computing language used. Enrollment is limited.

S&DS 5300a or b / PLSC 5300b, Data Exploration and Analysis Jonathan Reuning-Scherer
Survey of statistical methods: plots, transformations, regression, analysis of variance, clustering, principal components, contingency tables, and time series analysis. The R computing language and web data sources are used.

S&DS 5380a, Probability and Statistics Robert Wooster
Fundamental principles and techniques of probabilistic thinking, statistical modeling, and data analysis. Essentials of probability: conditional probability, random variables, distributions, law of large numbers, central limit theorem, Markov chains. Statistical inference with emphasis on the Bayesian approach: parameter estimation, likelihood, prior and posterior distributions, Bayesian inference using Markov chain Monte Carlo. Introduction to regression and linear models. Computers are used throughout for calculations, simulations, and analysis of data. Prerequisite: after or concurrently with MATH 118 or MATH 120.

S&DS 5400b, An Introduction to Probability Theory Robert Wooster
Introduction to probability theory. Topics include probability spaces, random variables, expectations and probabilities, conditional probability, independence, discrete and continuous distributions, central limit theorem, Markov chains, and probabilistic modeling. *This course may be appropriate for non-S&DS graduate students.* Prerequisite: MATH 115 or equivalent.

S&DS 5410a, Probability Theory Sinho Chewi
A first course in probability theory: probability spaces, random variables, expectations and probabilities, conditional probability, independence, some discrete and continuous distributions, central limit theorem, Markov chains, probabilistic modeling. Prerequisite: calculus of functions of several variables.

S&DS 5420b, Theory of Statistics Zhou Fan
Principles of statistical analysis: maximum likelihood, sampling distributions, estimation, confidence intervals, tests of significance, regression, analysis of variance, and the method of least squares. Prerequisite: S&DS 541.

S&DS 5510b / ECE 5021b, Stochastic Processes Ilias Zadik
Introduction to the study of random processes, including Markov chains, Markov random fields, martingales, random walks, Brownian motion, and diffusions. Techniques in probability such as coupling and large deviations. Applications chosen from image reconstruction, Bayesian statistics, finance, probabilistic analysis of algorithms, genetics, and evolution.

S&DS 5630b, Multivariate Statistical Methods for the Social Sciences Jonathan Reuning-Scherer
An introduction to the analysis of multivariate data. Topics include principal components analysis, factor analysis, cluster analysis (hierarchical clustering, k-means), discriminant analysis, multidimensional scaling, and structural equations modeling. Emphasis on practical application of multivariate techniques to a variety of examples in the social sciences. Students complete extensive computer work using either SAS or SPSS. Prerequisites: knowledge of basic inferential procedures, experience with linear models (regression and ANOVA). Experience with some statistical package and/or familiarity with matrix notation is helpful but not required.

S&DS 565ob, Introductory Machine Learning John Lafferty
This course covers the key ideas and techniques in machine learning without the use of advanced mathematics. Basic methodology and relevant concepts are presented in lectures, including the intuition behind the methods. Assignments give students hands-on experience with the methods on different types of data. Topics include linear regression and classification, tree-based methods, clustering, topic models, word embeddings, recurrent neural networks, dictionary learning, and deep learning. Examples come from a variety of sources including political speeches, archives of scientific articles, real estate listings, natural images, and others. Programming is central to the course and is based on the Python programming language.

S&DS 5720a, YData: Data Science for Political Campaigns Joshua Kalla
Political campaigns have become increasingly data driven. Data science is used to inform where campaigns compete, which messages they use, how they deliver them, and among which voters. In this course, we explore how data science is being used to design winning campaigns. Students gain an understanding of what data is available to campaigns, how campaigns use this data to identify supporters, and the use of experiments in campaigns. The course provides students with an introduction to political campaigns, an introduction to data science tools necessary for studying politics, and opportunities to practice the data science skills presented in S&DS 523.

S&DS 5730b, YData: Analysis of Baseball Data Ethan Meyers
The field of data science aims to extract insights from large data sets that often contain random variation. Baseball is a game that contains a high degree of randomness, and because professional baseball has been played since the nineteenth century, a large amount of data has been collected about players' performance. In this class we use baseball data to understand key concepts in data science including data visualization, data wrangling, and statistical inference. To understand these concepts, we analyze data that include season-level statistics going back to the 1870s, play-by-play statistics going back to the 1930s, and pitch trajectory statistics going back to 2006. The course uses the Python programming language and is paced to be accessible to students who have previously taken or are currently enrolled in S&DS 523. Co-requisite: S&DS 523.

S&DS 6000a, Advanced Probability Shuangping Li
Measure theoretic probability, conditioning, laws of large numbers, convergence in distribution, characteristic functions, central limit theorems, martingales. Some knowledge of real analysis is assumed.

S&DS 6010b, Advanced Topics in Probability Sekhar Tatikonda
Continuation of S&DS 600. Topics vary and may include martingales, Brownian motion, stochastic calculus, weak convergence, random matrix theory, concentration, large deviations, and Gibbs measures. Prerequisites: measure theoretic probability at the level of S&DS 600, stochastic processes at the level of S&DS 551, an appreciation for proofs.

S&DS 6020a, High-Dimensional Probability and Applications Zhou Fan
This course covers techniques for studying high-dimensional probabilistic problems, with a focus on non-asymptotic methods that find common use in applications across statistics, machine learning, computer science, and engineering. Topics covered include tail bounds for i.i.d. sums and martingale differences, concentration inequalities for non-linear functions, matrix concentration inequalities, suprema of Gaussian

processes, and interpolation techniques for understanding universality of high-dimensional phenomena. Prerequisite: S&DS 351b/551b, S&DS 400/600 (may be taken concurrently), or permission of instructor.

S&DS 6030a, Advanced Stochastic Processes Sekhar Tatikonda
Martingales, Brownian motion, stochastic integration, stochastic differential equations, general theory of Markov processes, and stochastic optimal control. Prerequisites: measure theoretic probability at the level of S&DS 6000, stochastic processes at the level of S&DS 5510, and an appreciation for proofs.

S&DS 6100a, Statistical Inference Theodor Misiakiewicz
A systematic development of the mathematical theory of statistical inference covering methods of estimation, hypothesis testing, and confidence intervals. An introduction to statistical decision theory. Knowledge of probability theory at the level of S&DS 541 is assumed.

S&DS 6120a, Linear Models Zongming Ma
The geometry of least squares; distribution theory for normal errors; regression, analysis of variance, and designed experiments; numerical algorithms (with particular reference to the R statistical language); alternatives to least squares. Prerequisites: linear algebra and some acquaintance with statistics.

S&DS 6140b / PLSC 5030b, Causal Inference Melody Huang
This course provides an intensive introduction to the statistical theory and practice of causal inference. Topics include: the potential outcomes framework, experimental design, selection on observables, instrumental variables, difference-in-differences, and panel data. Prerequisite: PLSC 500 or equivalent. Students are expected to come in with prior knowledge about statistical inference, regression/linear models, and statistical computing in R.

S&DS 6170b / PLSC 5110b, Advances in Large Language Models: Theory and Applications Jas Sekhon
This seminar explores recent advances in foundational language models (LLMs), with an emphasis on practical techniques to enhance their reasoning abilities. Students gain hands-on experience experimenting with frontier LLMs and post-inference algorithms to improve these models' reasoning capabilities. We also cover multiple cutting-edge papers on LLMs to provide a deeper understanding of the latest research and developments in this field. It is assumed that students come with a background in machine learning. A good background would be provided by S&DS 265/565, 365/665, or equivalent, plus some experience with applications and statistical computing. Some prior experience with deep learning will be assumed. Highly motivated undergraduates are very welcome and encouraged to apply to join the course.

S&DS 6180b, Asymptotic Statistics Zongming Ma
The course focuses on large sample theory. Time permitting, it extends to topics in high-dimensional statistical inference. It is a natural continuation of S&DS 610, Statistical Inference, in the S&DS Ph.D.-level mathematical statistics sequence. Enrollment is limited. Prerequisites: S&DS 600, 610, and permission of the instructor.

S&DS 6250a or b, Statistical Case Studies Staff
Statistical analysis of a variety of statistical problems using real data. Emphasis on methods of choosing data, acquiring data, assessing data quality, and the issues posed

by extremely large data sets. Extensive computations using R. Enrollment limited; requires permission of the instructor.

S&DS 6260a or b, Practical Work Jay Emerson
Individual one-term projects, with students working on studies outside the department, under the guidance of a statistician.

S&DS 6270a and S&DS 6280a or b, Statistical Consulting Jay Emerson
Statistical consulting and collaborative research projects often require statisticians to explore new topics outside their area of expertise. This course exposes students to real problems, requiring them to draw on their expertise in probability, statistics, and data analysis. Students complete the course with individual projects supervised jointly by faculty outside the department and by one of the instructors. Students enroll for both terms (S&DS 627 and 628) and receive one credit at the end of the year. Enrollment limited; requires permission of the instructor. ½ Course cr per term

S&DS 6610b, Data Analysis Brian Macdonald
By analyzing data sets using the R statistical computing language, a selection of statistical topics are studied: linear and nonlinear models, maximum likelihood, resampling methods, curve estimation, model selection, classification, and clustering. Prerequisite: after or concurrent with S&DS 542.

S&DS 6630b, Computational Mathematics Situational Awareness and Survival Skills Roy Lederman
Are you using a computer to analyze data? Will the computer ever finish processing the data? Will the result be junk? Will you recognize that it is junk? We discuss the difference between math on paper and math on a computer and the difference between general programming and implementing mathematics on a computer. We experience benign mathematical operations failing catastrophically without any error message. We experience mathematically equivalent operations taking anywhere between a fraction of a second and a lifetime. We develop situational awareness and survival skills for this harsh environment. We discuss algorithms, complexity, numerical computation, linear algebra, data analysis, programming, and prototyping. Assignments include theory, programming, data analysis, individual work, and collaborative work. We use C (optionally, FORTRAN) and Python. Making mistakes on assignments and respectful class discussions of insights from such mistakes are integral parts of the course. Prerequisites: linear algebra, multivariate calculus, and programming experience (any language). Prior experience with C, FORTRAN, or Python is recommended but not required; students unfamiliar with these languages must be comfortable independently learning them during the course. Limited size. Instructor permission is required.

S&DS 6640b, Information Theory Yihong Wu
Foundations of information theory in communications, statistical inference, statistical mechanics, probability, and algorithmic complexity. Quantities of information and their properties: entropy, conditional entropy, divergence, redundancy, mutual information, channel capacity. Basic theorems of data compression, data summarization, and channel coding. Applications in statistics.

S&DS 6650a or b, Intermediate Machine Learning Staff
S&DS 365 is a second course in machine learning at the advanced undergraduate or beginning graduate level. The course assumes familiarity with the basic ideas and techniques in machine learning, for example as covered in S&DS 265. The course

treats methods together with mathematical frameworks that provide intuition and justifications for how and when the methods work. Assignments give students hands-on experience with machine learning techniques, to build the skills needed to adapt approaches to new problems. Topics include nonparametric regression and classification, kernel methods, risk bounds, nonparametric Bayesian approaches, graphical models, attention and language models, generative models, sparsity and manifolds, and reinforcement learning. Programming is central to the course, and is based on the Python programming language and Jupyter notebooks.

S&DS 6690a, Statistical Learning Theory Omar Montasser
This course covers classical topics and recent advances in statistical learning theory. This includes topics such as PAC learning, VC theory, boosting, and online learning. We explore statistical and computational aspects, with an emphasis on developing a rigorous quantitative understanding of key machine learning concepts. A second aim is to introduce technical tools that help with designing learning algorithms and proving learning guarantees. Prerequisites: Mathematical maturity and comfort with proof-oriented courses. Background in probability (e.g., S&DS 241), machine learning (e.g., S&DS 265), and algorithms (e.g., CPSC 365). Familiarity with basic concepts in computational complexity (e.g., NP-hardness) is helpful but not required.

S&DS 6890a, Scientific Machine Learning Lu Lu
There are two main branches of technical computing: scientific computing and machine learning. Recently, there has been a convergence of the two disciplines in the emerging scientific machine learning (SciML) field. The main objective of this course is to teach theory, algorithms, and implementation of SciML techniques to graduate students. This course entails various methods to solve a broad range of computational problems frequently encountered in solid mechanics, fluid mechanics, nondestructive evaluation of materials, systems biology, chemistry, and non-linear dynamics. The topics in this course cover multi-fidelity learning, physics-informed neural networks, deep neural operators, uncertainty quantification, and parallel computing. Certain materials are discussed through student presentations of selected publications in the area. Students should have prior coursework in advanced calculus, linear algebra, and probability. Having a background in scientific computing, Python, and/or machine learning is helpful but not mandatory.

S&DS 6900a or b, Independent Study Jay Emerson
By arrangement with faculty. Approval of DGS required.

S&DS 6950b, Summer Internship in Statistics and Data Science Jay Emerson
The purpose of this course is to provide students with the opportunity to gain practical experience in statistics and data science. Students who identify a suitable summer internship consult with the DGS and prepare a one-page description of the plan. The internship must be full-time: 35–40 hours per week for 10–12 weeks during the summer. Upon completion of the internship, the student must submit a written report of the work to the instructor no later than October 1. Prerequisites: completion of at least one term of the M.S. program (or the M.A. program if transferring into the M.S. program) and permission of the DGS.

S&DS 6980a, Research Seminar in Mathematical Statistics Harrison Zhou
This course equips students with the skills to critically understand mathematical statistics papers and deliver professional seminar presentations. The instructor selects

high-quality papers from *The Annals of Statistics*, covering diverse topics such as LLMs, diffusion, reinforcement learning, deep learning, and causal inference. Enrollment is limited; requires permission of the instructor.

S&DS 7000a or b, Departmental Seminar Staff
Presentations of recent breakthroughs in statistics and data science. 0 Course cr

Translational Biomedicine

Boyer Center for Molecular Medicine BCMM110, 203.737.4628
https://medicine.yale.edu/ptb/
M.S., M.Phil., Ph.D.

Director
Megan King

Associate Director
Richard Kibbey

Directors of Graduate Studies
Richard Kibbey
Megan King

Director of Graduate Admissions
Jonathan Bogan

Professors Nita Ahuja (*Surgery*; *Pathology*), Fadi Akar (*Cardiovascular Medicine; Biomedical Engineering*), Anton Bennett (*Pharmacology; Comparative Medicine)*, Jonathan Bogan (*Endocrinology*; *Cell Biology*), Angelique Bordey (*Neurosurgery*), Kristen Brennand (*Psychiatry*), Lloyd Cantley (*Medicine/Nephrology*; *Cellular and Molecular Physiology*), Michael Caplan (*Cellular And Molecular Physiology*; *Cell Biology*), Keith Choate (*Dermatology*), Joseph Contessa (*Therapeutic Radiology*; *Pharmacology*), Marie Egan (*Pediatrics*; *Cellular and Molecular Physiology*), Richard Flavell (*Immunobiology*), Michael Girardi (*Dermatology*), Fred Gorelick (*Medicine/ Digestive Diseases*; *Cell Biology*), Jaime Grutzendler (*Neurology*), David Hafler (*Immunology*; *Neurology*), Stephanie Halene (*Hematology*; *Pathology*), Erica Herzog (*Pathology*; *Pulmonary, Critical Care, and Sleep Medicine*), Naftali Kaminski (*Medicine*; *Pulmonary*), Mustafa Khokha (*Genetics*; *Pediatrics*), Richard Kibbey (*Medicine/ Endocrinology*; *Cellular and Molecular Physiology*), Diane Krause (*Pathology; Cell Biology*; *Laboratory Medicine*), Mark Lemmon (*Pharmacology*), Chuan-Ju Liu (*Orthopaedics and Rehabilitation*), Ruth Montgomery (*Epidemiology*; *Pathology*), Katerina Politi (*Pathology*), Gerald Shulman (*Medicine/Endocrinology*; *Cellular And Molecular Physiology*), Stefan Somlo (Medicine/*Nephrology*; *Genetics*), Roel Verhaak (*Neurosurgery*), Lawrence Young (*Medicine/Cardiology*; *Cellular And Molecular Physiology*), David Zenisek (*Cellular and Molecular Physiology*; *Ophthalmology*)

Associate Professors Titus Boggon (*Pharmacology*; *Molecular Biophysics and Biochemistry*), Demetrios Braddock (*Pathology*), Emanuela Bruscia (*Pediatric Pulmonology, Allergy, Immunology and Sleep Medicine*), Christopher Bunick (*Dermatology*), Engin Deniz (*Pediatrics*, *Critical Care*), Brian Hafler (*Ophthalmology and Visual Science*; *Pathology*), Monique Hinchcliff (*Rheumatology*), Caroline Johnson (*Environmental Health Sciences*), Megan King (*Cell Biology*; *Molecular, Cellular, and Developmental Biology*; *Therapeutic Radiology*), Daryl Klein (*Pharmacology*), Liza Konnikova (*Neonatal-Perinatal Medicine*), Madhav Menon (*Kidney Transplantation, Nephrology*), Peggy Myung (*Dermatology*; *Pathology*) Don Nguyen (*Pathology*), Richard Pierce (*Pediatrics*), Renato Polimanti (*Psychiatry*), Faye Rogers (*Therapeutic Radiology*), Kurt Schalper (*Medical Oncology*; *Pathology*)

Assistant Professors David Alagpulinsa (*Comparative and Cardiovascular Medicine*), David Braun (*Medical Oncology*), Irene Chernova (*Medicine/Nephrology*), William Damsky (*Dermatology*; *Dermatopathology*), Sarah Fineberg (*Psychiatry*), Salil Garg (*Laboratory Medicine*), Vikas Gupta (*Medicine/Endocrinology*; *Digestive Diseases*), Won Jae Huh (*Pathology*), Mark Lee (*Laboratory Medicine*), Goran Micevic (*Dermatology*), Janitza Montalvo-Ortiz (*Psychiatry*), Ian Odell (*Dermatology*), Emily Olfson (*Child Study Center*), Micha Sam Raredon (*Anesthesiology*), Jason Sheltzer (*Surgery Oncology*; *Genetics*), Dennis Shung (*Medicine/Digestive Diseases*), Mancy Tong (*Obstetrics and Gynecology*), Wan-Ling Tseng (*Child Study Center*), Juan Vasquez (*Pediatrics*, *Hematology/Oncology*), Daniel Vatner (*Endocrinology*)

Lecturer Agnès Vignery (*Cell Biology*)

FIELDS OF STUDY

Cancer biology: leukemogenesis, metastasis, growth control, immune checkpoint therapy. Cell biology: cytoskeleton, nuclear structure and dynamics. Cell signaling: kinases, phosphatases, growth signaling. Epithelial cell biology: epithelial patterning, skin development and disease. Immunology: autoimmune disease, immunotherapy, systems biology. Genetics: disease etiology, birth defects. Lung function: cystic fibrosis, lung disease, idiopathic lung fibrosis. Maternal-fetal medicine. Metabolism: signaling and systems biology, diabetes. Neuroscience: pathogenesis of brain disease, neurogenomics. Organ homeostasis and injury: pancreatitis, kidney injury, macular degeneration, scleroderma. Physiology.

Students seeking admission into the Ph.D. program in Translational Biomedicine (PTB) apply to the Translational Molecular Medicine, Pharmacology, and Physiology (TMMPP) track within the interdepartmental graduate program in Biological and Biomedical Sciences (BBS), https://medicine.yale.edu/bbs/molmed/.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

The primary mission of the PTB is to prepare the next generation of translational scientists to be forward-thinking leaders in academic research, medicine, education, industry, and society. To achieve this mission, the PTB leverages its interdepartmental structure to break down silos between disciplines and to foster a collaborative community comprising laboratories across all the departments at the Yale School of Medicine. The PTB emphasizes a flexible curriculum, personalized professional development, and a supportive environment in which all participants can reach their full potential.

The first three to four terms of graduate study are spent in formal course work, independent reading, laboratory rotations, and early thesis work. Each student's program of study is designed in consultation with the TMMPP Track director during the first year and with an advisory committee of the PTB that includes the PTB director of graduate studies once the student affiliates with the PTB, typically in the spring of the first year of study. The goal is to provide flexibility, rigor, and breadth while ensuring that students are well prepared to meet the PTB course requirements and to have a strong foundation for their thesis research. Students also participate in at least three laboratory rotations during their first two terms.

PTB coursework includes at least five graduate-level courses typically taken over the first four terms. Students must meet the graduate school requirement of a grade of Honors in two courses, taking additional courses to fulfill this requirement if necessary. The graduate school requires this requirement be met by the end of the second year.

PTB students are expected to take at least one of the following: C&MP 5500, PATH 5690, or PHAR 5504 as well as PTB 5604 and the year-long graduate seminar course in the TMMPP Track. They are also required to take one course in biostatistics (from several offered). In their second year, PTB students are required to take four modules (one year) of the Mentored Clinical Experience (MCE), PTB 5610 and PTB 5611, and the PTB Grant Writing Course, PTB 5605.

A qualifying examination is given during the second year of study and consists of a written research proposal based on the proposed thesis project followed by an oral exam. Within one year after a successful qualifying exam, the student schedules the first thesis committee meeting and provides an updated summary of the thesis project (in the form of a revised Specific Aims page). At this meeting the student is considered for advancement to candidacy, which must occur prior to the end of year three. In addition to all other requirements, students must successfully complete the Responsible Conduct in Research course, PTB 5650, prior to the end of their first year of study. In their fourth year of study, all students must successfully complete PTB 5503, Responsible Conduct of Research, 4th-Year Refresher.

An important dimension of graduate training in the program in Translational Biomedicine is the acquisition of teaching skills through participation in courses appropriate for the student's academic interests. Ph.D. students are expected to participate in two terms (or the equivalent) of teaching.

M.D.-PH.D. STUDENTS

M.D.-Ph.D. students who affiliate with the Ph.D. program in Translational Biomedicine follow a different course than other incoming graduate students, resulting in some modifications of the academic requirements for the Ph.D. portion of the M.D.-Ph.D. degree. Typically, one or more research rotations are done during the first two years of medical school. (In many cases, several rotations are done during the summer between year one and year two.) No set number of research rotations is required. M.D.-Ph.D. students officially affiliate with the Ph.D. program in Translational Biomedicine after selecting a thesis adviser and consulting with the Director of Graduate Studies (DGS). M.D.-Ph.D. students interested in affiliating with the PTB are encouraged to consult with the DGS as early as possible to determine an appropriate set of courses tailored to the student's background and interests.

The courses, rotations, and teaching requirements for M.D.-Ph.D. students entering the PTB (see below) may be modified from the normal requirements for Ph.D. students with permission of the DGS. Although five graduate-level courses are still required, some medical school courses are recognized. M.D.-Ph.D. students must also meet the graduate school requirement of a grade of Honors in two courses, taking additional courses beyond the five required in the department to fulfill this requirement if necessary. Students must also maintain an average grade of High Pass in all courses. M.D./Ph.D students are also not required to take the MCE course. In addition, only one term of teaching is required.

M.D.-Ph.D. students will be admitted to candidacy once they have completed their course work, obtained two Honors grades, passed their qualifying exam, and had their dissertation prospectus accepted by their thesis committee.

MASTER'S DEGREES

M.Phil. See Degree Requirements under Policies and Regulations.

M.S. Students are not admitted for this degree. They may receive this recognition if they leave Yale without completing the qualifying exam but have satisfied the course requirements as described above as well as the graduate school's Honors requirement. Students who are eligible for or who have already received the M.Phil. will not be awarded the M.S.

Prospective applicants are encouraged to visit the PTB website at https://medicine.yale.edu/ptb.

PTB 5503b / C&MP 5503b / PATH 5503b / PHAR 5503b, Responsible Conduct of Research, 4th-Year Refresher Staff

The NIH requires that students receive training in the responsible conduct of research every four years. This mandatory course meets that requirement for fourth-year students. The course meets a total of eight hours (four two-hour) sessions. Faculty facilitate discussions based on RCR topics.

PTB 5504a / PHAR 5504a, Molecular Mechanisms of Drug Actions Wei Mi and Karen Anderson

This course provides fundamental background in core principles of pharmacology, molecular mechanisms of drug action, and important research areas in contemporary pharmacology. Material covered includes quantitative topics in pharmacology such as drug-receptor theory, multiple equilibria and kinetics, pharmacokinetics, therapeutic drug monitoring, and drug metabolism. Specific content on the mechanisms of drug action includes autonomics; ion channel blockers; endocrine agents (hormones); cardiovascular drugs (ACE inhibitors, organic nitrates, β-blockers, acetylsalicylic acid); antimicrobials (anti-bacterials, fungals, and virals); anti-cancer, anti-inflammatory, anti-asthma, and anti-allergy drugs; and immunosuppressants. Students learn how to model drug-receptor interaction parameters and how to analyze steady-state enzyme kinetics and inhibition data. Senior students serving as teaching assistants lead discussion groups covering problem sets, review topics or assigned manuscripts. The course includes a self-study component consisting of video modules produced in collaboration with Yale faculty and Merck that explore the preclinical and clinical phases of drug development.

PTB 5610a / C&MP 5610a, Medical Research Scholars Program: Mentored Clinical Experience Yelizaveta Konnikova

The purpose of the Mentored Clinical Experience (MCE), an MRSP-specific course, is to permit students to gain a deep understanding of and appreciation for the interface between basic biomedical research and its application to clinical practice. The MCE is intended to integrate basic and translational research with direct exposure to clinical medicine and patients afflicted with the diseases or conditions under discussion. The course provides a foundation and a critically important forum for class discussion because each module stimulates students to explore a disease process in depth over four ninety-minute sessions led by expert clinician-scientists. The structure incorporates

four perspectives to introduce the students to a particular disease or condition and then encourages them to probe areas that are not understood or fully resolved so they can appreciate the value and challenge inherent in using basic science to enhance clinical medicine. Students are provided biomedical resource material for background to the sessions as well as articles or other publicly available information that offers insight to the perspective from the non-scientific world. During this course students meet with patients who have experienced the disease and/or visit and explore facilities associated with diagnosis and treatment of the disease process. Students are expected to prepare for sessions, to participate actively, and to be scrupulously respectful of patients and patient facilities. Prior to one of the sessions students receive guidance as to what they will observe and how to approach the experience; and at the end of the session, the students discuss their thoughts and impressions. All students receive HIPAA training and appropriate training in infection control and decorum relating to patient contact prior to the course.

PTB 5620a and PTB 5622b / C&MP 5511a and C&MP 5512b / PATH 5620a and PATH 5622b / PHAR 5511a and PHAR 5512b, Laboratory Rotations Staff
TMMPP laboratory rotations, fall term.

PTB 5629a and PTB 5630b / C&MP 5629a and C&MP 5630b / PATH 5679a and PATH 5680b / PHAR 5501a and PHAR 5502b, Seminar in Molecular Medicine, Pharmacology, and Physiology Staff
Readings and discussion on a diverse range of current topics in molecular medicine, pharmacology, and physiology. The class emphasizes analysis of primary research literature and development of presentation and writing skills. Contemporary articles are assigned on a related topic every week, and a student leads discussions with input from faculty who are experts in the topic area. The overall goal is to cover a specific topic of medical relevance (e.g., cancer, neurodegeneration) from the perspective of three primary disciplines (i.e., physiology: normal function; pathology: abnormal function; and pharmacology: intervention). Required of and open only to Ph.D. and M.D./Ph.D. students in the Molecular Medicine, Pharmacology, and Physiology track.

PTB 5650b / C&MP 5650b / PATH 5660b / PHAR 5580b, The Responsible Conduct of Research Barbara Ehrlich
Organized to foster discussion, the course is taught by faculty in the Pharmacology, Pathology, and Physiology departments and two or three senior graduate students. Each session is based on case studies from primary literature, reviews, and two texts: Francis Macrina's *Scientific Integrity* and Kathy Barker's *At the Bench*. Each week, students are required to submit a reaction paper discussing the reading assignment. Students take turns leading the class discussion; a final short paper on a hot topic in bioethics is required.

Women's, Gender, and Sexuality Studies

315 William L. Harkness Hall, 203.432.0845
http://wgss.yale.edu
M.A., M.Phil., Ph.D.

Chair
Roderick Ferguson

Director of Graduate Studies
Dara Strolovitch

Professors Rene Almeling, Claire Bowern, Daphne Brooks, Jill Campbell, Carolyn Dean, Erica Edwards, Fatima El-Tayeb, Roderick Ferguson, Scott Herring, Margaret Homans, Regina Kunzel, Gail Lewis (*Visiting*), Lisa Lowe, Mary Lui, Joanne Meyerowitz, Laura Nasrallah, Tav Nyong'o, Ayesha Ramachandran, Ana Ramos-Zayas, Dara Strolovitch, Linn Tonstad, Kalindi Vora, Laura Wexler

Associate Professors Marijeta Bozovic, Rohit De, Robin Dembroff, Crystal Feimster, Marta Figlerowicz, Joseph Fischel, Greta LaFleur, Alice Miller, Juno Richards, Deb Vargas

Assistant Professors Gregg Gonsalves, Alka Menon, Eda Pepi, Evren Savci

Senior Lecturer Maria Trumpler

Lecturers Craig Canfield, Igor De Souza, Graeme Reid, Talya Zemach-Bersin

FIELDS OF STUDY

Women's, Gender, and Sexuality Studies (WGSS) is an interdisciplinary program that critically interrogates gender and sexuality as categories of inequality, difference, and identification. Gender (the social and historical meanings of distinctions across sexes) and sexuality (the domain of sexual practices, identities, discourses, and institutions) are studied as they intersect with class, race, indigeneity, nationality, religion, ability, and other axes of power, difference, and zones of experience. The introduction of these perspectives into all fields of knowledge necessitates new research paradigms, organizing concepts and analytics, and critique.

The Program in Women's, Gender, and Sexuality Studies offers a combined Ph.D. in conjunction with five partner departments and programs: Black Studies, American Studies, Anthropology, English, and Sociology. Students may only apply for the Ph.D. in WGSS in conjunction with their application to one of these five partnering departments or programs. Students already pursuing a Ph.D. in one of the partnering departments and programs may apply for transfer into the combined Ph.D. in WGSS in the first or second year of their degree study. Graduate students in other programs may also petition to pursue an ad hoc combined degree. They must do so during their first year in their Ph.D. programs.

There are no subfields, specified areas of study, or concentrations within the combined Ph.D. program, but current WGSS faculty concentrate on gender and sexuality as they articulate across transnational politics and security regimes; citizenship and statelessness; public law and sexual violence; public policy and political representation;

kinship, reproduction, and reproductive technologies; policing, surveillance, and incarceration; social movements and protest; indigeneity, racialization, and racism; literature, language, and translation; Islam and neoliberalism; colonialism and postcolonialism.

Students pursuing the combined Ph.D. in WGSS will determine their research and doctoral foci in coordination with their advisers and with the directors of graduate studies (DGS) in WGSS and the partnering department or program.

REQUIREMENTS FOR TRANSFER INTO THE COMBINED PH.D. PROGRAM

Students in the first or second year of their degree study in American studies, anthropology, English, and sociology wishing to transfer into the combined Ph.D. in WGSS should submit a departmental transfer request form and a two- to three-page statement of interest describing why they wish to pursue the combined Ph.D. to wgss.dgs@yale.edu. Please indicate whether you have completed WGSS 6600 and/or WGSS 9900, and if not, when you intend to do so. Your statement of interest should also outline a plan of completion for any outstanding WGSS course requirements.

Interested students in their first year of other Ph.D. programs may apply to do an ad hoc combined degree with WGSS. They must do so before they have advanced to candidacy and must first get permission from their current DGS, after which they should submit a departmental transfer request form and prepare a two- to three-page written proposal describing why they wish to pursue the combined Ph.D. The proposal should indicate whether they have completed WGSS 6600 and/or WGSS 9900 and should include a plan of completion for any other outstanding requirements in both WGSS and their other program. They should submit both the form and proposal for review and approval by the associate dean as well as by the DGS in the relevant departments.

Interested students should submit their forms and statements of interest to wgss.dgs@yale.edu by December 15. The WGSS graduate admissions committee will inform applicants of its decisions by early March.

SPECIAL REQUIREMENTS FOR THE PH.D. DEGREE

As a default rule, students should assume that a WGSS or WGSS-affiliated faculty member should participate in any partnering program/department requirements involving faculty committee supervision or assessment. For example, if a program requires oral exams or a dissertation prospectus to be defended to a multiperson faculty committee, at least one member of the committee should be WGSS or WGSS affiliated faculty. If the partnering program/department requires students to construct multiple reading lists for oral and/or written exams, one such list should substantively include gender and sexuality scholarship. At least one faculty member of the student's dissertation committee will hold a primary or secondary tenured or tenure-track appointment in WGSS.

In their first two years of study, students in the combined Ph.D. program will complete a minimum of twelve term courses. The WGSS combined Ph.D. student's course of

study and research will be coordinated with the student's adviser, the DGS of WGSS, and the DGS of the partnering department or program.

Students are required to complete the following courses:

- WGSS 6600, Introduction to Women's, Gender, and Sexuality Studies
- WGSS 7700, Feminist and Queer Theories
- WGSS 9900, Colloquium and Working Group (half credit per term; students should enroll for two sequential terms, ideally in the same academic year)
- One elective. Typically, electives taken in the student's partnering department will be cross-titled with WGSS or will substantively examine gender and sexuality.
- Students are also required to take at least one graduate-level methods course. Students are strongly encouraged to fulfill this requirement by taking WGSS 8800, Methods in Gender and Sexuality Studies, but may also do so using the methods courses offered by their partner department. Students should consult with the WGSS DGS about their plan to fulfill the WGSS methods requirement.

WGSS combined-Ph.D. students typically teach or serve as a teaching fellow (TF) in their third and fourth years in the program, unless their dissertation research plans require other arrangements (funding permitting). WGSS combined-degree students will be given priority for TF slots in WGSS classes, and at least one of the courses for which they serve as a TF should have undergraduate WGSS numbers.

Students will be admitted to candidacy when they have fulfilled all requirements of both WGSS and the relevant partnering department or program. The scheduling and structure of qualifying examinations, prospectuses, and dissertations will follow the protocols of the partnering department. However, WGSS combined-degree students are strongly encouraged to hold a prospectus meeting and at least one post-approval meeting at which all members of their committee are present.

MASTER'S DEGREES

M.Phil. See Degree Requirements under Policies and Regulations.

M.A. (en route to the combined Ph.D.) Students will be awarded a combined M.A. degree in Women's, Gender, and Sexuality Studies and the partnering department or program upon successful completion of all course work with the exception of the WGSS dissertation proposal workshop. See also Degree Requirements under Policies and Regulations.

COURSES

WGSS 741a / AMST 7740a / FILM 6810a, The Photographic Memory Workshop
Laura Wexler

This seminar considers landmark examples of photography's cultural work in producing, cementing and erasing individual and collective memory. Topics to be considered include but are not confined to "memory, post-memory and counter-memory"; "the biopolitics of images"; "the visuality of violence"; "photography's place and space"; and the "potential history of photography." Students are invited to develop and present their own case studies on topics of interest. Readings encompass: *The Unseen Truth* by Sarah Lewis; *Camera Geologica* by Siobhan Angus; *The Unintended* by Monica Huerta; *Race Stories* by Maurice Berger; *Through a Native Lens* by Nicole Dawn

Strathman; *When a Photograph is Home* by Leigh Raiford; *From These Roots* by Tamara Lanier; and *Collaboration: A Potential History of Photography* by Ariella Azoulay, Wendy Ewald, Susan Meiselas, Leigh Raiford, and Laura Wexler. Guest lectures and travel to exhibitions are anticipated.

WGSS 6310a / AMST 8808a / FILM 6310a, Media, Embodiment, and the Senses Neta Alexander

This graduate seminar examines the intersections of critical disability studies and media theory to challenge conventional understandings of communication, technology, and culture. Through critical engagement with contemporary film, media, art, and design, this course explores how all technology functions as "assistive" technology and interrogates the pervasive idealization of able-bodiedness. Readings, screenings, discussions, and practice-based assignments encourage students to rethink normative assumptions about the body, ability, and accessibility, moving beyond audio-visual approaches to media.

WGSS 6600a, Introduction to Women's, Gender, and Sexuality Studies Joseph Fischel and Linn Tonstad

Introduction to women's, gender, and sexuality studies as a field of knowledge and to the interdiscipline's structuring questions and tensions. The course genealogizes feminist and queer knowledge production, and the institutionalization of WGSS, by examining several of our key terms.

WGSS 6608b, Gender and Citizenship in the Middle East Eda Pepi

This seminar explores the complex interplay between gender, sexuality, and citizenship in the Middle East and North Africa. We examine how they are both shaped by and shape experiences of nationality, migration, and statelessness. Highlighting how gender and sexual minorities, and the gendered regulation of life, more broadly, both animate and contest colonial legacies tied to a racialized notion of "modernity." Through ethnography, history, and literature, students confront a political economy of intimacies that continuously reshape what it means to be or not to be a citizen. Our approach extends beyond borders and laws to include the everyday acts of citizenship that rework race, religion, and ethnicity across transnational fronts. We discuss how people navigate their lives in the everyday, from the ordinary poetry of identity and belonging to the spectacular drama of war and conflict. Our goal is to challenge orientalist legacies that dismiss theoretical insights from scholarship on and from this region by labeling it as focused on exceptional cases instead of addressing "universal" issues. Instead, we take seriously that the specific historical and social contexts of the Middle East and North Africa reveal how connections based on gender and sexuality within and across families and social classes are deeply entwined with racial narratives of state authority and political sovereignty on a global scale.

WGSS 6620a / AMST 6619a / ER&M 6520 / HSHM 7920a, Enduring Conditions: Chronic Illness, Disability, Care, and Access Kalindi Vora

This interdisciplinary course brings together scholarship on access and care that bridges concerns in the fields of disability studies and humanistic approaches to chronic illness. Scholarly texts are drawn from the fields of critical race and ethnic studies, gender and sexuality studies, anthropology and sociology of medicine, history, and feminist science and technology studies (fSTS). Seminar participants also engage with the arts and media as critical sites for understanding culture work bringing together knowledge in disability and chronic illness spaces. To embrace community-based research and

knowledge sharing, the course features regular guest lectures from grassroots disability justice organizers and culture workers. The course is offered in a hybrid format. To consider what disability studies and work on chronic illness can build together, we explore the work of Moya Bailey, Aimi Hamraie, Jina B. Kim, Sami Schalk, Akemi Nishida, Ryan Cartwright, and Arthur Kleinman, among others. Permission of instructor is required. Undergraduates may also enroll with permission of instructor.

WGSS 7700b, Feminist and Queer Theories Evren Savci
This course is designed as a graduate introduction to feminist and queer thought. It is organized by a number of key terms and institutions around which feminist and queer thinking has clustered, such as the state, the law, religion, family and kinship, capitalism and labor, the body and language, knowledge and affect, globalization and imperialism, militarism and security. The "conversations" that happen around each term speak to the richness of feminist and queer theories, the multidimensionality of feminist and queer intellectual and political concerns, and the "need to think our way out of these crises," to cite Jacqui Alexander and Chandra Mohanty. The aim is to leave students appreciating the hard labor of feminist and queer thought, and understanding the urgencies out of which such thinking emerges.

WGSS 7718b / ANTH 7818b / ER&M 6606b / SPAN 9718b, Multi-Sited Ethnography: Trans-Atlantic Port Cities in Colombia and Spain Eda Pepi and Ana Ramos-Zayas
Critical to colonial, imperial, and capitalist expansion, the Atlantic offers a dynamic setting for adapting ethnographic practices to address questions around interconnected oppressions, revolts, and revolutions that are foundational to global modernity. Anchored in a Spanish and a Colombian port city, this course engages trans-Atlantic "worlding" through a multi-sited and historically grounded ethnographic lens. Las Palmas, the earliest mid-Atlantic port and Europe's first settler colony in Africa, and Cartagena, once the principal gateway connecting Spain and its American empire, illuminate urgent contemporary issues such as climate, displacement, inter-regional subjectivities, and commerce. During a spring recess field experience (March 8–16, 2026), students will immerse themselves for four nights each in Las Palmas and Cartagena, developing critical "tracking" skills that bridge ethnographic practice with cultural theory. Preparation for fieldwork includes an on-campus curriculum, organized around Cartagena and Las Palmas, and sessions with Yale Ethnography Hub faculty, covering different methodologies. As part of this broader programming, the curriculum delves as well into trans-Atlantic migrations from the Middle East, South Asia, and Africa that have transformed port cities, labor and aesthetic practices, class-making racial formations, and global geopolitics. After recess, the course shifts toward independent work, as students synthesize field-collected data and insights into a collaborative multimodal group project and individual ethnographic papers. Instructor Permission: Interested students must apply by November first via the course website. This course does not have a shopping period, but students may withdraw by the university deadlines in April. Prerequisite: Conversational and reading proficiency in Spanish. Readings are in English and Spanish, with assignments accepted in either language.

WGSS 7730b / HIST 8932b / HSHM 7360b, Health Politics, Body Politics Naomi Rogers

A reading seminar on struggles to control, pathologize, and normalize human bodies, with a particular focus on science, medicine, and the state, both in North America and in a broader global health context. Topics include disease, race, and politics; repression and regulation of birth control; the politics of adoption; domestic and global population control; feminist health movements; and the pathologizing and identity politics of disabled people.

WGSS 7757a / ANTH 7853a, Feminist Anthropology Eda Pepi

This seminar explores the impact of feminist theory on anthropology and interdisciplinary ethnography, charting its influence from the decline of structural functionalism to the embrace of poststructuralist and post-colonial perspectives. It engages feminist contributions on pivotal debates over the universality of women's subordination, the denaturalization of kinship, and the reframing of gender and sexuality as performative, highlighting the intersection of the "sex/gender system" with other analytical categories on a global scale. Through the feminist reevaluation of kinship studies, once the bedrock of anthropology, the course takes up how traditional analyses of biological, social, and societal reproduction that treat politics, economy, kinship, and religion as distinct cultural domains naturalize power and inequality. This paradigm shift inspired empirically informed interdisciplinary analyses across the social sciences and humanities—including in women's studies, Black and Latina studies, queer studies, masculinity studies, affect theory, and science and technology studies. As such, the seminar is also an invitation to participate in both hopeful and skeptical new visions of anthropology—to dream of an "otherwise" future for our and other fields.

WGSS 7769b / ENGL 6742b, Fiction, Didacticism, and Political Critique: 1789–1818 Jill Campbell

A study of writings that seek a specific effect in their reader—whether didactic instruction and moral formation, or an instigation to take action toward political change—and their uneasy alliance in the late eighteenth and early nineteenth centuries with the literary genre of prose fiction. How do writings that seek to inform or reform the real person or the real world put fictional narratives to use? How is the genre of the novel shaped, explicitly or implicitly, by writing to a specific "end"? Texts include novels, tales for children, life-writing, poetry with a "cause," polemical essays; possible authors include Olaudah Equiano, Edmund Burke, William Godwin, Mary Wollstonecraft, Elizabeth Inchbald, Maria Edgeworth, Jane Austen, Anna Barbauld, and Mary Shelley.

WGSS 7779a / AMST 8805a / HSAR 6720a / RLST 6990a, Sensational Materialities: Sensory Cultures in History, Theory, and Method Sally Promey

This interdisciplinary seminar explores the sensory and material histories of (often religious) images, objects, buildings, and performances as well as the potential for the senses to spark contention in material practice. While course content focuses on United States things and religions (given the professor's areas of expertise and academic appointments), the course also considers broader geographical and categorical parameters so as to invite intellectual engagement with the most challenging and decisive developments in relevant fields, including recent literatures on material agencies. The goal is to investigate possibilities for scholarly examination of a robust human sensorium of sound, taste, touch, scent, and sight—and even "sixth senses"—

the points where the senses meet material things (and vice versa) in life and practice. Topics include the cultural construction of the senses and sensory hierarchies; investigation of the sensory capacities of things; and specific episodes of sensory contention in and among various religious traditions. In addition, the course invites thinking beyond the "Western" five senses to other locations and historical possibilities for identifying the dynamics of sensing human bodies in religious practices, experience, and ideas. Course is by permission of instructor; qualified undergraduates are welcome. In order to request permission, please email the professor (sally.promey@yale.edu) with responses to the following questions: (1) Why are you interested in taking this seminar?; (2) what educational, intellectual, artistic, or other experiences do you bring to the seminar's subjects?; (3) how does the content of this course relate to your own career and/or personal aspirations?

WGSS 8500a, The Genealogies of Our Now Roderick Ferguson
This course investigates the often unread genealogy of contemporary scholarship around gender and sexuality in classic and canonical writings coming from psychoanalysis, political theory, philosophy, cultural studies, ethnic studies and so on. The course is designed to give students a sense that interdisciplinary scholarship is built on the works and inquiries from earlier intellectual debates and struggles. Likely authors are Immanuel Kant, Freidrich Nietzsche, Karl Marx, Anna Julia Cooper, W.E.B. Du Bois, Mary Wollstonecraft, Simone De Beauvoir, Jacques Lacan, Stuart Hall, etc.

WGSS 9900a or b, Colloquium and Working Group Scott Herring
The course is made up of two components: the WGSS Graduate Colloquium, in which graduate students present ongoing research (meets every two to three weeks); and the WGSS Working Group, in which faculty present pre-circulated works-in-progress for critical feedback from the WGSS community (meets every two to three weeks). ½ Course cr

WGSS 9960a / CPLT 8810a / ENGL 6860a, Literary Theory Caleb Smith
What is literary theory today, and what is its history? The aim of the course is to introduce students to central concepts in theory and explore their relation to method. We examine the variety of approaches available within the field of literary studies, including older ones such as Russian formalism, Critical Race Theory, New Criticism, deconstruction, Marxism, and psychoanalysis, as well as newer ones like actor-network theory and digital humanities research. We explore the basic tenets and histories of these theories in a way that is both critical and open-minded, and discuss their comparative advantages and pitfalls. The focus is on recurrent paradigms, arguments, and topics, and on transhistorical relations among our various schools of literary-theoretical thought. Readings might include work by René Wellek, Paul de Man, Jacques Derrida, Gayatri Spivak, Bruno Latour, Judith Butler, Northrop Frye, Fred Moten, and many others.

NON-DEGREE-GRANTING PROGRAMS, COUNCILS, AND RESEARCH INSTITUTES

Students enrolled in the graduate school have the opportunity to participate in a number of non-degree-granting programs, councils, and institutes at Yale.

Archaia

http://archaia.yale.edu
Graduate Certificate in the Study of Ancient and Premodern Cultures and Societies

Graduate Coordinators
Sonam Kachru (*Religious Studies*)
Laura Nasrallah (*Divinity*; *Religious Studies*)

Program Director
Keith Geriak

Steering Committee Brent Bianchi (*South and Southeast Asian Studies*), Lisa Brody (*Yale University Art Gallery*), Malina Buturovic (*Classics*), Maria Doerfler (*Religious Studies*), Alexander Ekserdjian (*Classics*; *History of Art*), Milette Gaifman (*Classics*; *History of Art*), Felicity Harley-McGowan (*Divinity*), Michael Hunter (*East Asian Languages and Literatures*), Andrew Johnston (*Classics*), Denise Leidy (*Yale University Art Gallery*), Noel Lenski (*Classics*; *History*), Colin McCaffrey (*Classics*), James Patterson (*Classics*), Alexander Uskokov (*Sanskrit*; *South Asian Studies*) Kevin van Bladel (*Near Eastern Languages and Civilizations*), Jacqueline Vayntrub (*Divinity*), Molly Zahn (*Divinity*)

GRADUATE CERTIFICATE IN THE STUDY OF ANCIENT AND PREMODERN CULTURES AND SOCIETIES

Archaia is a collaborative forum bringing together one of the largest groups of scholars in the world working on early civilizations. Scholars in the humanities and social sciences join with those working in the Yale Divinity School, the Yale Law School, the collections, and the university libraries. While admiring and encouraging traditional modes of work and traditional fields of scholarship, we build a new inter- and multi-disciplinary framework that redefines old disciplinary boundaries.

Archaia aims to enhance an already world-class graduate education by exposing students early in their careers to a wider intellectual world and to understand in new ways the value of antiquity, from the Mediterranean to Japan, and its rich cultural heritage for our own world. It supplements the curriculum with seminars, conferences, and special lectures by scholars from Yale as well as visiting scholars and offers a graduate certificate. The certificate in Archaia is open to Yale Ph.D. students and to students at the Divinity School.

Students with an interest in Archaia should apply to one of the university's degree-granting departments and should meet the entrance standards of the admitting department. Departments and schools currently participating in Archaia are Anthropology, Classics, East Asian Languages and Literatures, History, History of Art, Judaic Studies, Near Eastern Languages and Civilizations, Religious Studies, and the Divinity School; students from other relevant units should contact the Archaia graduate coordinators.

The certificate program provides enhanced training to graduate students with wide-ranging interests in the ancient and premodern world to extend their studies beyond departmental lines. Program students are expected to fulfill the requirements of the home department, but their course of study is individually modified to allow for

interdisciplinary work through classes, examinations, and guidance by faculty in several departments.

Graduate students who are enrolled in and funded by participating departments will earn a certificate upon satisfactory completion of the requirements. Students should apply to the department that coincides best with their backgrounds and their prospective areas of specialization, and they should indicate an interest in the interdepartmental program at the time of their application to that department. Students in participating Ph.D. programs earn the certificate en route to the doctorate.

A program of study for completion of the certificate must include the Core Seminar—or, in special cases, an approved alternative seminar—introducing students to issues in the study of the premodern world. In addition, a minimum of three other courses plus a capstone project is required, the courses to be selected in consultation from offerings of advanced language study and seminars related to the premodern world at the graduate level. The course of study must be approved by a graduate coordinator of Archaia and by the director of graduate studies (DGS) of the student's home department, who, together with the student, will lay out a blueprint for completing the requirements, articulating a field of concentration and a direction for the capstone project, and identifying potential mentors.

REQUIREMENTS FOR THE CERTIFICATE

1. A team-taught Core Seminar—or, in special cases, an approved alternative seminar—introducing students to issues in the study of global antiquity, from a cross- and multidisciplinary perspective. Initiative students normally take the Core Seminar in the first year of study. Offered each year in the spring, the seminar is normally a team-taught class sponsored by two or more of the cooperating departments. There will be supplementary sessions in the Yale collections (e.g., the Yale Art Gallery or the Beinecke) and a required monthly colloquium component. Specific topics vary, but each seminar has significant interdisciplinary and comparative dimensions emphasizing the methodologies and techniques of the fields involved.
2. A minimum of three courses, of which at least two must be seminar or seminar-type courses, chosen in consultation with the DGS of the student's home department from courses offered across the university. These will in most cases be courses that also fill requirements for the student's home department and must be at a level that would normally be accepted for graduate study in that department.
3. A capstone project that demonstrates the student's capacity to pursue independent, interdisciplinary research (the equivalent of 1 or 2 course units, depending on the scope), to be approved in consultation with the Archaia coordinators and the DGS of the student's home department (e.g., an exhibition, documentary, research paper, conservation project). The capstone project may take the form of a research paper (approximately 10,000 words), an exhibition, a documentary, an annotated syllabus, or something else of the student's choosing. The project may evolve from work accomplished in a related seminar. The project should demonstrate the student's ability to conduct research on antiquity from an interregional, global, and/or interdisciplinary perspective. The committee welcomes explicit reflection, in the project's introduction and in the project itself, of how a project that is interdisciplinary and/or interregional may challenge scholarly consensus or notions entrenched in institutionally separate fields or departments.

4. Regular participation in events hosted by Archaia throughout the academic year, especially the monthly meetings of the Ancient Societies Workshop.

Students who fulfill these requirements will receive a letter from the Archaia coordinators indicating that they have completed the work for the certificate.

Combined Program in the Biological and Biomedical Sciences (BBS)

55 College Street, 203.785.5663
https://medicine.yale.edu/bbs

Director
Craig Roy

FIELDS OF STUDY

The Combined Program in the Biological and Biomedical Sciences (BBS) is intended to enable students to explore their research interests before committing to a Ph.D. program or thesis adviser. To accomplish this aim, students apply to and spend their first year within one of eight scientific homes, called "tracks":

Biochemistry, Quantitative Biology, Biophysics, and Structural Biology (BQBS)
Computational Biology and Biomedical Informatics (CBB)
Immunology
Microbiology
Molecular Cell Biology, Genetics, and Development (MCGD)
Translational Molecular Medicine, Pharmacology, and Physiology (TMMPP)
Neuroscience
Plant Molecular Biology (PMB)

There are approximately 450 faculty affiliated with the BBS Program, and they may affiliate with up to two of the tracks listed above. BBS faculty come from departments within the Faculty of Arts and Sciences, School of Medicine, School of Public Health, and School of Engineering & Applied Science.

TYPICAL COURSE OF STUDY

Year One From within their track students take two to four courses per semester and conduct two to four lab rotations over the course of the year. Each track has its own course requirements and course recommendations, though students may take elective courses from anywhere in BBS. Although each track also has its own list of participating faculty, with the guidance of the track director, students may rotate in any BBS labs. In the spring of their first year students select a thesis adviser.

Year Two Prior to the start of the year students leave their BBS track and formally join one of the Ph.D.-granting programs below that best aligns with the thesis lab and research project:

Cell Biology
Cellular and Molecular Physiology
Computational Biology and Biomedical Informatics
Genetics
Immunobiology
Interdepartmental Neuroscience Program
Microbiology
Molecular Biophysics and Biochemistry
Molecular, Cellular, and Developmental Biology

Pathology and Molecular Medicine
Pharmacology
Translational Biomedicine

Students in year two typically complete the course requirements for the graduate program they have joined, take a qualifying exam, and begin thesis research. Each BBS student is required to participate in two semesters (or its equivalent) of teaching during graduate school, but no student is expected to teach during the first year of study. Students may begin to fulfill this requirement in the second year.

Year Three and Beyond Students focus primarily on thesis research, publishing their results, and presenting their work at scientific meetings. Students also finish fulfilling their teaching requirement. The median time to degree across the twelve BBS-affiliated Ph.D. programs is 5.7 years.

Financial support for BBS students comes from a variety of sources including Yale University fellowships, Gruber Science fellowships, Wu Tsai fellowships, National Institutes of Health (NIH) training grants, external fellowships awarded to students, departmental funds, and research grants from the NIH, NSF, foundations, and companies.

MEDICAL RESEARCH SCHOLARS PROGRAM (MRSP)

Students applying to any BBS track may also apply to participate in the MRSP. See the MRSP description under Non-Degree-Granting Programs, Councils, and Research Institutes. For more information about the program and application process visit https://medicine.yale.edu/bbs/training/nih-programs/mrsp.

INTEGRATED GRADUATE PROGRAM IN PHYSICAL AND ENGINEERING BIOLOGY (PEB)

Students applying to the BQBS, CBB, MCGD, Neuroscience, or TMMPP tracks may also apply to be part of the PEB program. See the description under Non-Degree-Granting Programs, Councils, and Research Institutes. For more information about the program and application process visit https://peb.yale.edu.

COURSES

B&BS 5640a / PATH 5640a, Developing and Writing a Scientific Research Proposal
Katerina Politi, Renato Polimanti, Nelson LaMarche, Rui Chang, Jean-Ju Chung, and Stephania Libreros

The course covers the intricacies of scientific writing and guides students in the development of a scientific research proposal on the topic of their research. All elements of an NIH fellowship application are covered, and eligible students submit their applications for funding. Enrollment limited to twelve. Required of second-year graduate students in Pathology and Molecular Medicine. Registration allowed by prior authorization from course directors only.

College Teaching Preparation

https://poorvucenter.yale.edu/graduate-students/teaching-programs-and-grants/certificate-college-teaching-preparation-cctp/graduate-and-professional-cctp

Associate Director
Gina Hurley

GRADUATE CERTIFICATE OF COLLEGE TEACHING PREPARATION

The Poorvu Center for Teaching and Learning sponsors the Graduate Certificate of College Teaching Preparation (CCTP), which students can pursue in conjunction with graduate-degree programs in the Graduate Schools of Arts and Sciences. The goal of this certificate program is to equip students with transferrable skills that are valuable on the job market and for careers involving teaching and mentoring. There is no formal application procedure for this certificate, and the program is open to all graduate students at Yale University.

Upon completion of the CCTP, graduate students will understand and be able to do the following:

- Articulate learning goals for students, the nature of learning, and effective teaching strategies that can support specific learning goals
- Design processes to assess what students have learned
- Use relevant secondary literature, including research about high-impact teaching
- Describe learning theories
- Create opportunities for learning communities
- Use and promote strategies that value diversity and positively impact classroom equity
- Develop scholarship in teaching and learning within the context of higher education
- Leverage communities, including classrooms, institutions, departments, and the general public to impact teaching and learning

GENERAL REQUIREMENTS

Completion of the CCTP requires a total time commitment of approximately forty-five hours and can occur over the course of months or years. Options for completion are flexible and self-paced. The program requires:

1. Two terms of teaching in the Yale Teaching Fellow Program (as a teaching fellow or part-time acting instructor)

2. Completion of training and development workshops/courses (see Workshop Requirements below)

3. Two observations of teaching by others with written reflections

4. Two occasions of being observed teaching with written reflections

5. Participation in two learning communities

a. CCTP participants are required to participate in two learning communities that focus on teaching, as opposed to research. These groups can be as small as three to five people or much larger. They should meet at least four times.

b. Potential focuses for a learning community might include:

i. job market working groups, which can workshop teaching materials in preparation for academic job searches;

ii. disciplinary pedagogy, focused on teaching within a given field; or

iii. interdisciplinary pedagogy, focused on broad topics such as anti-racist teaching, accessibility, active learning, or STEM education.

6. Compilation of a teaching portfolio and completion of an exit interview with CTL Staff (see Teaching Portfolio below)

WORKSHOP REQUIREMENTS

Participants will complete a range of introductory and intermediate or advanced teaching workshops:

1. Introduction to Teaching, either:

   a. one Fundamentals of Teaching series (participants may select the topic) or

   b. one Scientific Teaching Fellows course (PHYS 5300)

2. Completion of eight Poorvu Center advanced/intermediate workshops (or CIRTL Network Workshops/Short Courses). Please note that the requirement regarding intermediate vs. advanced workshops was revised in fall 2022. Participants who joined the program before that term may disregard it.

   a. Up to six workshops can be "intermediate" teaching workshops. Intermediate teaching workshops do not presuppose any previous engagement with the topic but will draw on topics covered in the CIRTL MOOC/Scientific Teaching Fellows Course.

   b. At least two of these teaching workshops should be designated as "advanced." Participants may take as many advanced workshops as they wish.

TEACHING PORTFOLIO

The teaching portfolio requires graduate students to document the sum of their college teaching experience and articulate the unique perspective on teaching that they have acquired from it. The portfolio also allows them to articulate their teaching experience and ability for presentation to prospective academic employers. The format we have chosen is consistent with portfolios that are often part of an application for an academic position.

The portfolio should include a range of teaching-related materials, along with annotations for each one that describe context for the course, insight into how the materials were or will be used, and any additional information that would help the reader more fully understand the decisions made in designing this course.

The portfolio should include the following materials:

1. Teaching statement (no annotation required)
2. Sample course materials, e.g., policy sheet, syllabus, test questions, handouts, rubrics, review materials, in-class activities, or lesson plans
3. Two newly developed syllabi
4. Student evaluations, if applicable
5. Optional: Letters of support or consultation reports from observers who may be faculty or students. This category may include letters solicited from faculty or students as well as informal emails from students or others commenting on the participant's teaching.

The portfolio should also include an account of the requirements fulfilled as part of the CCTP along with a reflective narrative. These items require no annotation.

- A list of teaching experiences at Yale or elsewhere
- A list of Poorvu Center workshops attended
- A brief, one-line description of learning communities
- Documentation from observations
- A brief reflective narrative about the participant's experience in the CCTP program (one to two double-spaced pages).

FILING FOR THE AWARD OF THE CERTIFICATE

When they have fulfilled all relevant requirements, participants will complete their experience by submitting the teaching portfolio and undergoing an exit interview. The exit interview is a fifty-minute meeting with a Poorvu Center staff member. Participants spend twenty-five minutes offering reflections on the program and in the final twenty-five minutes, receive feedback on one or two items of their choice in the portfolio.

THE MCDOUGAL GRADUATE TEACHING FELLOWSHIP

Through the McDougal Graduate Teaching Fellowship, graduate students lead programs on teaching, promoting effective practices informed by pedagogical scholarship, while growing and deepening their own expertise. They work with graduate students and postdoctoral scholars from across the disciplines, while undergoing a yearlong program designed to enhance their professional development as scholars and pedagogues. Fellows who successfully complete a full year in the program receive a Certificate of College Teaching Preparation by fulfilling the following requirements:

- attending mandatory training in May and August,
- co-facilitating ten workshops (or the equivalent),
- attending team meeting every two weeks (or the equivalent),
- participating in fall and spring teaching at Yale Day and the Spring Teaching Forum (or the equivalent), and
- completing classroom observations as assigned (or the equivalent).

Cowles Foundation

30 Hillhouse Avenue
http://cowles.yale.edu

Director
Samuel Kortum

The Cowles Foundation for Research in Economics at Yale University has as its purpose the conduct and encouragement of research in economics. The Cowles Foundation seeks to foster the development and application of rigorous logical, mathematical, and statistical methods of analysis. Members of the Cowles research staff are faculty members with appointments and teaching responsibilities in the Department of Economics and other departments. Among its activities, the Cowles Foundation provides financial support for research, visiting faculty, postdoctoral fellowships, workshops, and graduate students. Cowles regularly sponsors conferences and publishes a working paper series and research monographs.

Economic Growth Center

27 Hillhouse Avenue, 203.432.3610, egc@yale.edu
https://egc.yale.edu

Director
Rohini Pande

A research center based in the Yale Department of Economics, the Economic Growth Center (EGC) is Yale's hub for economics research and teaching on issues concerning lower-income countries and the advancement of their populations. It was founded in 1961 as the first research center in a major U.S. university focused on the quantitative study of lower-income economies. Additionally, it sought to provide a training ground for future development researchers and policy practitioners.

Today, EGC continues this agenda, examining not only the links between economic growth and poverty, but also how rising inequality and a changing climate affect individual well-being, especially among marginalized groups. Many research projects at EGC are conducted in collaboration with governments and other policy counterparts in developing countries, creating a direct channel through which research insights benefit the lives of millions of people. The center supports the wider research community by enabling open access to large-scale surveys conducted by its researchers. EGC aims to create channels for economic research and data-driven insights to inform and enable equitable development. It also hosts the master's degree program in International and Development Economics (IDE), which brings together a focus on development and policy that offers a pipeline to top economics Ph.D. programs and quantitative policy and research positions.

EGC's programming includes the annual Simon Kuznets Memorial Lecture, featuring prominent economists speaking on issues in economic development. The center holds weekly research seminars and co-hosts Yale Development Dialogues, a series of panel discussions that convene economists, historians, journalists, and policy makers to apply insights from history and economics to some of the most pressing policy issues confronting developing countries.

The center's faculty affiliates hold appointments in the Department of Economics and other departments and schools at Yale. Current research areas include political economy of development, economic justice and issues of gender, migration, early childhood development, environment and climate change, and the relationship between trade and development. EGC provides fellowships and research grants to graduate students and faculty, and its internship program engages Yale students in events, communications, and data analysis.

Environmental Humanities

https://environmentalhumanities.yale.edu
Graduate Certificate in Environmental Humanities

Program Director and Director of Graduate Studies
Paul Sabin (HQ, Room 218; paul.sabin@yale.edu)

Affiliated Faculty Anthony Acciavatti (*School of Architecture*), Giulia Accornero (*Music*), Santiago Acosta (*Spanish and Portuguese*), Alvita Akiboh (*History*), Rene Almeling (*Sociology*), Sunil Amrith (*History*), Laura Barraclough (*American Studies*), Paola Bertucci (*History*; *History of Science and Medicine*), Ned Blackhawk (*History*; *American Studies*), Malina Buturovic (*Classics*), Jill Campbell (*English*), Allison Caplan (*History of Art*), Carol Carpenter (*School of the Environment*), Oksana Chefranova (*Film and Media Studies*), Deborah Coen (*History of Science and Medicine*), Edward Cooke, Jr. (*History of Art*), Ivano Dal Prete (*History*), Ryan Darr (*Divinity School*), Amity Doolittle (*School of the Environment*), Michael Dove (*School of the Environment*; *Anthropology*), Fabian Drixler (*History*), Keller Easterling (*Architecture*), Justin Farrell (*School of the Environment*), Paul Freedman (*History*), Jay Gitlin (*History*), Robert Harms (*History*), Alanna Hickey (*English*), Hi'ilei Hobart (*Ethnicity, Race, and Migration*), Jonathan Howard (*English*; *African American Studies*), Cajetan Iheka (*English*), Matthew Jacobson (*American Studies*; *African American Studies*; *History*), Jill Jarvis (*French*), Elleza Kelley (*English*; *African American Studies*), Verlyn Klinkenborg (*English*; *School of the Environment*), Jonathan Kramnick (*English*), Douglas Kysar (*Law School*), Anthony Leiserowitz (*School of the Environment*), Pauline LeVen (*Classics*), Katja Lindskog (*English*), J.G. Manning (*Classics*; *History*), Millicent Marcus (*Italian*), Lisa Messeri (*Anthropology*), Alan Mikhail (*History*), Charles Musser (*American Studies*; *Film and Media Studies*; *Theater Studies*), Luna Najera (*Spanish and Portuguese*), Fatima Naqvi (*German*; *Film and Media Studies*), Morgan Ng (*History of Art*), John Peters (*English*; *Film and Media Studies*), Richard Prum (*Ecology and Evolutionary Biology*), Jennifer Raab (*History of Art*), Joanna Radin (*History of Science and Medicine*; *Anthropology*; *History*), William Rankin (*History*), Carolyn Roberts (*History of Science and Medicine*; *African American Studies*), Douglas Rogers (*Anthropology*), Elihu Rubin (*School of Architecture*; *American Studies*), Paul Sabin (*History*; *American Studies*), Oswald Schmitz (*School of the Environment*; *Ecology and Environmental Biology*), Stuart Schwartz (*History*), Lloyd Sy (*English*), Rasheed Tazudeen (*English*), Gary Tomlinson (*Music*; *Humanities*), Gerald Torres (*School of Environment*; *Law School*), Jane Tylus (Italian), Michael Warner (*English*; *American Studies*), Harvey Weiss (*Near Eastern Languages and Civilizations*; *School of the Environment*), Nurfadzilah Yahaya (*History*), Carl Zimmer (*Adjunct*; *School of Medicine*)

GRADUATE CERTIFICATE IN ENVIRONMENTAL HUMANITIES

Yale Environmental Humanities aims to deepen our understanding of the ways that culture is intertwined with nature and to contribute to a broad interdisciplinary conversation about humanity and the fate of the planet. Humanities scholars have an opportunity to reshape how we think about environmental problems and "the environment" itself. In turn, interdisciplinary dialogue with scientists and social scientists can stimulate the humanities in productive ways, raising new research

questions and providing fresh ways to approach long-standing issues. As an interdisciplinary initiative, Yale Environmental Humanities draws particularly on faculty and courses from across the humanities departments, including American Studies, Anthropology, English and other literature departments, Film and Media Studies, History, History of Art, and Music, as well as from professional schools, including Architecture, Divinity, Drama, Environment, and Public Health.

The Graduate Certificate in Environmental Humanities is available to students already enrolled in a Ph.D. program at Yale who seek to establish a strong foundation in environmental humanities topics and methodologies across the humanities disciplines. Students who complete the graduate certificate will gain skills working in interdisciplinary environmental settings and representing humanities perspectives on a broad range of environmental topics. Interested students are strongly encouraged to register for the certificate by meeting with the director of graduate studies (DGS) during their first year.

SPECIAL REQUIREMENTS FOR THE GRADUATE CERTIFICATE IN ENVIRONMENTAL HUMANITIES

Students who wish to receive the certificate must complete the following course work, research, and teaching requirements:

1. Three approved graduate or professional school courses focusing entirely or substantially on environmental themes, broadly defined. At least one of the courses should involve approximately 50 percent of its material from outside a student's home department or discipline. In consultation with the DGS and the student's Environmental Humanities adviser (who can also be their departmental adviser), each student is expected to organize their elective courses around a concentration related to their departmental course work and doctoral research. Elective courses will be chosen from a list of the environmental humanities graduate courses that are being offered each term.
2. Two terms of the Environmental Humanities certificate workshop, Topics in the Environmental Humanities (HIST 5804 and HIST 5805). Students must complete both a fall term and a spring term of the workshop, but the two terms of student participation need not be consecutive. Topics in the Environmental Humanities is a half-credit course that will be offered in both the fall and spring terms (one credit total). Academic credit from the workshop course typically does not count toward departmental course work requirements.
3. Students must demonstrate the capacity to pursue independent, interdisciplinary research in environmental humanities by presenting a qualifying paper at a meeting of the Environmental Humanities workshop, Graduate Research Symposium, or other approved venue.
4. Students must fulfill a teaching requirement by serving as a teaching fellow for an approved environmental humanities course or by completing an approved public humanities project. Other options are possible if appropriate teaching opportunities are not available.

Each of these requirements will require approval from the DGS of Environmental Humanities. Additional certificate program information, including the application and requirements checklist for the certificate, is available on the Environmental

Humanities website (https://environmentalhumanities.yale.edu) or by contacting environmentalhumanities@yale.edu.

CERTIFICATE WORKSHOP

HIST 5804a and HIST 5805b / ANTH 8897a and ANTH 8898b / HSAR 6841a and HSAR 6842b / HSHM 7691a and HSHM 7692b, Topics in the Environmental Humanities Paul Sabin

This is the required workshop for the Graduate Certificate in Environmental Humanities. The workshop meets six times per term to explore concepts, methods, and pedagogy in the environmental humanities, and to share student and faculty research. Each student pursuing the Graduate Certificate in Environmental Humanities must complete both a fall term and a spring term of the workshop, but the two terms of student participation need not be consecutive. The fall term each year emphasizes key concepts and major intellectual currents. The spring term each year emphasizes pedagogy, methods, and public practice. Specific topics vary each year. Students who have previously enrolled in the course may audit the course in a subsequent year. This course does not count toward the coursework requirement in history. Open only to students pursuing the Graduate Certificate in Environmental Humanities. ½ Course cr per term

HIST 5805b / ANTH 8898b / HSAR 6842b / HSHM 7692b, Topics in the Environmental Humanities Paul Sabin

This is the required workshop for the Graduate Certificate in Environmental Humanities. The workshop meets six times per term to explore concepts, methods, and pedagogy in the environmental humanities, and to share student and faculty research. Each student pursuing the Graduate Certificate in Environmental Humanities must complete both a fall term and a spring term of the workshop, but the two terms of student participation need not be consecutive. The fall term each year emphasizes key concepts and major intellectual currents. The spring term each year emphasizes pedagogy, methods, and public practice. Specific topics vary each year. Students who have previously enrolled in the course may audit the course in a subsequent year. This course does not count toward the coursework requirement in history. Open only to students pursuing the Graduate Certificate in Environmental Humanities. This course does not count toward the coursework requirement in history. ½ Course cr

Ethnicity, Race, and Migration

82–90 Wall Street, 2nd floor, 203.432.5116,
erm@yale.edu
https://erm.yale.edu

Chair
Fatima El-Tayeb

Director of Graduate Studies
Hi'ilei Hobart

Faculty Tarren Andrews (*Ethnicity, Race, and Migration*), Laura Barraclough (*American Studies*), Ned Blackhawk (*History*; *American Studies*), Chris Cutter (*School of Medicine, Child Study Center*), Michael Denning (*American Studies*; *English*), Fatima El-Tayeb (*Ethnicity, Race and Migration*; *Women's, Gender, and Sexuality Studies*), Roderick Ferguson (*American Studies*; *Women's, Gender, and Sexuality Studies*), Zareena Grewal (*American Studies*; *Ethnicity Race and Migration*), Fadila Habchi (*Ethnicity, Race, and Migration*), Leigh-Anna Hidalgo (*Ethnicity, Race, and Migration*), Hi'ilei Hobart (*Ethnicity, Race, and Migration*), Grace Kao (*Sociology*), Albert Laguna (*American Studies*; *Ethnicity, Race, and Migration*), Ximena López Carillo (*Ethnicity, Race, and Migration*), Lisa Lowe (*American Studies*), Mary Lui (*American Studies*; *History*), Gana Ndiaye (*Ethnicity, Race, and Migration*), Stephen Pitti (*History*; *American Studies*), Ana Ramos-Zayas (*American Studies*; *Ethnicity, Race, and Migration*; *Women's, Gender, and Sexuality Studies*), Alicia Schmidt Camacho (*Ethnicity, Race, and Migration*), David Simon (*Political Science*), Quan Tran (*American Studies*; *Ethnicity, Race, and Migration*), Deborah Vargas (*Ethnicity, Race, and Migration*; *Women's, Gender, and Sexuality Studies*), Kalindi Vora (*Ethnicity, Race and Migration*; *Women's, Gender, and Sexuality Studies*).

GRADUATE CERTIFICATE IN ETHNICITY, RACE, AND MIGRATION

The program of Ethnicity, Race, and Migration (ER&M) provides a framework for interdisciplinary inquiry related to global race formations, indigeneity, human mobility, culture, and politics. The program draws from the long-standing fields of U.S. ethnic and Native studies, postcolonial, and subaltern studies but also represents emergent areas like queer of color critique, comparative diaspora studies, critical Muslim and critical refugee studies, race and media studies, feminist science studies, and the environmental humanities. Our concerns are both historical and of the present, and we work at various scales of analysis: (trans)local, (trans)national, (trans)regional, and global. Our approach departs from nation-centered area studies by crossing geographic and linguistic boundaries. We ask fundamental questions that have long defined the humanities and social sciences, but often from the vantage point of non-state peoples, diasporas, and the minoritized. We value the social and political imaginaries of global subjects and use them to investigate sovereign power, social conflict, labor formations, and cultural production from a critical, integrative approach. We actively support public-facing and socially engaged scholarship and cultural work.

The certificate is open to doctoral students (currently FAS Ph.D. students) with a research focus related to ethnicity, race, indigeneity, and migration in line with the program's interdisciplinary and transnational framework. Students are encouraged to

apply for the certificate by meeting with the ER&M director of graduate studies (DGS) during their first year. The application form can be found on the program website.

SPECIAL REQUIREMENTS FOR THE GRADUATE CERTIFICATE IN ETHNICITY, RACE, AND MIGRATION

Students who wish to receive the certificate must complete the following coursework, research, and teaching requirements:

1. ER&M 7000: The core seminar in Ethnicity, Race, and Migration (offered every spring term). This seminar provides an in-depth survey of historical and current research and methods in the study of race, ethnicity, indigeneity, and migration within a global and interdisciplinary framework.

2. Three electives from existing graduate-level courses. The ER&M certificate program draws from graduate courses taught by faculty members with primary or secondary appointments in ER&M. The course list may be found at the ER&M website. Courses offered by faculty without an ER&M affiliation but with relevant content must be approved by the DGS. The same elective courses may count for the student's home department's requirements and the ER&M certificate.

3. ER&M 7001, Advanced Practicum in Ethnicity, Race, and Migration: This course is open to students in their third year and beyond. The seminar provides support for designing or writing the dissertation and for other professionalization matters (including publication, pedagogy, and conference presentation). Students choose to complete one of the following within the practicum:
a. A thirty-five page essay based on original research. This paper can develop from an assignment in one of their elective courses. It can take the form of a research paper, dissertation prospectus, draft dissertation chapter, or journal-length article. Students will present their paper to the ER&M community as part of this requirement.
b. A research project that departs from the format of the traditional academic essay or thesis. This project should be based on original research and may culminate in an annotated syllabus, exhibit, webpage, documentary, or other multimedia project. Students will present their project to the ER&M community as part of this requirement.

4. Teaching: Students will complete one semester of teaching in ER&M. This can include a teaching fellowship for an ER&M course, or students may apply for the Associates in Teaching program to serve as co-instructor of a seminar with a member of the ER&M faculty. When appropriate, students may elect to complete an Opportunity for Professional Development, offered through the Graduate School of Arts and Sciences, in lieu of a standard teaching assignment. Teaching and alternate assignments will be approved by the DGS.

5. Advising: Students are expected to name a member of the ER&M faculty to their doctoral committee. This faculty member will serve as a primary adviser in ER&M at the end of coursework. Students should designate this adviser by the end of their final qualifying exam and prior to presenting the dissertation prospectus.

COURSES

ER&M 6606b / ANTH 7818b / SPAN 9718b / WGSS 7718b, Multi-Sited Ethnography: Trans-Atlantic Port Cities in Colombia and Spain Eda Pepi and Ana Ramos-Zayas

Critical to colonial, imperial, and capitalist expansion, the Atlantic offers a dynamic setting for adapting ethnographic practices to address questions around interconnected oppressions, revolts, and revolutions that are foundational to global modernity. Anchored in a Spanish and a Colombian port city, this course engages trans-Atlantic "worlding" through a multi-sited and historically grounded ethnographic lens. Las Palmas, the earliest mid-Atlantic port and Europe's first settler colony in Africa, and Cartagena, once the principal gateway connecting Spain and its American empire, illuminate urgent contemporary issues such as climate, displacement, inter-regional subjectivities, and commerce. During a spring recess field experience (March 8–16, 2026), students will immerse themselves for four nights each in Las Palmas and Cartagena, developing critical "tracking" skills that bridge ethnographic practice with cultural theory. Preparation for fieldwork includes an on-campus curriculum, organized around Cartagena and Las Palmas, and sessions with Yale Ethnography Hub faculty, covering different methodologies. As part of this broader programming, the curriculum delves as well into trans-Atlantic migrations from the Middle East, South Asia, and Africa that have transformed port cities, labor and aesthetic practices, class-making racial formations, and global geopolitics. After recess, the course shifts toward independent work, as students synthesize field-collected data and insights into a collaborative multimodal group project and individual ethnographic papers. Instructor Permission: Interested students must apply by November first via the course website. This course does not have a shopping period, but students may withdraw by the university deadlines in April. Prerequisite: Conversational and reading proficiency in Spanish. Readings are in English and Spanish, with assignments accepted in either language.

ER&M 6680b / AMST 7768b / HIST 7500b, Asian American History and Historiography Mary Lui

This reading and discussion seminar examines Asian American history through a selection of recently published texts and established works that have significantly shaped the field. Major topics include the racial formation of Asian Americans in U.S. culture, politics, and law; U.S. imperialism; U.S. capitalist development and Asian labor migration; and transnational and local ethnic community formations. The class considers both the political and academic roots of the field as well as its evolving relationship to "mainstream" American history.

ER&M 7001a, Advanced Practicum in Ethnicity, Race, and Migration Fatima El-Tayeb

This course is open to graduate certificate students in their third year and beyond. The seminar provides support for designing or writing the dissertation and for other professionalization matters (including publication, pedagogy, and conference presentation). Students complete an essay of thirty-five pages based on original research. This paper can develop from an assignment in one of their elective courses. It can take the form of a research paper, dissertation prospectus, draft dissertation chapter, or journal-length article. Students present their paper to the ER&M community as part of this requirement. Or, students may choose to complete a research project that departs

from the format of the traditional academic essay or thesis. This project should be based on original research and may culminate in an annotated syllabus, exhibit, webpage, documentary, or other multimedia project. Students present their project to the ER&M community as part of this requirement. Prerequisite: admission into graduate certificate program/completion of qualifying exam in home department.

ER&M 7100a, Pedagogies in ERM Ana Ramos-Zayas
Faculty members who have a 2:2 course expectation may develop a pedagogy seminar associated with their undergraduate introductory lecture course if it enrolls at least seventy-two students and has at least three teaching fellows leading discussion sections. The course's TFs must enroll in the pedagogy seminar; they receive full course credit but not toward their degree requirements. This course intends to properly recognize the additional time required of faculty who offer large lecture classes, especially in the fulfillment of the responsibilities outlined in the start of term memo. Courses with sections require substantive guidance on teaching, including weekly teaching fellow meetings, meetings, section visits, and discussions of course assessment. This course is graded SAT/UNSAT. Two student-teaching fellows are able to submit teaching evaluations of their experience in this pedagogy seminar through the course evaluation process. Prerequisite: TF position in an ER&M undergraduate lecture course with at least seventy-three students. 0 Course cr

Further details about the certificate requirements, courses, and the application process can be found at the ER&M Program website, at https://erm.yale.edu.

Film and Media Studies

Humanities Quadrangle, 1st floor, 203.436.4668
http://filmstudies.yale.edu
Graduate Certificate in Film and Media Studies

Chair
Fatima Naqvi

Director of Graduate Studies
John MacKay

Faculty
For faculty listings, see Film and Media Studies under Degree-Granting Departments and Programs in this bulletin.

GRADUATE CERTIFICATE IN FILM AND MEDIA STUDIES

With the world awash in moving images, the Film and Media Studies Program gives students the tools necessary to grapple with the decisive media of the past one hundred years: from film to television to the platform-agnostic digital images of today. That knowledge is critical and practical, analytic and experimental, historical and theoretical. As an interdisciplinary program, Film and Media Studies draws on a wide range of course offerings—from history of art to comparative literature, from Slavic to American studies, from music to theater studies—taught by a dedicated group of world-renowned faculty.

The Certificate in Film and Media Studies is open to students already enrolled in a Ph.D. program, a professional school, or a terminal master's degree at Yale. The aim is to provide graduate and professional students in other programs, departments, divisions, and schools with the opportunity to develop and demonstrate a degree of competence in the history and theory of film and media technologies.

Interested students are strongly encouraged to register for the certificate by meeting with the director of graduate studies (DGS) during their first year.

SPECIAL REQUIREMENTS FOR THE GRADUATE CERTIFICATE IN FILM AND MEDIA STUDIES

Students who wish to receive the certificate must complete the following:

- FILM 6010, Foundations of Film and Media.
- Two electives, one of which must be drawn from the FMS curriculum; the second may focus on media relevant to the student's own research interests but must be approved by the DGS of FMS.
- The FMS Certificate Workshop (FILM 6050 and FILM 6060), courses only offered to certificate students which will meet bi-weekly over two terms and count as one regular course credit. Students are required to present a qualifying paper demonstrating their capacity to do interdisciplinary work.
- In approved cases, FMS Certificate students may TF courses in FMS. However, there is no formal teaching requirement for the certificate program.

Each of these requirements will require approval from the DGS of FMS, the DGS of the student's degree department or school, and an FMS adviser. A plan for fulfilling the requirements will be worked out in advance, in consultation with all three of the above. A student can apply to count a course they took during their first year.

During two years of work with an interdisciplinary program of Film and Media Studies, students will develop competence in the history and theory of film and media. This may be necessary to the completion of their dissertations and to academic careers beyond Yale.

Film and Media Studies Program invites applications for the graduate certificate from students already enrolled in a Ph.D. program, professional school, or terminal master's at Yale. The number of students admitted each year will not exceed five. Applications to the certificate are due by May 15, 2024. Prospective students should send on a letter of interest to the DGS of Film and Media Studies. Information on the certificate, requirements, and application process can be found at https://filmstudies.yale.edu/graduate-certificate-film-and-media-studies. Please send inquiries and applications to: Francesco Casetti (francesco.casetti@yale.edu), Oksana Chefranova (oksana.chefranova@yale.edu), and Katherine Kowalczyk (katherine.germano@yale.edu)

Additional certificate program information is available on the Film and Media Studies website (http://filmstudies.yale.edu). For information on the Ph.D. program in Film and Media Studies, see Film and Media Studies under Degree-Granting Departments and Programs in this bulletin.

Graduate School of Arts and Sciences (GSAS) Summer Programs

http://gsas.yale.edu

Dean
Lynn Cooley

The graduate school offers two courses to support summer training through practical internships. For the summer of 2025, students will register for these courses as part of the internship approval process and not through the usual class registration processes.

COURSES

GSAS 901c, Pre-candidacy Applied Research Experience Allegra di Bonaventura
The purpose of this course is to provide students with the opportunity to gain practical experience in research. This experience provides a basis for developing a dissertation prospectus that addresses significant research questions. Students work with a faculty mentor to select a suitable placement for the summer internship. As part of the application/registration, a one-page description of the student's research plan is submitted to the DGS at least three weeks prior to starting the internship, for approval within two weeks. Upon completion of the internship, a written report of the work must be submitted to the DGS no later than October 1. Prerequisites: completion of one year of the Ph.D. program and approval of the DGS. 1 credit; graded Satisfactory/Unsatisfactory.

GSAS 902c, Post-candidacy Applied Research Experience Allegra di Bonaventura
The purpose of this course is to provide students with the opportunity to perform dissertation research or to gain practical experience using the methodology or results of their dissertation research. Students work with a faculty mentor to select a suitable placement for the summer internship. As part of the application/registration, a one-page description of the student's research plan is submitted to the student's dissertation adviser and DGS at least three weeks prior to starting the program, for approval within two weeks. Upon completion of the internship, a written report of the work must be submitted to the adviser and DGS no later than October 1. Prerequisites: completion of one year of the Ph.D. program, admission to candidacy, and approval of the dissertation adviser and DGS. 1 credit; graded Satisfactory/Unsatisfactory.

Institution for Social and Policy Studies

77 Prospect Street, 203.432.3234
http://isps.yale.edu

Director
Alan Gerber

Executive Committee Steven Berry, Kerwin Charles, Ana De La O, Heather Gerken, Grace Kao, John Lafferty, Steven Wilkinson

The Institution for Social and Policy Studies (ISPS) is an interdisciplinary research center dedicated to furthering our understanding of society and sharing that knowledge to improve policy and practice.

Recognizing that important social problems cannot be studied adequately by a single discipline, the Yale Corporation established ISPS in 1968 to stimulate interdisciplinary collaboration within the university, both across the social sciences and between the social sciences and other disciplines. Over the decades, ISPS has conducted research on elections, education, criminal justice, health care, government regulation, labor, taxation, immigration, and much more. Today, ISPS maintains a broad research portfolio among its many interdisciplinary faculty affiliates.

In addition to conducting research, ISPS organizes faculty seminars, hosts and promotes collaborations among faculty fellows and postdoctoral researchers, runs fellowships to mentor undergraduate and graduate students, convenes scholars and practitioners from across the country to learn from one another, and helps sponsor an interdisciplinary undergraduate major: the Program in Ethics, Politics and Economics (EP&E).

ISPS also supports specialized study centers: the Center for the Study of American Politics (CSAP), the Interdisciplinary Center for Bioethics, the Center for the Study of Inequality, and the Data-Intensive Social Science Center. And ISPS recently launched its Democratic Innovations program, designed to identify and test new ideas for improving the quality of democratic representation and governance.

Our commitment to training students for future leadership centers around our four fellowship programs: Dahl Research Scholars, Director's Fellows, Millstone Fellows (for undergraduates), and the Graduate Policy Fellows (for graduate and professional school students). These fellowships offer students the opportunity to apply rigorous research to real-world social policy issues. In these yearlong programs, we offer the scholars biweekly workshops, mentorship, media training, and a series of policy-related skill training sessions. ISPS also runs a two-year predoctoral fellowship through CSAP and the Tobin Center for Economic Policy.

As the hub for problem-oriented interdisciplinary research at Yale, ISPS provides intellectual leadership in the social sciences; fosters sound and creative research on public policies of local, state, and national significance; and informs both teaching at Yale and academic and public debates beyond Yale.

Jewish Studies

Humanities Quadrangle, Rm. 423, 203.432.0843
http://jewishstudies.yale.edu

Chair and Director of Graduate Studies
Elli Stern

Professors Joel Baden (*Divinity*), Steven Fraade (*Emeritus, Religious Studies*), Paul Franks (*Philosophy*), Sarit Kattan Gribetz (*Religious Studies*), Christine Hayes (*Emerita, Religious Studies*), Hannan Hever (*Comparative Literature*), Ivan Marcus (*History*; *Religious Studies*), Paul North (*German*), Maurice Samuels (*French*), David Sorkin (*History*), Elli Stern (*Religious Studies*; *History*)

Associate Professors Marci Shore (*History*), Jacqueline Vayntrub (*Divinity*)

Professor in Practice Peter Cole (*Comparative Literature*)

Senior Lector II Shiri Goren (*Near Eastern Languages and Civilizations*), Dina Roginsky (*Near Eastern Languages and Civilizations*)

Senior Lector Josh Price (*German*)

Jewish Studies offers an interdisciplinary approach to the critical study of the culture, history, languages, literature, religion, and thought of the Jews. Jewish institutions, philosophies, societies, and texts are studied critically and in comparative historical perspective in relation to the surrounding societies and cultures.

Graduate-level programs are available through the following departments: Comparative Literature (Hebrew and comparative literature), History (ancient, medieval, and modern Jewish history), Religious Studies (history and literature of ancient Judaism, medieval and modern Jewish history, philosophy of religion), Near Eastern Languages and Civilizations (Northwest Semitic, Hebrew language and literature), and Philosophy. Applications are made to a specific department, and programs of study are governed by the degree requirements of that department.

Other resources include the Judaica collection of Sterling Memorial Library and its Judaica bibliographer, the Fortunoff Archive for Holocaust Testimonies, the biweekly faculty/graduate student Jewish Studies Seminar, several lecture series, postdoctoral fellowships, and graduate fellowships in Jewish Studies.

Additional information is available on request to the director of graduate studies of the department of intended specialization, or to the Chair, Program of Jewish Studies, Yale University, PO Box 208282, New Haven CT 06520-8282, and at http://jewishstudies.yale.edu.

COURSES

For course offerings in the Hebrew language and in Israeli society and culture, see Near Eastern Languages and Civilizations.

JDST 764b / HIST 6155b / MDVL 7155b / RLST 7770b, Jews in Muslim Lands from the Seventh through the Sixteenth Century Ivan Marcus
Introduction to Jewish culture and society in Muslim lands from the Prophet Muhammad to Suleiman the Magnificent. Topics include Islam and Judaism; Jerusalem as a holy site; rabbinic leadership and literature in Baghdad; Jewish courtiers, poets, and philosophers in Muslim Spain; and the Jews in the Ottoman Empire.

JDST 6500a / RLST 6520a, Introduction to Jewish Studies David Sorkin and Sarit Kattan Gribetz
In a society that is broadly ambivalent about—if not roundly antagonistic against—Jews and Judaism, how can one study Jewish texts and history? Is the study of Jews and their religion and cultures necessarily an act of apologetics or polemics? What does "objectivity" mean in this loaded context? This course examines the inception and development of the modern field of Jewish studies in nineteenth-century Germany and the ways in which the field evolved and spread from Europe to Palestine, Israel, and the United States. Ultimately, students grapple with the question of the place of Jews and Jewish studies in the modern academy. The course begins with readings of the major practitioners of the "academic study of Judaism" (Wissenschaft des Judentums) since its inception in the nineteenth century with close examination of the ways in which those scholars read the ancient, medieval, and early modern sources that they used to construct their studies of Jews and Judaism. It then turns to the institutionalization of the field through the establishments of seminaries, large-scale publication projects (encyclopedias, anthologies), historical societies and archives, research institutes, and university programs. Finally, the course examines the intersection between the personal and professional through pairing memoirs written by scholars with the scholarship they published. Throughout, programmatic statements are combined with close analysis of the way scholars read their sources.

JDST 7206b / HIST 6157b / MDVL 7157b / RLST 6160b, How the West Became Antisemitic: Jews and the Formation of Europe, 800–1500 Ivan Marcus
This seminar explores how medieval Jews and Christians interacted as religious societies between 800 and 1500.

JDST 7261a / HIST 6229a / MDVL 7229a / RLST 7730a, Jews and the World: From the Bible through Early Modern Times Ivan Marcus
The course is a comprehensive introduction for GS students as well as YC students. It serves as a window course to pre-modern Jewish history. For YC students this can lead to taking seminars on more limited topics. For graduate students it is a good preparation for comprehensive exams and provides a model survey course to be offered later on as an instructor.

JDST 7445a / RLST 6430a, The Global Right: From the French Revolution to the American Insurrection Elli Stern
This seminar explores the history of right-wing political thought from the late eighteenth century to the present, with an emphasis on the role played by religious and pagan traditions. This course seeks to answer the question, what constitutes the right? What are the central philosophical, religious, and pagan, principles of those groups associated with this designation? How have the core ideas of the right changed over time? We do this by examining primary tracts written by theologians, political philosophers, and social theorists as well as secondary literature written by scholars interrogating movements associated with the right in America, Europe, Middle East,

and Asia. Though touching on specific national political parties, institutions, and think tanks, its focus is on mapping the intellectual overlap and differences between various right-wing ideologies. While the course is limited to the modern period, it adopts a global perspective to better understand the full scope of right-wing politics.

JDST 7680b / CPLT 6180b / GMAN 7090b, Walter Benjamin's Critical Theory Paul North
Careful analysis of central texts in Benjamin's oeuvre in the context of his philosophical, political, and literary reading.

JDST 8274b / HEBR 5780b, Languages in Dialogue: Hebrew and Arabic Dina Roginsky
Hebrew and Arabic are closely related as sister Semitic languages. They have a great degree of grammatical, morphological, and lexical similarity. Historically, Arabic and Hebrew have been in cultural contact in various places and in different aspects. This advanced Hebrew language class explores linguistic similarities between the two languages as well as cultural comparisons of the communities, built on mutual respect. Students benefit from a section in which they gain a basic exposure to Arabic, based on its linguistic similarity to Hebrew. Conducted in Hebrew. Prerequisite: HEBR 5030, or placement test, or permission of the instructor.

JDST 8295b / HEBR 5630b, From Biblical to Modern Hebrew Dina Roginsky
This course aims to support students who have reading knowledge of Biblical Hebrew but cannot read or converse in Modern Hebrew. The course concentrates on reading and aims at enabling students to use Modern Hebrew for research purposes. The texts chosen are tailored to students' particular areas of interest. Prerequisite: two years of Biblical or Modern Hebrew studies, or permission of the instructor. Conducted in English.

Leadership and Research Management for Physician-Scientists

M.D.-Ph.D. Program
Edward S. Harkness Hall, Rm. D317, 203.737.5613
https://medicine.yale.edu/mdphd/education/cert-physician-scientists

Director
Barbara Kazmierczak

GRADUATE CERTIFICATE IN LEADERSHIP AND RESEARCH MANAGEMENT FOR PHYSICIAN-SCIENTISTS

One part of the Yale M.D.-Ph.D. joint-degree program's mission is to develop skills in our trainees that are associated with success in a broad range of physician-scientist research careers through experiential learning. The Certificate in Leadership and Research Management for Physician-Scientists was developed to provide formal training in the skills necessary for effective leadership and management of research and clinical teams. We realize that many of these skills also help our students during their M.D. and Ph.D. training period, and we therefore think it is critical that our students learn and practice these skills early in training. Although many of our students already engage in some of these training and experiential activities, the certificate allows us to evaluate and recognize their mastery of these specific skills.

REQUIREMENTS OF THE CERTIFICATE PROGRAM

Modules 1–4 are required of all M.D.-Ph.D. students. Module 1: Mentoring will be offered in late spring/early summer and should be taken by students prior to the experience of mentoring a junior trainee. Module 2: Proposal Development will be offered in the summer/fall and should be taken by students in year three, when they are also qualifying. Module 3: Teaching should be taken by students prior to their Teaching Fellow service. Module 4: Inclusive Leadership is offered every spring and should be taken by students in year four or five during their Ph.D. training.

Students will also be required to complete at least one of the four optional modules (Module 5: Communication; Module 6: Leadership and Teamwork; Module 7: Self-Management; Module 8: Nuts and Bolts of Research Management) during the course of their training. The optional modules will be offered every other year, allowing students to complete the workshops during their M.D.-Ph.D. training period.

Each module includes an experiential project that must be completed as part of the certificate program. Students who complete all eight modules will receive a Certificate in Leadership and Research Management for Physician-Scientists.

Additional certificate program information is available on the M.D.-Ph.D. program website: https://medicine.yale.edu/mdphd/education/cert-physician-scientists.

The Whitney and Betty MacMillan Center for International and Area Studies at Yale

Luce Hall, 203.432.0694
http://macmillan.yale.edu

Director
Steven Wilkinson (*Political Science*)

For more than eighty-five years, the Whitney and Betty MacMillan Center for International and Area Studies at Yale and its precursors have served as the university's focal point for teaching and research on cultures, languages, societies, institutions, and practices around the world. The MacMillan Center seeks to make understanding the world outside the borders of the United States an integral part of liberal education and professional training at the university. It brings together scholars from all relevant schools and departments to provide insightful interdisciplinary, comparative, and problem-oriented teaching and research on regional, international, and global issues.

The MacMillan Center administers nine degree programs. The six undergraduate majors include African Studies; East Asian Studies; Latin American Studies; Modern Middle East Studies; Russian and East European Studies; and South Asian Studies. The three graduate degree programs award master's degrees in African Studies, East Asian Studies, and European and Russian Studies. There are joint-degree graduate programs with the schools of the Environment, Law, Management, and Public Health. Additionally, the programs offer four graduate certificates of concentration: in African Studies, European Studies, Latin American and Iberian Studies, and Modern Middle East Studies.

The many councils, committees, and programs at the MacMillan Center support research and teaching across departments and professions, support doctoral training, advise students at all levels, and provide extracurricular learning opportunities, as well as funding resources for student and faculty research related to their regions and subject areas. Regional studies programs include African Studies; Arabic Program; Baltic Studies; Buddhist Studies; Canadian Studies; East Asian Studies; European Studies; Stavros Niarchos Foundation Center for Hellenic Studies; Iranian Studies; Japan at the Crossroads Project; Latin American and Iberian Studies; Middle East Studies; Project on Religious Freedom and Society in Africa; Russian, East European, and Eurasian Studies; South Asian Studies; and Southeast Asia Studies. Comparative and international programs include Agrarian Studies; Center for the Study of Globalization; Center for the Study of Representative Institutions; Conflict, Resilience, and Health Program; European Union Studies; Genocide Studies; Geographically based Economic Data Project (G-Econ); Gilder Lehrman Center for the Study of Slavery, Resistance, and Abolition; Center for Historical Enquiry and the Social Sciences (CHESS); Yale Research Initiative on Innovation and Scale (Y-RISE); InterAsia Initiative; Georg Walter Leitner Program in International and Comparative Political Economy; Program on Peace and Development; Program on Refugees, Forced Displacement, and Humanitarian Responses; and Translation Initiative.

The MacMillan Center's regional councils regularly teach all levels of eight foreign languages (Modern Greek, Hindi, Indonesian, Sanskrit, Swahili, Vietnamese, Yorùbá,

Zulu). Additionally, the MacMillan Center collaborates with the Center for Language Study (CLS) in supporting Directed Independent Language Study of more than sixty languages for undergraduate, graduate, and professional school students. Regional councils and language faculty participate actively in the Cornell, Columbia, and Yale Shared Course Initiative led by CLS, using distance learning technology for less commonly taught languages.

The MacMillan Center provides opportunities for scholarly research and intellectual innovation; awards nearly 500 fellowships and grants each year to students and faculty; encourages faculty/student interchange; sponsors some 800 lectures, conferences, workshops, seminars, and films each year (most of which are free and open to the public); produces a range of working papers and other academic publications; and contributes to library collections comprising 1.4 million volumes in the languages of various areas. The MacMillan Center is home to the Fox International Fellowship, a graduate student exchange program between Yale University and twenty world-renowned academic partners. The MacMillan Center supports *The MacMillan Report*, an online show that features Yale faculty in international and area studies and their research in a one-on-one interview format. Shows can be viewed at http://macmillanreport.yale.edu.

For details on degrees, programs, and faculty leadership, please consult http://macmillan.yale.edu.

- Council on African Studies
- Council on East Asian Studies
- European Studies Council
- Council on Latin American and Iberian Studies
- Council on Middle East Studies
- South Asian Studies Council
- Council on Southeast Asia Studies

GRADUATE CERTIFICATES OF CONCENTRATION IN AREA STUDIES

General Guidelines—Program Description

The Whitney and Betty MacMillan Center for International and Area Studies at Yale, through the regional councils on African Studies, European Studies, Latin American and Iberian Studies, and Middle East Studies, sponsors graduate certificates of concentration that students may pursue in conjunction with graduate-degree programs in the Graduate School of Arts and Sciences and the professional schools. The certificate is intended for students seeking to demonstrate substantial preparation in the study of one of four areas of concentration: Africa, Europe, Latin America, and the Middle East.

Candidates for the certificate must demonstrate expertise in the area of concentration through their major graduate or professional field, as well as show command of the diverse interdisciplinary, geographic, and cultural-linguistic approaches associated with expertise in the area of concentration. Admission to the graduate certificate is contingent on the candidate's acceptance into a Yale graduate-degree program. Award

of the graduate certificate, beyond fulfilling the relevant requirements, is contingent on the successful completion of the candidate's Yale University degree program.

Application Procedure

Specific requirements of each council are reflected in its application, monitoring, and award procedures. Application forms can be picked up at the relevant council or downloaded from its website. Prospective students should submit a completed application form to the relevant council.

Applications may be submitted by students admitted to a graduate program at Yale or during their program of study but no later than the beginning of the penultimate term of study. Each council may set limits on the number of candidates for its program in any given year. For further information, see the council administrator.

General Requirements

While the general requirements are consistent across all councils of the MacMillan Center, the specific requirements of each council may vary according to the different expertise required for its area of concentration. In addition to the specific requirements, students pursuing the certificate are expected to be actively engaged in the relevant council's intellectual community and to be regular participants at its events, speaker series, and other activities. Serious study, research, and/or work experience overseas in the relevant region is highly valued.

COURSEWORK

Students must complete a total of six courses focused on the area from at least two different fields, including a Foundations Course if designated by the council. Of the remaining five courses, only two may be "directed readings" or "independent study." Please note:

- No more than four courses may count from any one discipline or school.
- Courses from the home field of the student are eligible. Courses may count toward the student's degree as well as toward the certificate.
- Literature courses at the graduate level may count toward the six-course requirement, but elementary or intermediate language courses may not. At the discretion of the faculty adviser, an advanced language course at the graduate level may be counted if it is taught with substantial use of field materials such as literature, history, or social science texts and journals relevant to the area.
- Coursework must demonstrate broad comparative knowledge of the region rather than focus on a specific country.
- Coursework must demonstrate a grasp of the larger thematic concerns affecting the region, such as environment, migration, or global financial movements.
- Only those courses listed on the Graduate Course Listings provided by the area council may be used to fulfill course requirements. For courses not listed there, please consult the certificate adviser. Non-listed courses may only be counted with prior approval of the council adviser, not after the fact.
- A minimum grade of HP must be obtained or the course will not be counted toward the certificate.

- Only coursework taken during the degree program at Yale may be counted toward the certificate.

LANGUAGE PROFICIENCY

Language proficiency in at least one language relevant to the area of concentration beyond proficiency in English is required. (For some councils and for some individual circumstances, proficiency in two languages beyond English is required.) In the major-area language targeted for meeting the proficiency requirement, students must demonstrate the equivalent ability of two years of language study at Yale with a grade of B+ or better. Language proficiency must encompass reading, writing, speaking, and listening skills plus grammar. Students may demonstrate proficiency by completing coursework, by testing at Yale, or by other means as approved by the council adviser. When a second major language of the region beyond English is required, the relevant council will specify the target level. The typical departmental graduate reading exam is not sufficient for certifying the four-skill language requirement of the certificate.

Normally, a candidate who is a native speaker of one of the area's major languages will be expected to develop language proficiency in a second major-area language.

INTERDISCIPLINARY RESEARCH PAPER

A qualifying research paper is required to demonstrate field-specific research ability focused on the area of concentration. After they have completed substantial coursework in the area of concentration, students must seek approval from the council faculty adviser for the research project they propose as the qualifying paper. Normally, students will submit their request no later than the fourth week of the term in which they plan to submit the qualifying paper.

The interdisciplinary research paper may be the result of original research conducted under the supervision of a faculty member in a graduate seminar or independent readings course or in field research related to the student's studies. An M.A. thesis, Ph.D. prospectus, or dissertation may also be acceptable if it is interdisciplinary as well as focused on the area of concentration. The qualifying paper should examine questions concerning the area of concentration in a comparative and/or interdisciplinary context. It should also use relevant international and area-focused resource materials from a relevant region and/or resource materials in the language(s) of a relevant region or regions. Normally the paper should incorporate at least two of the following elements:

- Address more than one country relevant to the area of concentration
- Draw on more than one disciplinary field for questions or analytic approaches
- Address a transregional or transnational theme relevant to the area of concentration

The paper will be read by two faculty members selected in agreement with the council adviser. The readers will be evaluating the paper for the quality of research, knowledge of the relevant literature, and depth of analysis of the topic. The qualifying paper must be fully footnoted and have a complete bibliography. The council adviser may call for a third reader as circumstances warrant.

Progress Reports and Filing for the Award of the Certificate

Students should submit a progress report along with a copy of their unofficial transcript to the council faculty adviser at the end of each term. Ideally, this will include a brief

narrative describing the student's engagement in the relevant council's intellectual community and participation in its events, speaker series, and the like, as well as any planned or newly completed experience overseas.

A student who intends to file for the final award of the certificate should contact the council no later than the end of the term prior to award. No later than the fourth week of the term of the expected award, candidates should demonstrate how they have or will have completed all the requirements on time.

At the end of the term as grades are finalized, the council will confirm that the candidate is cleared to receive the home degree and has fulfilled all the requirements of the certificate. The final award will require review and clearance by the deputy director of the MacMillan Center.

Pursuit of Two Certificates

No courses may overlap between the two certificates. Any application for two certificates by a single student must robustly fulfill all of the requirements for each of the two certificates. Each certificate must be approved independently by each respective council's certificate adviser.

In addition to the approval of both council advisers, any award of two certificates will require review and approval by the deputy director of the MacMillan Center.

Council on African Studies

The MacMillan Center
137 Rosenkranz Hall, 203.432.1425
http://african.macmillan.yale.edu
Graduate Certificate of Concentration in African Studies

Chair
Cajetan Iheka (*English*)

Faculty
For faculty listings, see African Studies under Degree-Granting Departments and Programs in this bulletin.

SPECIAL REQUIREMENTS FOR THE GRADUATE CERTIFICATE OF CONCENTRATION IN AFRICAN STUDIES

The Graduate Certificate of Concentration in African Studies enables graduate and professional school students in fields other than African Studies to demonstrate interdisciplinary area expertise, language proficiency, and research competence in African Studies. The certificate program is intended to complement existing fields of studies in other M.A. and Ph.D. programs and to provide the equivalent of such specialization for students in departments and schools without Africa-related fields of study. The certificate program is designed to be completed within the time span of a normal Ph.D. residence. Professional school students and M.A. students in the graduate school may require an additional term of registration to complete the certificate requirements depending on the requirements of specific programs.

The certificate program includes interdisciplinary course work, language study, and research components. The specific requirements are as follows.

Courses Successful completion of at least six courses in African Studies from at least two departments or schools.

Language Demonstration of proficiency in an African language. Students may demonstrate proficiency in one of the following ways, subject to the approval of the African Studies DGS.

A. A transcript from undergraduate or summer language study, showing two semesters or equivalent with grades of B or better. This work must have been completed no more than three years earlier, or in some cases it may be completed during the summer after the student's first year in the Ph.D. program. The DGS may require detailed information about the coursework.
B. Passing a reading/translation exam administered by a language department at Yale, if such an exam exists.
C. Passing, with a grade of B, HP or better, two semesters of a language course given at Yale.
D. Passing, with a grade of B, HP or better, a seminar at Yale that is fully conducted in the target language (this includes undergraduate courses).

E. In the case of languages for which this is appropriate as determined by the DGS, students may pass an oral proficiency test administered by the Yale Center for Language Study.
F. The DGS, at their discretion, may accept other evidence of language competence, such as (but not limited to) completion of secondary education at a school that principally uses the language in question.

Research Paper Evidence of research expertise in African Studies. Research expertise may be demonstrated by completion of an interdisciplinary thesis, dissertation prospectus, or dissertation, or by completion of a substantive research seminar paper or the equivalent as approved by the faculty adviser.

The certificate courses and research work should be planned to demonstrate clearly fulfillment of the goals of the certificate. Certificate candidates should design their course schedules in consultation with the DGS for African Studies. Ideally, students should declare their intention to complete the certificate requirements early in their program at Yale. Graduate- and professional-school students who intend to complete the certificate program must declare their intention to do so no later than during their penultimate term of enrollment.

COURSES

For course listings, see African Studies under Degree-Granting Departments and Programs in this bulletin.

Council on East Asian Studies

The MacMillan Center
320 Luce Hall, 203.432.3426
http://ceas.yale.edu

Faculty
For faculty listings, see East Asian Studies under Degree-Granting Departments and Programs in this bulletin.

The Council on East Asian Studies (CEAS) was founded in 1961 and continues a long tradition of East Asian Studies at Yale. CEAS provides an important forum for academic exploration and support related to the study of China, Japan, and Korea. Its mission is to facilitate the training of undergraduate and graduate students and to foster outstanding education, research, and intellectual exchange about East Asia. For over sixty years, it has promoted education about East Asia both in the Yale curriculum and through lectures, workshops, conferences, film series, cultural events, and other activities open to students, faculty, and the general public. With more than twenty-five core faculty and twenty language instructors spanning twelve departments on campus, East Asian Studies remains one of Yale's most extensive area studies programs. Its interdisciplinary emphasis encourages collaborative linkages across fields and departments and contributes to diversity across the curriculum and in the classroom. Approximately one hundred fifty courses on East Asia in the humanities and social sciences are offered each year.

CEAS administers Bachelor of Arts (B.A.) and Master of Arts (M.A.) programs. While the B.A. program focuses on the study of either a country or an area within East Asia, the M.A. program focuses on the study of China, Japan, Korea, or a transnational region in East Asia. Graduates of the East Asian Studies B.A. and M.A. programs have gone on to distinguished careers in the fields of academia, business, nonprofit organizations, and government service. For details on the M.A. program, see East Asian Studies under Degree-Granting Departments and Programs in this bulletin.

East Asian Studies endowments make it possible for CEAS to offer grants and fellowships for Yale students conducting East Asian-related research and language study, as well as to support student organization programming and conferences.

Every year, CEAS welcomes domestic and international scholars to campus as guest lecturers, visiting fellows, research scholars, and professors. In 1999 the council initiated the CEAS Postdoctoral Associates Program, bringing talented individuals into the community of scholars at Yale to conduct research and teach advanced undergraduate seminars.

Study and research in East Asian Studies at Yale are supported by one of the finest library collections in the country. The Chinese-, Japanese-, and Korean-language print resources in the East Asia Library at Sterling Memorial Library constitute one of the oldest and largest collections found outside of East Asia. The Asian art collections at the Yale University Art Gallery also support classroom instruction, faculty research, and community outreach activities.

COURSES

For course listings, see East Asian Studies under Degree-Granting Departments and Programs in this bulletin.

European Studies Council

The MacMillan Center
242 Luce Hall, 203.432.3107
http://europeanstudies.macmillan.yale.edu
Graduate Certificate of Concentration in European and Russian Studies

Chair
Julia Adams (*Sociology*)

Director of Graduate Studies
Isaac Nakhimovsky (*History*; *Humanities*)

Faculty and Participating Staff
For faculty listings, see European and Russian Studies under Degree-Granting Departments and Programs in this bulletin.

The European Studies Council at the MacMillan Center promotes innovative research on Europe's past and present in the context of regional and global interactions. The council collaborates with schools and departments throughout Yale to support faculty, students, and visiting scholars by sharing their interdisciplinary expertise on European affairs with the broader public. The council aims to foster a wider understanding of Europe as both a place and an idea, reflecting the evolving nature of the region and its network of connections throughout the world.

The European Studies Council formulates and implements new curricular and research programs reflective of current developments in Europe. The geographical scope of the council's activities extends from Ireland to the lands of the former Soviet Union (Russia, Ukraine, Belarus, the Caucasus, and central Asia). Its definition represents a concept of Europe that transcends the conventional divisions into Western, Central, and Eastern Europe, and is understood to include the Balkans and Russia. The U.S. Department of Education has repeatedly designated the council a National Resource Center and a FLAS Center under its HEA Title VI program.

The European Studies Council builds on existing programmatic strengths at Yale, while serving as a catalyst for the development of new initiatives. Yale's current resources in European studies are vast and include the activities of many members of the faculty who have teaching and research specialties in the area. Such departments as Comparative Literature, Economics, History, History of Art, Political Science, and Sociology regularly offer courses with a European focus. These are complemented by the rich offerings and faculty strength of the French, German, Italian, Slavic Languages and Literatures, and Spanish and Portuguese departments, as well as the European resources available in the professional schools and other programs, such as Film and Media Studies. By coordinating Yale's existing resources, including those in the professional schools, encouraging individual and group research, and promoting an integrated comparative curriculum and degree programs, the council strongly supports the disciplinary and interdisciplinary study of European regions and their interactions. The council is also home to special programs in European Union Studies; Baltic Studies; and Russian, East European, and Eurasian Studies.

In addition to the M.A. degree program, the council offers students in the University's doctoral and other professional degree programs the chance to obtain a Graduate Certificate of Concentration in European and Russian Studies by fulfilling a supplementary curriculum. The undergraduate major in Russian, East European, and Eurasian Studies is administered by the Department of Slavic Languages and Literatures.

The benefits provided to the Yale community by the European Studies Council include its affiliation with interuniversity and international organizations that can offer specialized training programs and research grants for graduate students (see https://yale.communityforce.com/Funds/Search.aspx), support conferences among European and North American scholars, and subsidize European visitors to Yale. The Fox International Fellowship Program, for example, offers generous fellowship support to qualified students who undertake research at specified institutions in the United Kingdom, Germany, France, and Russia; and the Geneva Exchange supports Yale doctoral students who wish to study at the Graduate Institute of International and Development Studies in Geneva, Switzerland. Furthermore, the council supplements the regular Yale curriculum with film series, lectures, and seminars by eminent scholars, artists, diplomats, and political officials. The European Studies Council constantly expands its formal connections with a variety of European institutions and regularly hosts a European Union Fellow sponsored by the European Commission.

FIELDS OF STUDY

European and Eurasian languages and literatures; economics; history; journalism; policy; political science; law; music; sociology and other social sciences.

GRADUATE CERTIFICATE OF CONCENTRATION IN EUROPEAN AND RUSSIAN STUDIES

Yale graduate students may pursue the Graduate Certificate of Concentration in European and Russian Studies in conjunction with graduate-degree programs in the Graduate School of Arts and Sciences and the professional schools. Candidates will choose to focus on one of two areas of concentration, either (1) Russia, East Europe, Eurasia or (2) West and Central Europe. Admission is contingent on the candidate's acceptance and matriculation into a Yale graduate-degree program. To complete the certificate, candidates must demonstrate expertise in the area through their major graduate or professional field, as well as show command of the diverse interdisciplinary, geographic, and cultural-linguistic approaches associated with expertise in the area of concentration. In order to be awarded the certificate, candidates need to fulfill all requirements detailed below, as well as complete their Yale University graduate degree program.

Certificate candidates must comply with the general requirements for all MacMillan Center graduate certificates, as described at http://macmillan.yale.edu/academic-programs/graduate-certificate-concentration.

Additional Requirements Specific to European and Russian Studies

1. Minimum L4 language proficiency in one modern European or Eurasian language, in addition to English. Students wishing to focus on Russia, East Europe, and

Eurasia must demonstrate knowledge of Russian, an East European, or an Eurasian language; those focusing on West and Central Europe must demonstrate knowledge of one of the appropriate languages. Students must demonstrate proficiency in oral (speaking/listening), reading, and writing skills.

2. Six graduate-level courses in the area of concentration, of which:
   a. Three courses must offer transnational approaches to Europe and Eurasian-related issues
   b. For students focusing on Russia, East Europe and Eurasia, at least one of the remaining three courses must concern the nations of West and Central Europe. For those focusing on West and Central Europe, at least one of the remaining three courses must concern Russia, East Europe, and Eurasia.
3. Research paper: Evidence of research expertise in European and Russian studies. Research expertise may be demonstrated by completion of an interdisciplinary thesis, dissertation prospectus, or dissertation, or by completion of a substantive research seminar paper or the equivalent as approved by the faculty advisor.
4. Progress reports: Students should submit a progress report along with a copy of their unofficial transcript to the council faculty adviser at the end of each term. Ideally, this will include a brief narrative on engagement in the relevant council's activities and planned or newly completed experience overseas in the relevant region.
5. Filing for the award of the graduate certificate of concentration: Students who intend to file for the final award of the certificate should contact the council no later than the end of the term prior to award. No later than the fourth week of the term of the expected award, students should demonstrate how they have or will have completed all the requirements in a timely fashion. At the end of the term as grades are finalized, the council will confirm that the student is cleared to receive the home degree and has fulfilled all the requirements of the certificate. Students may elect to retrieve the certificate award in person from the council after commencement. Otherwise, the council will email the certificate award to the student after commencement.

COURSES

For course listings, see European and Russian Studies under Degree-Granting Departments and Programs in this bulletin.

For more information, contact the European Studies Council, Yale University, PO Box 208206, New Haven CT 06520-8206; european.studies@yale.edu; 203.432.3107.

Council on Latin American and Iberian Studies

The MacMillan Center
232 Luce Hall
https://macmillan.yale.edu/latam
latinamerica@yale.edu
Graduate Certificate of Concentration in Latin American and Iberian Studies

Chair
K. David Jackson (*Spanish and Portuguese*)

Professors Ned Blackhawk (*History*; *American Studies*), Richard Burger (*Anthropology*), Marlene Daut (*French*), Enrique De La Cruz (*Molecular Biophysics and Biochemistry*), Carlos Eire (*History*; *Religious Studies*), Eduardo Fernandez-Duque (*Anthropology*), Paul Freedman (*History*), Aníbal González-Pérez (*Spanish and Portuguese*), K. David Jackson (*Spanish and Portuguese*), Albert Ko (*Epidemiology*; *Internal Medicine*), Daniel Markovits (*Law*), Catherine Panter-Brick (*Anthropology*; *Global Affairs*), Stephen Pitti (*History*; *American Studies*; *Ethnicity, Race, and Migration*), Claire Priest (*Law*), Ana Ramos-Zayas (*Ethnicity, Race, and Migration*; *American Studies*; *Anthropology*), Cristina Rodríguez (*Law*), Carla Rothlin (*Immunobiology*; *Pharmacology*), Alicia Schmidt Camacho (*Ethnicity, Race, and Migration*; *American Studies*), Claudia Valeggia (*Anthropology*), Noël Valis (*Spanish and Portuguese*), Lisa Voigt (*Spanish and Portuguese*), Elisabeth Wood (*Political Science*)

Associate Professors Paulo Brando (*School of the Environment*), Oswaldo Chinchilla Mazariegos (*Anthropology*), Ana De La O Torres (*Political Science*), Marcelo Dietrich (*Medicine*), Marcela Echeverri Muñoz (*History*), Anne Eller (*History*), Moira Fradinger (*Comparative Literature*), Albert Laguna (*American Studies*; *Ethnicity, Race, and Migration*), Michael Murrell (*Biomedical Engineering*), Christen Smith (*Anthropology*; *African American Studies*), Aurélie Vialette (*Spanish and Portuguese*)

Assistant Professors Santiago Acosta (*Spanish and Portuguese*), Ángel Escamilla García (*Sociology*), Nicholas Jones (*Spanish and Portuguese*), Gana Ndiaye (*Ethnicity, Race, and Migration*), Catalina Ospina (*History of Art*), Didac Queralt (*Political Science*), David Sadighian (*Architecture*), Emily Sellars (*Political Science*), Erika Valdivieso (*Classics*)

Senior Lectors and Lectors (Spanish and Portuguese) Sybil Alexandrov, María Pilar Asensio-Manrique, María Carolina Baffi, Mercedes Carreras, María de la Paz García, Igor de Souza, Sebastián Díaz, Kevin Ennis, Alexander Gil Fuentes, Sarah Glenski, María José Gutiérrez Barajas, María Jordán, Rosamaría León, Mayte López, Jorge Méndez-Seijas, Luna Najera, Juliana Ramos-Ruano, Lissette Reymundi, Lucía Rubio, Ian Russell, Lourdes Sabé Colom, Margherita Tortora

Affiliated Faculty Fadila Habchi (*African American Studies*; *American Studies*), María José Hierro Hernández (*Political Science*), Jana Krentz (*Yale University Library*), Ximena López Carrillo (*Ethnicity, Race, and Migration*), Florencia Montagnini (*School of the Environment*), Alejandro Roca (*Voice and Opera*), Maria Saez Marti (*Economics*)

A variety of Latin American Studies options are available for graduate students in history and other humanities disciplines, the social sciences, and the professional schools. Latin American area course offerings are available in twenty-five disciplines

with distinct strengths in anthropology; history; political science; ethnicity, race, and migration; and Spanish and Portuguese. Latin Americanist faculty specialize in the Andes (Burger, Ospina, Valdivieso, Voigt), Argentina (Fradinger, Valeggia), Brazil (Jackson, Ko, Ndaye, Smith), the Caribbean (Daut, Echeverri Muñoz, Eller, Espín-Sánchez, Fradinger, Gil Fuentes, González-Pérez, Glover, Habchi, Hernández-Acosta, Neilson), Central America (Chinchilla, Escamilla-García, Sellars, Wood), Colombia (Echeverri Muñoz, Espín-Sánchez, Francis, Wood), Cuba (Espín-Sánchez, Laguna), Guatemala (Chinchilla), Haiti (Daut, Eller, Glover), Mexico (Caplan, De La O Torres, Espín-Sánchez, López Carrillo, Pitti, Schmidt Camacho, Sellars), and the Southern Cone (Fradinger). School of the Environment faculty (Ashton, Bell, Brando, Doolittle, Gentry, Mendelsohn, Montagnini, Queensborough) have tropical research interests or participate in educational exchanges with Argentina, Brazil, Chile, Costa Rica, Dominica, Ecuador, Haiti, Honduras, Mexico, Nicaragua, Panama, Peru, and Venezuela. Latin American content courses are also offered in the Schools of Architecture, Environment, Management, and Public Health as well as the Law School, the Divinity School, the David Geffen School of Drama, and the Jackson School of Global Affairs.

Students may pursue the Graduate Certificate of Concentration in Latin American and Iberian Studies in conjunction with graduate degree programs in the Graduate School of Arts and Sciences and the professional schools. To complete the certificate, candidates must demonstrate expertise in the area through their major graduate or professional field, as well as show command of the diverse interdisciplinary, geographic, cultural, and linguistic approaches associated with expertise in Latin America or Iberia.

Admission is contingent on the candidate's acceptance into a Yale graduate degree program, and award of the certificate, beyond fulfilling the relevant requirements, requires the successful completion of the candidate's Yale University degree program. Active participation in the council's extracurricular and research programs and seminars is also strongly encouraged.

Financial resources, such as CLAIS Summer Research grants, are available to graduate and professional school students for summer research. Information on grants is available at https://yale.communityforce.com/Funds/Search.aspx.

SPECIFIC REQUIREMENTS FOR THE GRADUATE CERTIFICATE OF CONCENTRATION

Language Proficiency The equivalent of two years' study of one language and one year of the other, normally Spanish and Portuguese. Less frequently taught languages, such as Nahuatl, Quechua, or Haitian Creole, may also be considered for meeting this requirement.

Coursework Six graduate courses in at least two different disciplines. No more than four courses may count in any one discipline.

Geographical and Disciplinary Coverage At least two countries and two languages must be included in the course work or thesis.

Research A major graduate course research paper or thesis that demonstrates the ability to use field resources, ideally in one or more languages of the region, normally with a focus on a comparative or regional topic rather than a single country.

The certificate adviser of the Council on Latin American and Iberian Studies will assist graduate students in designing a balanced and coordinated curriculum. The council will provide course lists and other useful materials.

ACADEMIC RESOURCES OF THE COUNCIL

The council supplements the graduate curriculum with annual speaker and film series, special seminars, and conferences that bring visiting scholars and experts to campus. The council also serves as a communications and information center for a vast variety of enriching events in Latin American studies sponsored by other departments, schools, and independent groups at Yale. It is a link between Yale and Latin American centers in other universities, and between Yale and educational programs in Latin America and Iberia.

The Latin American Collection of the university library has approximately 630,000 volumes printed in Latin America, plus newspapers and microfilms, CD-ROMs, films, sound recordings, and maps. The library's Latin American Manuscript Collection is one of the finest in the United States for unpublished documents for the study of Latin American history. Having the oldest among the major Latin American collections in the United States, Yale offers research opportunities unavailable elsewhere.

For more information on the Graduate Certificate, contact the Council on Latin American and Iberian Studies, Yale University, PO Box 208206, New Haven CT 06520-8206; latin.america@yale.edu

Council on Middle East Studies

The MacMillan Center
346 Rosenkranz Hall, 203.436.2553
http://cmes.macmillan.yale.edu
Graduate Certificate of Concentration in Modern Middle East Studies

Chair
Travis Zadeh (*Religious Studies*)

Professors Abbas Amanat (*Emeritus*; *History*), Harold Attridge (*Emeritus*; *Divinity*), Asli Bali (*Law*), Gerhard Bowering (*Emeritus*; *Religious Studies*), John J. Collins (*Emeritus*; *Divinity*), John Darnell (*Near Eastern Languages and Civilizations*), Stephen Davis (*Religious Studies*), Omnia El Shakry (*History*), Owen Fiss (*Emeritus*; *Law*), Steven Fraade (*Religious Studies*), Eckart Frahm (*Near Eastern Languages and Civilizations*), Frank Griffel (*Religious Studies*), Dimitri Gutas (*Emeritus*; *Near Eastern Languages and Civilizations*), Christine Hayes (*Religious Studies*), Hannan Hever (*Comparative Literature*), Frank Hole (*Emeritus*; *Anthropology*), Marcia Inhorn (*Anthropology*), Anthony Kronman (*Law*), Amara Lakhous (*Italian*), J.G. Manning (*Classics*), Ivan Marcus (*History*), Alan Mikhail (*History*), A. Mushfiq Mobarak (*School of Management*), Nadine Moeller (*Near Eastern Languages and Civilizations*), Robert Nelson (*Emeritus*; *History of Art*), Catherine Panter-Brick (*Anthropology*), Kishwar Rizvi (*History of Art*), Laura Robson (*Global Affairs*; *History),* Maurice Samuels (*French*), Shawkat Toorawa (*Near Eastern Languages and Civilizations*), Kevin van Bladel (*Near Eastern Languages and Civilizations*), Harvey Weiss (*Near Eastern Languages and Civilizations*), Robert Wilson (*Emeritus*; *Religious Studies*), Jonathan Wyrtzen (*Sociology*; *History*), Travis Zadeh (*Religious Studies*)

Associate Professors Thomas Connolly (*French*), Robyn Creswell (*Comparative Literature*), Hussein Fancy (*History*), Zareena Grewal (*American Studies*), Jill Jarvis (*French*), Kaveh Khoshnood (*Public Health*), Hani Mowafi (*Emergency Medicine*), Alden Young (*History*; *Global Affairs*)

Assistant Professors Giulia Accornero (*Music*), Supriya Gandhi (*Religious Studies*), Samuel Hodgkin (*Comparative Literature*), Yagmur Karakaya (*Sociology*), Jane Mikkelson (*Humanities*), Eda Pepi (*Women's, Gender, and Sexuality Studies*), Claire Roosien (*Slavic Languages and Literatures*), Evren Savci (*Women's, Gender, and Sexuality Studies*), Madiha Tahir (*American Studies*)

Senior Lecturers and Lecturers Leslie Gross-Wyrtzen, Tolga Köker (*Economics*), Nicholas Lotito (*Political Science*), Emma Sky (*Global Affairs*), Kathryn Slanski (*Near Eastern Languages and Civilizations*)

Senior Lectors (I, II) and Lectors Sarab Al Ani (*Arabic*), Muhammad Aziz (*Arabic*), Ramla Bedoui (*French*), Jonas Elbousty (*Arabic*), Ozgen Felek (*Turkish*), Shiri Goren (*Hebrew*), Randa Muhammed (*Arabic*), Dina Roginsky (*Hebrew*), Farkhondeh Shayesteh (*Persian*), Ezgi Yalcin (*Turkish*), Orit Yeret (*Hebrew*)

Librarians and Curators Roberta Dougherty (*Near East Collection*), Konstanze Kunst (*Judaica Collection*), Agnete Wisti Lassen (*Babylonian Collection*), Susan Matheson (*Ancient Art, Yale Art Gallery*)

The Council on Middle East Studies is part of the Whitney and Betty MacMillan Center for International and Area Studies. The council brings together faculty and students sharing an interest in the Middle East by sponsoring conferences, discussions, films, and lecture series by scholars from Yale as well as visiting scholars. It provides information concerning grants, fellowships, research programs, and foreign study opportunities. It also administers research projects in a variety of Middle East–related areas.

In addition to the resources of the individual departments, Yale's library system has much to offer the student interested in Middle East studies. Of particular note are the collections of Arabic and Persian manuscripts, as well as large holdings on the medieval and modern Middle East.

The Council on Middle East Studies administers the Middle East Studies National Resource Center at Yale, which is funded by the U.S. Department of Education under HEA Title VI. As a National Resource Center, the council supports a number of projects and activities and an extensive outreach program.

The council also offers a Graduate Certificate of Concentration in Modern Middle East Studies. Students with an interest in the Middle East should first apply to one of the University's degree-granting departments, such as Anthropology, History, Linguistics, Near Eastern Languages and Civilizations, Political Science, Religious Studies, or Sociology, and then apply for the graduate certificate of concentration no later than the beginning of their penultimate term of study.

GRADUATE CERTIFICATE OF CONCENTRATION IN MODERN MIDDLE EAST STUDIES

The certificate represents acknowledgment of substantial preparation in Middle East studies, both in the student's major graduate or professional field and also in terms of the disciplinary and geographical diversity required by the council for recognized competency in the field of Middle East studies. As language and culture are the core of the area studies concept, students are required to attain or demonstrate language proficiency.

Requirements

1. Language proficiency: At least two years of successful study at the college level (or the equivalent) in one of the four major modern languages of the Middle East: Arabic, Hebrew, Persian, and Turkish.
2. Course work: A total of six courses in at least two disciplines on the Middle East and related issues. All courses must be completed with a passing grade.
3. Interdisciplinary research paper: A qualifying research paper that demonstrates field-specific research ability focused on the area of concentration. After having completed substantial course work in the area of concentration, students must seek approval from the council faculty adviser for the research project they propose as the qualifying paper. Normally, students submit their request no later than the fourth week of the term in which they plan to submit the qualifying paper.

For more information on the Graduate Certificate and inquiries about Middle East Studies, contact the Council on Middle East Studies, Yale University, PO Box 208206, New Haven CT 06520-8206; cristin.siebert@yale.edu.

South Asian Studies Council

The MacMillan Center
210 Luce Hall, 203.436.3517
http://southasia.macmillan.yale.edu

Chair
Rohit De (*History*)

Professors Sunil Amrith (*History*), Tim Barringer (*History of Art*), Veneeta Dayal (*Linguistics*), Mayur Desai (*School of Public Health*), Michael Dove (*Anthropology*; *School of the Environment*), David Engerman (*History*; *Global Affairs*), Robert Jensen (*Economics*), Mushfiq Mobarak (*Economics*; *School of Management*), Bhramar Mukherjee (*School of Public Health*), Kaivan Munshi (*Economics*), Rohini Pande (*Economics*), Kishwar Rizvi (*History of Art*), Kalyanakrishnan Sivaramakrishnan (*Anthropology*; *School of the Environment*), Kalindi Vora (*Women's, Gender, and Sexuality Studies*; *Ethnicity, Race, and Migration*), Steven Wilkinson (*Political Science*)

Associate Professors Anthony Acciavatti (*Architecture*), Rohit De (*History*), Zareena Grewal (*Ethnicity, Race, and Migration*)

Assistant Professors Supriya Gandhi (*Religious Studies*), Sonam Kachru (*Religious Studies*), Jane Mikkelson (*Humanities*), Priyasha Mukhopadhyay (*English*), Ameera Nimjee (*Music*), Madiha Tahir (*American Studies*), Brian Wahl (*School of Public Health*)

Senior Lecturers Carol Carpenter (*Anthropology*; *School of the Environment*), Shilarna Stokes (*Theater, Dance, and Performance Studies*)

Lecturers Jane Lynch (*Anthropology*), Sushant Singh (*South Asian Studies*), Nafeesa Syeed (*English*; *South Asian Studies*)

Senior Lectors Swapna Sharma (*Hindi*), Aleksandar Uskokov (*Sanskrit*)

Lector Mansi Bajaj (*Hindi*)

Students with an interest in South Asian Studies should apply to one of the university's degree-granting departments, such as Anthropology, History, Political Science, Economics, or Religious Studies. The South Asian Studies Council is part of the MacMillan Center for International and Area Studies. It has been organized to provide guidance to graduate students who desire to use the resources of the departments of the university that offer South Asia-related courses.

The South Asian Studies Council aims to bring together faculty and students sharing an interest in South Asia, and it supplements the curriculum with seminars, conferences, and special lectures by scholars from Yale as well as visiting scholars. It provides information concerning grants, fellowships, research programs, and foreign study opportunities.

Language instruction is offered in Hindi and Sanskrit. Students planning to undertake field research or language study in South Asia may apply to the council for summer fellowship support.

For information and program materials, contact the South Asian Studies Council, Yale University, PO Box 208206, New Haven CT 06520-8206; or visit our website, https://macmillan.yale.edu/southasia.

COURSES

HNDI 5100a, Elementary Hindi Swapna Sharma
An in-depth introduction to modern Hindi, including the Devanagari script. Through a combination of graded texts, written assignments, audiovisual material, and computer-based exercises, the course provides cultural insights and increases proficiency in understanding, speaking, reading, and writing Hindi. Emphasis placed on spontaneous self-expression in the language. No prior background in Hindi assumed.

HNDI 5300a, Intermediate Hindi I Mansi Bajaj
First half of a two-term sequence designed to develop proficiency in the four language skill areas. Extensive use of cultural documents including feature films, radio broadcasts, and literary and nonliterary texts to increase proficiency in understanding, speaking, reading, and writing Hindi. Focus on cultural nuances and various Hindi literary traditions. Emphasis on spontaneous self-expression in the language. Prerequisite: HNDI 520 or equivalent.

HNDI 5320a, Accelerated Hindi I Mansi Bajaj
Development of increased proficiency in the four language skills. Focus on reading and higher language functions such as narration, description, and comparison. Reading strategies for parsing paragraph-length sentences in Hindi newspapers. Discussion of political, social, and cultural dimensions of Hindi culture as well as contemporary global issues.

HNDI 5500a, Advanced Hindi Swapna Sharma
An advanced language course aimed at enabling students to engage in fluent discourse in Hindi and to achieve a comprehensive knowledge of formal grammar. Introduction to a variety of styles and levels of discourse and usage. Emphasis on the written language, with readings on general topics from newspapers, books, and magazines. Prerequisite: HNDI 540 or permission of instructor.

HNDI 5980a, Advanced Tutorial Swapna Sharma
For students with advanced Hindi language skills who wish to engage in concentrated reading and research on material not otherwise offered by the department. The work must be supervised by an adviser and must terminate in a term paper or its equivalent. Prerequisites: HNDI 540, and submission of a detailed project proposal and its approval by the language studies coordinator.

SAST 8200a / HIST 8600a, Readings in South Asia: Across the Disciplines Rohit De and Sunil Amrith
Since the emergence of subaltern studies in the 1980s, South Asian historiography has been dominated by debates over the methods and theory that have come to influence the broader discipline of history. The seminar introduces participants to the major debates in South Asian studies through reading the original texts alongside newer scholarship addressing the themes of bureaucracy, secularism, visual media, political economy, and the environment.

SKRT 5100a / LING 5150a, Introductory Sanskrit I Aleksandar Uskokov
An introduction to Sanskrit language and grammar. Focus on learning to read and translate basic Sanskrit sentences in the Indian Devanagari script. No prior background in Sanskrit assumed. Credit only on completion of SKRT 520/LING 525.

SKRT 5300a / LING 5380a, Intermediate Sanskrit I Aleksandar Uskokov
The first half of a two-term sequence aimed at helping students develop the skills necessary to read texts written in Sanskrit. Readings include selections from the *Hitopadesa, Kathasaritsagara, Mahabharata,* and *Bhagavadgita*. Prerequisite: SKRT 520/ LING 525 or equivalent.

SKRT 5500a, Advanced Sanskrit: Readings in Indian Philosophy and Aesthetics Aleksandar Uskokov
This advanced language course introduces the jargon of the philosophical disciplines (theory of knowledge, metaphysics, philosophy of mind and language, philosophical theology, hermeneutics) and aesthetics in the several systems of learning in ancient and classical India, across the traditions of Hinduism, Buddhism, and Jainism. Additionally, the course introduces topics of philosophical significance in foundational texts such as the Upaniṣads, portions of the *Mahābhārata* and the *Purāṇa*s, and the Buddhist *sūtra* literature. Special attention is given to matters of style, scholastic techniques, and advanced morphology and syntax. The course thus combines advanced language instruction with learning intellectual and cultural content, and it facilitates training in primary research in one of the classical languages of South Asia. Prerequisite: SKRT 540.

Council on Southeast Asia Studies

The MacMillan Center
311 Luce Hall
seas@yale.edu
http://cseas.yale.edu

Chair
Erik Harms (*Anthropology*)

Professors Sunil Amrith (*History*), Michael Dove (*School of the Environment*), Erik Harms (*Anthropology*), Mimi Hall Yiengpruksawan (*History of Art*)

Assistant Professor Alka Menon (*Sociology*), Nurfadzilah Yahaya (*History*)

Lecturers and Lectors (I, II) Dinny Risri Aletheiani (*Indonesian Language Studies*), Carol Carpenter (*School of the Environment*), Amity Doolittle (*School of the Environment*), Indriyo Sukmono (*Indonesian Language Studies*), Quan Tran (*American Studies*), Quang Phu Van (*Vietnamese Language Studies*), Louward Allen Zubiri

Curators and Librarians Ruth Barnes (*Indo-Pacific Art, Yale Art Gallery*), Brent Bianchi (*Librarian, South and Southeast Asian Studies*)

Yale does not offer higher degrees in Southeast Asia studies. Instead, students apply for admission to one of the university's degree-granting departments or professional schools and turn to the Council on Southeast Asia Studies for guidance regarding the development of their special area interest, courses outside their department, and instruction in Southeast Asian languages related to their research interest. Faculty members of the SEAS council are available to serve as Ph.D. advisers and committee members. The council aims to bring together faculty and students sharing an interest in Southeast Asia and contributes to the graduate and undergraduate curriculum with language courses, an annual seminar series, periodic conferences, cultural events, and special lectures.

Yale offers extensive library and research collections on Southeast Asia in Sterling Memorial Library, the Economic Growth Center, and the Peabody Museum. Further information on library resources is available from Sterling Memorial Library (203.432.9350).

Language instruction is offered to graduate and undergraduate students in three Southeast Asian languages, Indonesian, Vietnamese, and Filipino (Tagalog). The council supports language tables and independent study or tutoring in other Southeast Asian languages through the Directed Independent Language Study Program or by special arrangement. Students planning to undertake field research or language study in Southeast Asia may apply to the council for summer fellowship support; see http://cseas.yale.edu/grants-students.

For information on program activities and participating faculty, contact the Council on Southeast Asia Studies, Yale University, PO Box 208206, New Haven CT 06520-8206; seas@yale.edu.

COURSES

Courses in Indonesian and Vietnamese languages at the elementary, intermediate, and advanced levels are listed in *Yale College Programs of Study* and at http://courses.yale.edu.

INDN 5700b, Readings in Indonesian Dinny Aletheiani
For students with advanced Indonesian language skills preparing for academic performance and/or research purposes. Prerequisites: advanced Indonesian and permission of the instructor.

Material Histories of the Human Record

https://materialhistories.yale.edu

Program Directors and Directors of Graduate Studies Lucy Mulroney, Ayesha Ramachandran

Steering Committee Melissa Barton (*Beinecke Library*), Jacqueline Goldsby (*English*; *African American Studies*; *American Studies*), Melissa Grafe (*Medical Historical Library*), Agnete Lassen (*Yale Babylonian Collection*; *Yale Peabody Museum*), Brian Meacham (*Yale Film Archive*), Shawkat Toorawa (*Near Eastern Languages and Civilizations*; *Comparative Literature*), Erika Valdivieso (*Classics*)

Affiliated Faculty and Staff Melissa Barton (*Beinecke Library*), Marissa Bass (*History of Art*), Jessica Brantley (*English*), Jacqueline Goldsby (*English*; *African American Studies*; *American Studies*), Bruce Gordon (*History*), Melissa Grafe (*Medical Historical Library*), Alice Kaplan (*French*), Agnete Lassen (*Yale Babylonian Collection*; *Yale Peabody Museum*), Brian Meacham (*Yale Film Archive*), Priyasha Mukhopadyay (*English*), Lucy Mulroney (*Yale Special Collections*), John Durham Peters (*English*), Jennifer Raab (*History of Art*), Ayesha Ramachandran (*Comparative Literature*), Camille Thomasson (*Film and Media Studies*), Shawkat Toorawa (*Near Eastern Languages and Civilizations*; *Comparative Literature*), Erika Valdivieso (*Classics*)

GRADUATE CERTIFICATE IN MATERIAL HISTORIES OF THE HUMAN RECORD

The archive, the book: Our ability to bear witness, hold history to account, and imagine a more just future is at the core of the humanities as a scholarly project. The certificate in Material Histories of the Human Record is designed to expose students to multiple forms of expertise within Yale's special collections libraries, equip emerging scholars with new analytical skills, and teach them the methodologies that scholars, librarians, archivists, conservators, and curators employ as they preserve, interrogate, and steward the human record. Drawing on Yale Libraries' extraordinary collections and staff expertise, and the ongoing faculty interest in the histories and politics of archives, the material text, and metadata, the graduate certificate in Material Histories of the Human Record fosters innovation at the interstices and intersections of disciplines.

"Material histories" signals an expansive interest in a wide variety of materials and media—not only manuscripts, written documents and paper-based records, but also papyrus fragments, tablets, photographs, film, textile, audio, three-dimensional works, and other formats. The purview of the certificate also necessarily includes an engagement with the opportunities and challenges of new digital methods for preservation, cataloging, and research. Areas of particular focus for the certificate may include: archival studies and theories of archives; global histories of the book; material formats and their histories; the non-neutrality of metadata; privacy and questions of evidence; social injustice in/and/as the historical record; preservation and conservation science; international law, the book trade, and provenance.

Eligibility

The certificate is open to graduate students pursuing the Ph.D. or a professional school degree, with the approval of their director of graduate studies (DGS). Interested

students should meet with one of the certificate's directors during their first two years of graduate study. However, we welcome applications from students in advanced years (year three and above) who have already completed substantial coursework in the broad field of material histories of the human record. In such cases, we will work closely with the students' DGS and dissertation adviser to determine whether and how the student might reasonably complete the certificate without detriment to their advancement through the doctoral degree. Requirements for the certificate must be completed by the time that the student's dissertation (or equivalent program requirement) is filed.

Requirements for the Certificate in Material Histories of the Human Record

Students who wish to receive the certificate must complete the following course work, research, and teaching requirements:

Coursework Each student must take MHHR 7000 and MHHR 7001, Theory and Praxis of Material Histories. In addition, each student is required to take two elective courses, which also count towards the student's doctoral coursework in their department. At least one of these courses would need to be substantively taught with collections; the other course may be a directed reading or focus on archives, book history, or metadata as a theoretical or historical object of study. Each student is expected to organize their elective courses around a concentration related to their departmental coursework and doctoral research. Students should consult the co-directors about which courses might be eligible as electives.

Capstone (MHHR 9900) In addition to the two elective courses, in order to facilitate specialization, students are expected to propose a capstone project with one of Yale's cultural heritage institutions (to be approved by the student's DGS and the co-directors of the certificate). This project must be completed before the student's terminal graduation date. It must be structured as a directed reading/independent study for course credit. From the start of their pursuit of the certificate, students consult with the co-directors on what kinds of projects would work best for them. Possible projects include assisting with: the curation of an exhibition, reparative archival description, the Black Bibliography Project, provenance research, scientific conservation analysis. The practicum should culminate in either a final paper and/or a public presentation (which might take the form of a symposium, a finding aid, a descriptive bibliography, an edition, an exhibit, a digital humanities project, etc.). The co-directors maintain an ongoing list of possible opportunities and also help to facilitate new ones based on students' and librarians' interest. Students are then be matched with an appropriate adviser/mentor who help guide the project.

Teaching (MHHR 9500) Students commit to doing significant teaching in the collections through one of the following pathways: (a) serving as a teaching fellow in a course with a substantial collections-based curriculum (such as courses associated with the Six Pretty Good Ideas first-year program); (b) assisting with a Beinecke intensive course three to four times a semester; or (c) supporting collections-based courses on a one-off basis four to six times over the course of a year. The codirectors also work on creating graduate professional development opportunities for students within the Yale libraries which can be used as a substitute for the teaching requirement. Students

should plan to consult early with the certificate co-directors and their DGS to plan for this requirement. Students must register for MHHR 9500 in the semester when they plan to complete their teaching requirement for the certificate.

CERTIFICATE WORKSHOP

MHHR 7000a, Theory and Praxis of Material Histories Ayesha Ramachandran and Melissa Grafe

This year-long workshop focuses on the concepts, debates, methodologies, theories, and real-world constraints of the material histories of the human record across a range of formats and media. Organized around six rubrics—Collecting, Describing, Displaying, Embodying, Disembodying, and Representing—we aim to cut across long-standing divides between collections, archives and libraries, on the hand, and scholarly/artistic spaces of the academic world; between preservation and consumption; between privacy and publicity; between the social sciences and the humanities. Through critical readings that engage with diverse geographic and temporal subjects; the close analysis and physical handling of rare books, maps, manuscripts, images, objects, and textiles; and an orientation to cultural heritage and library professional practices and procedures, students learn the critical interventions of the history of the book and the archival turn in the humanities; the key concepts and genealogies of archives and library special collections; and the generative collaborations currently underway between faculty and librarians to jointly address legacies of racism and white privilege, advance intellectual freedom and parity, and define the ethical stewardship of the material histories of the human record today. This workshop takes the form of a half-credit course in each semester that meets six times a term (every other week). This course must be taken before or after MHHR 7001 to earn 1 full credit. We welcome all curious students to the first class, but permission of the instructors is subsequently required for enrollment/registration. This course meets in the Gates Classroom, Sterling Library. ½ Course cr

Medical Research Scholars Program

https://medicine.yale.edu/bbs/training/nih-programs/mrsp

Directors
Michael Caplan
George Lister
Megan C. King

MEDICAL RESEARCH SCHOLARS PROGRAM GRADUATE CERTIFICATE

The Medical Research Scholars Program (MRSP) bridges barriers between traditional predoctoral and medical training by providing students with both medically oriented coursework and a mentored clinical experience. The coursework provides a grounding in biomedicine, and the clinical experience enables students to interact with patients to learn firsthand about disease symptoms, treatment options, and the limitations of current therapies. This combination of medical knowledge and face-to-face interaction with patients and their doctors provides a new perspective and enhances the rigorous training students receive in the Yale Biological and Biomedical Sciences (BBS) Program.

Program Eligibility

Incoming BBS students are eligible to apply, and five to seven students are admitted per year. Students are invited to apply after accepting Yale's offer of admission to the Graduate School of Arts and Sciences. A separate MRSP application is required, and the MRSP core leadership team will review applications and select students for the program. If admitted, students remain within the BBS Program but participate in the additional MRSP curriculum.

The Curriculum

The MRSP curriculum consists of four full-term courses that focus first on normal human physiology and organ-based cell biology, followed by human pathobiology and then an introduction to drug discovery, validation and clinical trials. Students also take an intensive summer course in biostatistics. Some of these MRSP courses are open to all BBS students at the discretion of the course directors. The centerpiece of the MRSP is an additional two-year Mentored Clinical Experience course during years two and three of the program. This course integrates basic and clinical research while additionally granting students access to patients and patient settings. Exposure to patients and to the practice of medicine will enable graduates to work more confidently at the interface of research and medicine and facilitate future collaborations with clinical researchers. The Mentored Clinical Experience is open only to students formally enrolled as Medical Research Scholars and to students in the Translational Biomedicine Ph.D. program.

Year One

Fall		
C&MP 5500	Physiological Systems	1

Spring		
PTB 5604	Physiologic Function and Cellular Structure of Organ Systems	1
Summer		
IMED 5645	Introduction to Biostatistics in Clinical Investigation	1
Year Two		
Fall		
PATH 5690	Molecular Mechanisms of Disease [1]	1
Spring		
IMED 6680	Topics in Human Investigation	1
Years Two and Three		
C&MP 5610	Medical Research Scholars Program: Mentored Clinical Experience	1

[1] May be substituted with C&MP 5700, Physiology in Medicine.

Award of the Certificate

Students who complete the full curriculum and who remain in good academic standing in their graduate programs will be awarded the certificate.

Integrated Graduate Program in Physical and Engineering Biology (PEB)

http://peb.yale.edu
peb@yale.edu

Director
Corey O'Hern (*Mechanical Engineering*; *Physics*; *Applied Physics*; *Materials Science*; *Computational Biology and Biomedical Informatics*)

Associate Director
Emma Carley

The Yale PEB program brings together faculty from the physical, engineering, and biological sciences, who carry out collaborative, interdisciplinary research and teaching. Participation in the PEB program is open to any graduate student (Ph.D. or Master's) who is interested in applying quantitative, physical approaches to study important biological questions. PEB-participating departments, tracks (BBS), and degree-granting programs include Applied Mathematics; Applied Physics; Biochemistry, Quantitative Biology, Biophysics, and Structural Biology (BBS track); Biomedical Engineering; Chemical and Environmental Engineering; Chemistry; Computational Biology and Biomedical Informatics (BBS track and also degree-granting program); Engineering and Applied Sciences; Mechanical Engineering and Materials Science; Molecular Cell Biology, Genetics, and Development (BBS track); Molecular Medicine, Pharmacology, and Physiology (BBS track); Neuroscience (BBS track); Plant Molecular Biology (BBS track); and Physics.

Graduate Certificate in Physical and Engineering Biology (PEB)

Upon advancement to candidacy in a home department and satisfaction of the PEB, master's, and Ph.D. requirements, students receive a certificate from the Integrated Graduate Program in Physical and Engineering Biology.

Students interested in participating in the PEB program may indicate their interest on their graduate application for admission to a home department or track. Students may also join the PEB after they have matriculated at Yale. After arriving at Yale, students should e-mail peb@yale.edu to express their interest in the PEB, and the leadership will review their application materials.

PEB students acquire a depth of knowledge in their home department and also a breadth of knowledge across disciplines from PEB courses and activities. They will become skilled at applying physical and engineering methods and quantitative reasoning to biological problems, and at identifying and tackling cutting-edge problems in the life sciences, and they will be proficient at combining theory and computation with wet lab experiments. In addition, students will become comfortable working in an interdisciplinary and collaborative research environment and adept at communicating with scientists from a variety of disciplines as well as with nonscientists.

CURRICULUM

The PEB curriculum consists of four core courses, which all students, regardless of their undergraduate background, take together. We suggest that these courses are completed by the second year of study, however this is not required.

Core Courses

Typically taken in the first year:		
ENAS 5710	Integrated Workshop	1
MB&B 5170	Methods and Logic in Interdisciplinary Research	1
Typically completed by the second year:		
ENAS 5410	Biological Physics	1
ENAS 5620	Modeling Biological Systems II	1

With permission of the PEB leadership, students may substitute either Biological Physics or Modeling Biological Systems II with a different graduate-level course that more closely aligns with their research interests. To request a substitution, students should email Professor O'Hern and Dr. Carley.

Two primer courses are also offered (but not required). Boot Camp Biology (MB&B 5200) is a primer course for students entering PEB with little or no background in biology, and Quantitative Approaches in Biophysics and Biochemistry (MB&B 6350/ENAS 5180) is a primer course for students entering PEB with little or no background in mathematics and computation.

CERTIFICATE REQUIREMENTS (PH.D. STUDENTS)

To receive the certificate, students must:

- Complete the PEB curriculum
- Meet with PEB leadership at least once in their first or second year to discuss certificate progress
- Present their research during the PEB Discussion Group in May of their second year
- Participate in at least one PEB-hosted outreach event or an approved non-PEB outreach event (email Dr. Carley to request permission for a non-PEB outreach event to fulfill this requirement).
- Participate in at least two professional development opportunities. Eligible professional development opportunities include: attending an external workshop on a PEB-related topic, presenting research at a non-Yale conference or meeting, attending a PEB-hosted professional development event, helping organize a PEB outreach event or the PEB discussion group, inviting and hosting a PEB Distinguished Seminar Series speaker, meeting with Yale alumni working in a PEB-related field, or having a one-on-one career advising appointment with the Yale Office of Career Strategy.
- Be admitted to candidacy in their home department or degree granting program

CERTIFICATE REQUIREMENTS (MASTER'S STUDENTS)

To receive the certificate, students must:

- Complete the PEB curriculum
- Meet with PEB leadership at least once to discuss certificate progress.
- Participate in at least two professional development opportunities. Eligible professional development opportunities include: attending an external workshop on a PEB-related topic, presenting research at a non-Yale conference or meeting, attending a PEB-hosted professional development event, helping organize a PEB outreach event or the PEB discussion group, inviting and hosting a PEB Distinguished Seminar Series speaker, meeting with Yale alumni working in a PEB-related field, or having a one-on-one career advising appointment with the Yale Office of Career Strategy.
- Complete all master's program requirements.

For more information about the programming, coursework, and other enrichment activities available to PEB students; see http://peb.yale.edu.

Public Humanities

https://ph.yale.edu
Graduate Certificate in Public Humanities

Program Directors
Matthew Jacobson
Laura Wexler

Director of Graduate Studies
Matthew Jacobson

Assistant Program Director and Assistant Director of Graduate Studies
Karin Roffman

Faculty and Staff Associated with the Program Laura Barraclough (*American Studies*; *Ethnicity, Race, and Migration*), Tim Barringer (*History of Art*), Melissa Barton (*Beinecke Library*; *English*), Ned Blackhawk (*History*; *American Studies*), David Blight (*History*), Ryan Brasseaux (*American Studies*), David Bromwich (*English*; *Humanities*), Daphne Brooks (*American Studies*; *African American Studies*; *Women's, Gender, and Sexuality Studies*), Emily Coates (*American Studies*), Aimee Meredith Cox (*African American Studies*; *Anthropology*), Carolyn Dean (*History*; *French*), Richard Deming (*English*), Michael Denning (*American Studies*), Wai Chee Dimock (*Emerita*; *English; American Studies*), Crystal Feimster (*American Studies*; *African American Studies*; *Women's, Gender, and Sexuality Studies*), Nicholas Forster (*African American Studies*; *Film and Media Studies*), Joanne Freeman (*History*), Beverly Gage (*History*), Bryan Garsten (*Political Science*), Jacqueline Goldsby (*English*; *American Studies*; *African American Studies*; *Women's, Gender, and Sexuality Studies*), Zareena Grewal (*American Studies*; *Ethnicity, Race, and Migration*), Jacob Hacker (*Political Science*), Langdon Hammer (*English*), Daniel HoSang (*American Studies*; *Ethnicity, Race, and Migration*), Matthew Jacobson (*American Studies*; *Ethnicity, Race, and Migration*; *History*; *African American Studies*), Kathryn James (*Beinecke Library*), Grace Kao (*Sociology*; *Ethnicity, Race, and Migration*), Alice Kaplan (*French*; *Women's, Gender, and Sexuality Studies*), Jennifer Klein (*History*; *Women's, Gender, and Sexuality Studies*), Nancy Kuhl (*Beinecke Library*), Albert Laguna (*American Studies*; *Ethnicity, Race, and Migration*), Kathryn Lofton (*Religious Studies*; *American Studies; Women's, Gender, and Sexuality Studies*), Mary Lui (*History*; *American Studies*), John MacKay (*Slavic Languages and Literatures*; *Film and Media Studies*), Tracey Meares (*Law School*), George Miles (*Beinecke Library*), Lucy Mulroney (*Beinecke Library*), Charles Musser (*Film and Media Studies*; *American Studies*), Meghan O'Rourke (*Yale Review*), Stephen Pitti (*History*; *American Studies*), Sally Promey (*History of Art*), Anna Reisman (*School of Medicine*), Carolyn Roberts (*History of Science and Medicine*; *American Studies*), Marc Robinson (*Theater and Performance Studies*; *American Studies*; *English*), Karin Roffman (*Humanities*; *American Studies*; *English*), Douglas Rogers (*Anthropology*), Elihu Rubin (*Architecture*; *American Studies*), Sebastian Ruth (*School of Music*), Paul Sabin (*History*), Alicia Schmidt Camacho (*American Studies*; *Ethnicity, Race, and Migration*), Caleb Smith (*English*; *American Studies*), Timothy Snyder (*History*), Jason Stanley (*Philosophy*), Gary Tomlinson (*Music*; *Humanities*), John Wargo (*School of the Environment*; *Political Science*), Michael Warner (*English*;

American Studies), Laura Wexler (*American Studies*; *Women's, Gender, and Sexuality Studies*), Timothy Young (*Beinecke Library*)

GRADUATE CERTIFICATE IN PUBLIC HUMANITIES

Public Humanities at Yale trains graduate students by expanding academic discourse beyond the confines of the classroom, academic publishing, and the academic conference circuit. By cultivating a dialogue with specialists in non-academic areas, students earning a Certificate in Public Humanities are prepared for public intellectual work such as museum and gallery installation, documentary film and photography, and oral/community history. Our mission is to expand the concept of "audience" by building bridges to a wide range of local and regional institutions and their respective publics.

Public Humanities at Yale represents an interdisciplinary certificate that is open to graduate students pursuing the Ph.D., a professional school degree, or a master's degree in any department, with the approval of their director of graduate studies (DGS). Requirements for the certificate must be completed by the time that the student's dissertation (or equivalent program requirement) is filed.

The mission of Public Humanities is fivefold:

1. To offer students an expanded curriculum in the methods, practices, and skill sets associated with the Public Humanities,
2. To cultivate and articulate best practices for collaborative and creative scholarly work,
3. To create new venues for intellectual work, both within Yale and across the city and the region,
4. To create new venues for *non*-academic expertise within Yale, and thus,
5. To create new conversations and to cultivate new relationships with contiguous institutions throughout the region (museums, libraries, archives, galleries, media outlets, historical societies, performance troupes, etc.) and with non-academic individuals who have much to offer in an academic setting (artists, photographers, curators, broadcast journalists, filmmakers, writers, etc.).

Distinct areas of focus within Public Humanities at Yale include Museums and Collections, Documentary Studies, Digital Humanities, Space and Place, History and the Public, Arts Research, and Public Writing.

REQUIREMENTS OF THE CERTIFICATE PROGRAM

1. Introduction to Public Humanities, PHUM 9003.
2. Methods and Theory. Students complete for a grade at least one course selected from preapproved courses offered across the university that include topical specializations such as public memory, documentary studies, documentary film, ethnography, material culture, architecture, research-based performance, art history, public history, public writing, etc. As needed, this requirement can also be fulfilled in an independent study course with one of the affiliated faculty members and with the approval of the DGS or assistant DGS.
3. Practicum (PHUM 9004). In addition to coursework, public humanities students are required to complete a one-term internship with one of our partnered affiliates

(to be approved by the Public Humanities DGS or assistant DGS) for practical experience in the field. Potential internships include in-house opportunities at the Beinecke Library, Sterling Memorial Library, or one of Yale's museums, or work at a regional or national institution such as a media outlet, museum, or historical society. In lieu of the internship, students may choose to complete a "micro-credential." Micro-credentials are structured as workshop series (three to five daylong meetings over the course of a year) rather than as term courses, and include revolving offerings in topics such as oral history, collections and curation, writing for exhibits, podcast production, website design, scriptwriting from the archive, or grant writing for public intellectual work.

4. Public Humanities Capstone Project (PHUM 9005). The coursework and practicum/micro-credential will lead to a significant project to be approved by the DGS or assistant DGS (an exhibition, documentary, research paper, etc.) and to be presented in a public forum on its completion.
5. Teaching Component. The final requisite for the certificate is a one-term teaching component. This assignment may be fulfilled by co-teaching one of our current public humanities courses, such as Introduction to Public Humanities, Introduction to Documentary Studies, the Documentary Film Workshop, or Introduction to Digital Humanities; or by teaching a special Digital Humanities or Public Humanities section for an existing course (e.g., The History of Right Now); or by fulfilling duties needed by education curators of the Yale Center for British Art, Yale Art Gallery, Peabody Museum, Beinecke Library, or Schwarzman Center.

Quantum Materials Science and Engineering

Directors
Sohrab Ismail-Beigi (*Applied Physics*)
Corey O'Hern (*Mechanical Engineering*)

Program Coordinator
Emma Carley

GRADUATE CERTIFICATE IN QUANTUM MATERIALS SCIENCE AND ENGINEERING

Quantum materials have played a key role in technologies with broad societal impacts (e.g., semiconductors, lasers, LEDs, and medical imaging). Their importance will increase with the growing research on harnessing quantum effects for computation and sensing (e.g., quantum computation and information research programs at leading technology companies). In addition, the role of data science and machine learning methods continue to grow in importance in all fields of science and engineering. The aim of this certificate program is to train Ph.D. students in the multidisciplinary field of quantum materials and associated data science methods to allow them to be at the cutting edge of research and engineering on understanding and using quantum matter that can lead to scientific and engineering breakthroughs.

This certificate program is open to Ph.D. students in several graduate-degree granting programs in the Graduate School of Arts and Sciences, including the Departments of Applied Physics, Chemistry, Computer Science, Mechanical Engineering and Materials Science, and Physics. Students can either choose to participate in the certificate program during the application process to the Graduate School or, if already enrolled in the graduate program of one of the above departments, apply to the certificate program by contacting its directors.

Core Requirements

In addition to the department-specific requirements for completing a Ph.D., this certificate program has the following requirements. For coursework, each student must successfully complete the six courses below (within the first two years of matriculating at Yale):

1. QMSE 5010, Introduction to Quantum Materials Science and Engineering
2. CPSC 5530/CB&B 5555/GENE 5550 Unsupervised Learning for Big Data
3. APHY 4480/PHYS 5480 Solid State Physics I
4. One of three choices for quantum mechanics: APHY 5060, Basic Quantum Mechanics; PHYS 5080, Quantum Mechanics I; or CHEM 570, Quantum Chemistry
5. An elective course in materials science and engineering, statistical and many-body physics, or machine learning and data science. Examples include PHYS 6500, Theory of Solids I; MENG 8664, Forces on the Nanoscale; CPSC 5520, Deep Learning Theory and Applications; and MENG 8652, Solidification and Phase Transitions
6. Responsible Conduct of Research course (offered by each home department)

Some exceptions and replacements for these course requirements are permitted with prior approval of the QMSE Directors.

Certificate Requirements for Ph.D Students

To receive the certificate, students must:

- Complete the QMSE curriculum
- Meet with QMSE leadership at least once each year until the certificate is completed to discuss certificate progress
- Present their research work in a public setting twice: once at Yale (research in progress, chalk talk, or departmental seminar) and once at a non-Yale conference.
- Participate in one QMSE outreach event organized by the directors.
- Complete four of the following professional development activities:
  - External Internship of at least ten weeks (fulfills 50 percent of the professional development requirement)
  - Attend a workshop on a QMSE-related topic
  - Attend a QMSE-hosted professional development event (held at least once per semester)
  - Participate in the QMSE hackathon
  - Help organize the QMSE symposium or hackathon
  - Invite and host an external seminar speaker at Yale to present on QMSE-related research through student's home department
  - Meet with Yale alumni working in a QMSE-related field to learn about their career path
  - Have a career-advising appointment with the Yale Office of Career Strategy (OCS)
- Maintain a 60 percent attendance rate at all QMSE monthly cohort meetings until the certificate is completed. If a student receives stipend support from QMSE, 100 percent attendance is required.
- Be admitted to candidacy in their home department or degree granting program

Certificate Requirements for Master's Students

To receive the certificate, students must:

- Complete the QMSE curriculum
- Meet with QMSE leadership at least once each year until the certificate is completed to discuss certificate progress
- Complete two of the following professional development activities:
  - Attend a workshop on a QMSE-related topic
  - Attend a QMSE-hosted professional development event (held at least once per semester)
  - Participate in the QMSE hackathon
  - Help organize the QMSE symposium or hackathon
  - Invite and host an external seminar speaker at Yale to present on QMSE-related research through student's home department

    - Meet with Yale alumni working in a QMSE-related field to learn about their career path
    - Have a career-advising appointment with the Yale Office of Career Strategy (OCS)
    - Participate in a QMSE outreach event organized by the directors.
- Maintain a 60 percent attendance rate at all QMSE monthly cohort meetings until the certificate is completed.
- Complete the course of study in their home department

For more information about the programming, coursework, and other enrichment activities available to QMSE students, see https://qmse.yale.edu. To contact the program email qmse@yale.edu.

Second Language Acquisition

https://cls.yale.edu

Director
Fernando Rubio

GRADUATE CERTIFICATE IN SECOND LANGUAGE ACQUISITION

The Center for Language Study (CLS) offers the Certificate in Second Language Acquisition (SLA Certificate) which is specifically designed for Ph.D. students in language and literature departments and provides a comprehensive training program in second language acquisition and language teaching methodology. The SLA Certificate offers students a solid foundation in second language acquisition, language teaching methodology, and applied linguistics. It covers both the theoretical principles and the practical pedagogy training essential for a career in a language-related field.

Upon completing the SLA Certificate, students will:

- be familiar with current theories in Second Language Acquisition;
- understand key theoretical, methodological, and pedagogical concepts;
- apply current pedagogical principles to their teaching practice;
- be familiar with current approaches to language teaching; and
- have completed a language teaching e-portfolio documenting their college teaching experience and philosophy in a format that can be used in the academic job application process.

Only students enrolled in Ph.D. programs in the Graduate School of Arts and Sciences are eligible to receive the SLA Certificate, which is noted on students' transcripts. The program is best undertaken by students starting their teaching years, although Ph.D. students in later years may be able to be accommodated.

APPLICATION PROCEDURE

To apply to the program, visit https://cls.yale.edu/certificate-second-language-acquisition-registration-page, which allows students to submit an application directly to the CLS. The CLS will then contact the student to schedule an entry interview.

PROGRAM REQUIREMENTS

- Eportfolio (to be scheduled following your entry interview)
- Training and professional development (numbers 1, 2, and 4 should be taken in sequence, when possible)
    1. CLS Pedagogy Workshop offered in August the week before fall semester starts
    2. Fundamentals of Language Teaching (fall semester, five sessions)
    3. Advanced Fundamentals of Language Teaching (spring semester, five sessions)
    4. LING 5640, Principles of Language Teaching and Learning

5. Professional development activities; for example, Brown Bags, language pedagogy-related conferences, workshops (note: a departmental methods course would be equal to two professional development activities)

- Teaching observations

1. A minimum of four language class observations of others, with a report on your observations:

- Two peer observations (one of which in a language you do not understand)
- Two observations of a senior language instructor

2. A minimum of two observations of your language class, with a report from the observer (one from a senior language instructor and one from a peer). If you are not teaching a language class, there are alternative ways to complete this requirement.

- Teaching at Yale University (minimum of two semesters)
- Completed Teaching ePortfolio

1. Teaching statement
2. Portfolio workshop
3. Annotated syllabi (one for a beginning and intermediate-level language course)
4. Annotated sample course materials, such as task-based and communicative activities
5. Annotated lesson plan
6. Annotated student evaluations
7. Teaching video sample
8. Reflective narrative on your experiences

- Exit Interview (to be scheduled upon completion of all requirements or at least one month before graduation)

Note: Documentation of all requirements must be updated at the end of each semester using the form you will be given access to upon registration.

For further details, see the SLA Certificate Completion Instructions (https://cls.yale.edu/certificate-second-language-acquisition-sla-completion-instructions).

FILING FOR THE AWARD OF THE CERTIFICATE

A student who intends to file for the final granting of the SLA Certificate *must* schedule an exit interview with the CLS Director and submit in advance their e-portfolio and their reflective narrative no later than the end of the term prior to the award. Students should allow two to four weeks for materials review and to schedule an interview. Upon successful completion of the exit interview, the CLS Director will confirm that the student has fulfilled all the requirements of the certificate with the University Registrar's Office so that the SLA certificate will appear as a notation on the student's transcript.

Translation Studies

https://macmillan.yale.edu/translation
Graduate Certificate in Translation Studies

Program Director
Alice Kaplan

Certificate Coordinator
Marijeta Bozovic

Steering Committee Ned Blackhawk (*History*; *American Studies*), Marijeta Bozovic (*Slavic Languages and Literatures*; *Film and Media Studies*; *Women's, Gender, and Sexuality Studies*), Paul Bracken (*Management*; *Political Science*), Peter Cole (*Jewish Studies*; *Comparative Literature*), Robyn Creswell (*Comparative Literature*), Robert Frank (*Linguistics*), Supriya Gandhi (*Religious Studies*), Alice Kaplan (*French*), Shawkat Toorawa (*Near Eastern Languages and Civilizations*), Jane Tylus (*Italian Studies*), Alyson Waters (*French*)

GRADUATE CERTIFICATE IN TRANSLATION STUDIES

The goal of the Graduate Certificate in Translation Studies is to promote the interdisciplinary study of translation, encompassing its literary, social, political, economic, legal, technological, and medical dimensions. As human migration and globalization alter the manner and speed of language change, translation has become increasingly central to the workings of the contemporary world. We believe now is the time to capture the new energies and map out the new fields this expanded horizon offers to us. The aim is to provide graduate students across a number of programs, departments, and divisions the opportunity to develop and demonstrate a degree of competence in translation theory, practice, and technologies. A central focus of the program will be to bring together a maximally intellectually and culturally diverse cohort of participating students each year. The certificate program will serve the interests of graduate students looking for a competitive edge in the academic job market as well as open doors to careers outside of academia for others.

Eligibility

The Certificate in Translation Studies (TS) is open to students currently enrolled in a Ph.D. program at Yale or those entering a graduate program in the fall term. Application to the TS program is due May 1 for the following academic year's cohort; for more information and the online application, visit https://macmillan.yale.edu/translation.

Course work for the certificate will primarily be completed in the second year of graduate study and will supplement (and in some cases, overlap with) required course work in the student's home department. All course work for the TS certificate will need to be approved by the director of graduate studies (DGS) of the student's home department and the TS coordinator, to ensure that TS requirements do not slow down time to degree.

Requirements for the Certificate

Students who wish to receive the TS certificate are required to complete three courses and a capstone activity:

Core Course All TS certificate students will take the Proseminar in Translation Studies (CPLT 5004) as their shared foundational course. The proseminar will balance a historically minded introduction to Translation Studies as a growing field with a multidisciplinary survey of its relationships to various fields and academic practices. This core course will be developed and taught by the TS coordinator in consultation with the Executive Committee. The course will necessarily vary with the different background and approaches of the TS coordinator, but the fundamental structure will remain in place each year. The coordinator will incorporate a number of guest lectures by Yale faculty and other invited speakers to expose students to maximally diverse research and practice in the many areas surveyed by the course.

Two Electives Each student will take two elective courses approved by the TS coordinator as relevant to the student's own research interests. One directed reading course may count as one of the electives; undergraduate courses may be modified through the addition of graduate-level work. Electives will generally consist of courses focusing substantially on topics that inform the student's research interests within Translation Studies. Examples include:

ANTH 568	Language, Culture, and Identity	1
CPLT 5150	Proseminar in Comparative Literature	1
ENGL 936/ AFST 7746	Postcolonial World Literature and Theory	1
LING 6710/ PHIL 7742	Philosophy of Language	1
RLST 6190/ CLSS 7678/ NELC 6830	Law and History, Law in History: Premodern Civilizations through the Lens of Legal Historiography	1

The expectation is that students will select at least one elective outside of their home department or program.

Yale offers many courses that qualify as Translation Studies electives at both the undergraduate and graduate level. See https://macmillan.yale.edu/translation/courses-translation-and-related-topics-yale for information on this year's offerings.

Capstone Project Students will be required to complete one of the following tasks for the final project in Translation Studies: (1) an article suitable for publication; (2) an original translation of a text approved by the TS coordinator; or (3) a minimum of forty hours of community service in translation. Examples include interpreting with a health or social service organization or an internship with a publisher or other organization dedicated to translation, to be approved by the TS coordinator. For internship opportunities for graduate students with both nonprofit and profit-making organizations, see https://macmillan.yale.edu/translation/grants-fellowships and https://macmillan.yale.edu/translation/resource-links on the Translation Initiative website.

In addition, and if such teaching is available, students will be strongly encouraged to serve as teaching fellows for one term in any course approved by the TS coordinator.

The completion of all requirements will need approval from the TS coordinator and the DGS of the student's degree department. By the end of their third term at Yale, participating students will need to outline a plan for fulfilling all TS requirements in consultation with both the TS coordinator and their home department DGS.

Students will track their completion of requirements in an online worksheet and update the form each term, as instructed. A written proposal for their capstone project, a mid-project progress report, and a final report are required, as well as brief written reports on any relevant translation work and collaborative projects to be included as part of their work for the certificate.

Students in the certificate program will be expected to attend and participate in a diverse range of talks, conferences, screenings, and other intellectual programming connected to translation throughout the year, using the reporting mechanism to note their participation.

For more information or if you have any questions, email translation@yale.edu.

CORE COURSE

CPLT 5004a, Proseminar in Translation Studies Robyn Creswell and Alice Kaplan
This graduate proseminar combines a historically minded introduction to Translation Studies as a field with a survey of its interdisciplinary possibilities. The proseminar is composed of several units (Histories of Translation; Geographies of Translation; Scandals of Translation), each with a different approach or set of concerns, affording the students multiple points of entry to the field. The Translation Studies coordinator provides the intellectual through-line from week to week, while incorporating a number of guest lectures by Yale faculty and other invited speakers to expose students to current research and practice in different disciplines. The capstone project is a conference paper-length contribution of original academic research. Additional assignments throughout the term include active participation in and contributions to intellectual programming in the Translation Initiative.

Women's, Gender, and Sexuality Studies

315 William L. Harkness Hall, 203.432.0845
http://wgss.yale.edu
Graduate Certificate in Women's, Gender, and Sexuality Studies

Chair
Rod Ferguson

Director of Graduate Studies
Dara Strolovitch

Faculty
For faculty listings, see Women's, Gender, and Sexuality Studies under Degree-Granting Departments and Programs in this bulletin.

GRADUATE CERTIFICATE IN WOMEN'S, GENDER, AND SEXUALITY STUDIES

Women's, Gender, & Sexuality Studies (WGSS) is an interdisciplinary program that critically interrogates gender and sexuality as categories of inequality, difference, subjectivity, and identification. Gender (the social and historical meanings of distinctions across sexes) and sexuality (the domain of sexual practices, identities, discourses, and institutions) are studied as they intersect with class, race, nationality, citizenship, religion, ability, and other axes of power, difference, and zones of experience. The introduction of these perspectives into all fields of knowledge necessitates new research paradigms, organizing concepts and analytics, and critique.

The Certificate in Women's, Gender, and Sexuality Studies is open to doctoral students currently enrolled in a Ph.D. program at Yale whose research engages the foregoing questions and approaches. Interested students are encouraged to (1) email the WGSS director of graduate studies (DGS) to indicate their intention to pursue the certificate and (2) submit the application linked on the website, ideally during their first year in their Ph.D. program. The application may be updated as requirements are completed.

Students who wish to receive the certificate must fulfill the following requirements:

1. complete WGSS 6600, Introduction to Women's, Gender, and Sexuality Studies;
2. complete two WGSS-titled or substantively themed electives;
3. enroll in and attend WGSS 9900, the WGSS Working Group and Colloquium, for two sequential semesters (preferably in the same academic year);
4. present a research paper at a meeting of the WGSS Colloquium or a similar venue; and
5. fulfill a pedagogy requirement. The pedagogy requirement can be fulfilled by teaching or serving as Teaching Fellow for a WGSS-titled course; because opportunities to do so are limited, however, certificate students may also fulfill the pedagogy requirement by designing a syllabus for a WGSS-related course that they hope to teach in the future. Certificate students may also petition to fulfill this requirement if they serve as Teaching Fellow for a non-WGSS course that contains a substantial amount of WGSS-related content. Certificate students electing this last option should submit the syllabus and a brief justification (three

to five sentences) that explains how gender and/or sexuality or WGSS-related frameworks were featured in the class and/or how they foregrounded it in their discussions sections.

These requirements should be met in consultation with the DGS. Students who fulfill these expectations will receive a letter from the DGS indicating that they have completed the work for the certificate.

COURSES

For course listings, see Women's, Gender, and Sexuality Studies under Degree-Granting Departments and Programs in this bulletin.

Wu Tsai Institute

100 College Street, Suite 1184
https://wti.yale.edu/initiatives/graduate-certificate

Director
Samuel McDougle

Program Coordinator
Liz Knapp

The Wu Tsai Institute (WTI) is a university-wide neuroscience initiative with the mission to understand human cognition and explore human potential by sparking interdisciplinary inquiry. WTI brings together biological, psychological, and computational perspectives through shared facilities, training and mentorship, joint faculty hiring, collaborative spaces, community-building events, and moonshot projects. It prioritizes mission-driven research that bridges disciplines and advances a more integrated understanding of the mind and brain across scales and species through the common language of data science.

GRADUATE CERTIFICATE IN BRAINS, MINDS, AND MACHINES

The human mind remains a mystery of science. It can be studied through psychological research on human behavior. However, this approach is limited because the mind's inner workings do not always lead to observable or interpretable behaviors. Indeed, behavioral measures are limited by the actions that the body is physically able to perform and reflect the end of a long chain of mental processes. Additional approaches are needed to provide a more complete and mechanistic understanding.

If the mind is like software, then the brain is the hardware. Genes, molecules, and cells in the brain self-organize into local circuits and broader systems. These structures have specialized functions for the mind and are connected to each other to generate complex behaviors. A better biological understanding of these intermediate stages of neural processing in humans and other animals will help reveal how the mind works.

Intelligent behavior arises not only from living organisms but increasingly from machines. Through rapid advances in deep neural networks, robotics, and brain-computer interfaces, AI models can achieve human-like performance in language, vision, and other digital tasks. These models provide a computational platform for exploring the algorithms of the mind while incorporating constraints from the brain.

Most Ph.D. programs specialize in one, or occasionally two, of these psychological, biological, and computational levels of analysis. The purpose of the Graduate Certificate in Brains, Minds, and Machines is to train students in all three, emphasizing levels they would otherwise be missing, in order to gain a broader and more integrative mindset and skillset for advanced research related to the mission of the Wu Tsai Institute. This interdisciplinary training provided by the certificate includes courses, talks, workshops, and internships.

First-year graduate students from any Ph.D. program in Yale's Graduate School of Arts and Sciences are eligible to apply. The student's dissertation adviser and an

additional member of their thesis committee should be Wu Tsai Faculty Members (for a list of faculty, visit https://wti.yale.edu/humans/faculty). Certificate students are expected to fulfill their home department/program requirements in addition to those of the certificate below. Upon satisfactory completion, students receive the Graduate Certificate in Brains, Minds, and Machines to be reflected on their official transcript.

The certificate will begin accepting applications from first-year graduate students in spring 2026, with the first cohort (rising second-year students) starting in fall 2026. Outstanding applicants may be awarded a competitive Wu Tsai Graduate Fellowship.

Requirements

To receive the Graduate Certificate in Brains, Minds, and Machines, students must complete the following requirements:

COURSES

In addition to the courses required by their home department or program, certificate students must complete three courses:

- Core course in brains, minds, and machines (BM&M 5000, to be developed)
- Methods course selected from an approved list (may also count toward home department/program requirements)
- Elective course selected from an approved list (may also count toward home department/program requirements)

ACTIVITIES

As members of the Wu Tsai Institute community, certificate students are expected to participate in the following events:

- WTI Inspiring Speaker Series (monthly)
- WTI Science Communication Series
- WTI Professional Development Workshops
- Brains, Minds, and Machines Poster Session (annually)

INTERNSHIPS

For additional interdisciplinary training outside of the classroom, certificate students must complete at least two pre-approved hands-on learning experiences, including:

- Attend the lab meeting of a faculty member other than your adviser(s)
- Join an industry project or visit a company regularly
- Gain skills at a shared research facility in WTI
- Contribute to an open science team by curating data and reviewing code
- Organize a workshop, tutorial, poster session, or bootcamp in WTI
- Contribute to a science communication team by creating a media campaign
- Organize community outreach programs and events
- Host a journal club or special interest group
- Serve as a student representative on a WTI committee

Yale Center for the Study of Globalization

Betts House, 203.432.1900
http://ycsg.yale.edu

Director
Ernesto Zedillo

The Yale Center for the Study of Globalization (YCSG) is devoted to examining the impact of our increasingly integrated world on individuals, communities, and nations. The center's purpose is to support the creation and dissemination of ideas for seizing the opportunities and overcoming the challenges resulting from globalization's impact on the world's people and places. The center also explores solutions to problems that, even if they do not result directly from globalization, are global in nature and can therefore be effectively addressed only through international cooperation. In accordance with this mission, the YCSG enriches the debate about globalization on campus and promotes the flow of ideas between Yale and the policy world.

One of the center's strengths, and an important area of focus, is its ability to engage with multilateral institutions and global organizations in activities pertinent to its mission through an activity well known in international and policy circles: Commission Diplomacy. Over a ten-year period from 2002 to 2012, the YCSG was involved in over 50 percent of the international commissions convened worldwide, and the center continues this effective work today, bringing its efforts here to the Yale community in a variety of public forums. Among current such work is our involvement in the Independent Panel on Pandemic Preparedness and Response (IPPPR), mandated by the World Health Assembly to review critically how international and national institutions have prepared for and reacted to COVID-19 and to recommend ways to strengthen the world's preparedness and response for future pandemics.

The YCSG's current projects include the Rockefeller Foundation Economic Council on Planetary Health, which focuses on the interconnectedness between planetary health and human well-being; a project to produce a Charter on Universal Health Coverage; and work on global drug policy reform. These highlighted activities are in addition to the center's consistent focus on global development, global trade, financial globalization, peace and security, nuclear disarmament, and climate change mitigation.

On campus, the center hosts international conferences, organizes brainstorming sessions and panels, and works constantly to bring to the Yale community individuals who have input on international policy. The center's project International Cooperation in the National Interest: In Defense of the Multilateral System is an ongoing series of lectures and public presentations at Yale by leaders of the world's multilateral institutions and the experts and scholars who have studied and analyzed them.

POLICIES AND REGULATIONS

Admissions

http://gsas.yale.edu/admission

Application for admission to any of the graduate school's programs should begin in the summer or fall of the academic year prior to the one in which the applicant seeks to matriculate. Application can be made to only one department, program, or combined program. The graduate school utilizes an online application. Access to this application as well as application procedures, guidelines, requirements, fees, deadline dates, and all other information that an applicant will need are available at the website listed above.

Holders of American Ph.D. or Sc.D. degrees, or their international equivalents, are not eligible for admission to the graduate school in the field in which they have already earned their degree. They may, however, apply in other fields and are also eligible to apply for admission to the Division of Special Registration as Visiting Students for nondegree study. (See Nondegree Study under Programs of Study for more information, or visit the website listed above.) With the approval of the appropriate associate dean, holders of master's degrees are eligible for admission to a terminal master's degree program in the same field at the graduate school provided that there is significant curricular distinction between the previous and proposed programs of study.

Individual program descriptions, prerequisites, special admissions requirements, and links to these programs are available via the graduate school's website. Although programs may have varying prerequisites and special requirements for admission, all programs will require, in addition to an application and the application fee, three letters of recommendation, a résumé/CV, and transcripts from each academic institution previously attended. Some degree programs require the submission of scores from the Graduate Record Examinations (GRE) General Test, which is administered in the United States and abroad by the Educational Testing Service (ETS). This examination, in addition to any GRE Subject Tests that may be required by the student's program of study, should be taken as early as possible to ensure that official scores are released and received no later than the stated deadline of the program for which the student is applying. Applicants to combined degree programs should consult both programs' admissions requirements and submit scores if either of the two programs require the GRE General Test and/or Subject Tests. For all programs where the GRE General Test is not accepted, any scores submitted will not be considered for the purposes of admission. For programs where the GRE General Test is optional, any scores submitted will be taken into consideration for the purposes of admission, and any self-reported scores must be verified with official scores.

Applicants whose native language is not English must present evidence of proficiency in English by satisfactorily completing the Test of English as a Foreign Language (TOEFL), which is administered by ETS, or the International English Language Testing System (IELTS). Applicants who have received or will receive an undergraduate degree from a college or university where English is the primary language of instruction are exempt from the English Language Test requirement and are not required to submit the TOEFL or IELTS. Applicants must have studied in residence at the undergraduate

institution for at least three years to qualify. The TOEFL or IELTS, if required, should be taken as early as possible to ensure that official scores are released and received no later than the stated deadline of the program for which the student is applying.

Students who do not demonstrate sufficient proficiency in English may be retested or asked to take courses in English for speakers of other languages. A higher level of proficiency will be required in order for students to serve as teaching fellows.

Non-U.S. applicants who accept offers of admission will be required to give appropriate evidence of necessary financial support before the university will be able to issue visa documents.

The application contains questions regarding prior or pending criminal charges, disciplinary sanctions, and breaks or leaves of absence in educational/professional experience. Responses regarding prior or pending criminal charges are not shared with the program to which an applicant seeks admission, nor are they a bar to admission in the graduate school. When an applicant answers affirmatively to any of these questions, however, the graduate school will evaluate the circumstances outlined by the applicant to determine if they are potentially relevant to the applicant's participation in the Yale community as a graduate student. In cases where such charges are pending, the graduate school may decide to admit the applicant contingent upon the charges being resolved or to defer the decision on admission until the charges are resolved. If new criminal or disciplinary charges are filed against an applicant after submission of the application but prior to matriculation, applicants are required to notify the graduate school admissions office of this fact in writing. Failure to do so may result in rejection of an application or rescission of an offer of admission.

It is the policy of the graduate school to verify all credentials submitted in support of an application. All transcripts, recommendations, publications, standardized test scores, and supplemental materials may be traced to their sources in order to confirm their authenticity. Written materials submitted by an applicant are subject to review for the purpose of identifying plagiarism. Any falsification or misrepresentation contained in the application and supplied by an applicant may be cause for denying or rescinding admission to the Graduate School of Arts and Sciences.

Applicants are typically notified of decisions regarding their applications during the months of February and March. Official notification is sent from the Graduate School of Arts and Sciences only.

All entering students must have obtained the bachelor's degree or its international equivalent. Offers of admission are contingent on a student's providing an official transcript indicating that the student has been awarded a baccalaureate degree (or its international equivalent) prior to matriculation. Students who are not able to provide such evidence will not be permitted to register. Those who have been engaged in graduate work at Yale or another university must also present an official transcript giving evidence of degree(s) awarded and/or satisfactory completion of the previous year's work.

Applicants who have been previously denied admission to the Graduate School of Arts and Sciences three times may not apply again.

The Office of Graduate Admissions will not release application materials, including standardized test scores, letters of recommendation, or transcripts, to the applicant or other institutions or agencies for any purpose. Students will need to contact ETS, recommenders, or educational institutions they have previously attended in order to furnish such materials to a third party.

Programs of Study

FULL-TIME DEGREE CANDIDACY

Most students enrolled in the graduate school are registered for full-time study as they pursue a Ph.D. or master's degree program. These students devote their full effort to coursework, preparing for qualifying examinations, gaining teaching experience, and researching and writing a thesis or dissertation. Students who are employed full time at the time of admission must terminate their employment prior to matriculating in the graduate school no later than August 15 of the year in which they matriculate.

PART-TIME STUDY

In rare circumstances, qualified individuals who are unable to devote their full time to graduate study may apply and be admitted as part-time students in terminal master's programs. For more complete information, see Part-Time Study under Academic Regulations.

NONDEGREE STUDY

Qualified individuals who wish to study at the graduate level as nondegree candidates may be admitted to the Division of Special Registration (DSR). Admission to the DSR is for one term or one year only and carries with it no commitment by the graduate school for further study. Students admitted for the academic year must demonstrate satisfactory academic performance in the first term in order to register for the second term. Students in the DSR may obtain transcripts indicating the appropriate credit for work completed. Students enrolled full-time in the DSR may pursue internship opportunities only after they complete their program. They may not concurrently participate in an internship while enrolled in the DSR. International students who are in the United States on a J-1 visa should consult with the Office of International Students and Scholars (OISS) about their eligibility to extend their visa in order to participate in an internship opportunity after their program.

DSR students engaged solely in course work are identified as *visiting students.* Although normally admitted for full-time study, visiting students who are U.S. citizens or permanent residents may be admitted for part-time study and are charged tuition on a per-course basis, whether for credit or audit. International visiting students must maintain a record of full-time enrollment (four courses for credit per term) for the duration of their program due to visa requirements. Please refer to Financing Graduate School for a schedule of tuition and fee charges. Students admitted to the DSR as vsiting students are not eligible for financial aid, including federal and most nonfederal student loans.

Advanced graduate students who are degree candidates (at the master's or Ph.D. level) at another university and who have made arrangements with a specific graduate school faculty member for a research project under that faculty member's direct

supervision may be admitted to the DSR as *visiting assistants in research*. Undergraduate students in combined or simultaneous B.S./M.S., B.A./M.A., or similar programs are not considered advanced graduate students. Visiting assistants in research are not eligible to take courses and are limited to a maximum of two years of study. Student research conducted at Yale must be part of the visiting assistant in research's degree requirements. The extent and location of the research completed at Yale must be cited in the completed thesis or dissertation. The graduate school does not provide financial support to visiting assistants in research. Such students either hold standard graduate-student assistantship in research appointments that are funded by the faculty adviser or provide their own funding through external awards or personal resources. Please refer to Financing Graduate School for a schedule of tuition and fee charges.

Detailed information, requirements, and access to the online DSR application are available at https://gsas.yale.edu/admissions/non-degree-application-process. DSR applicants must provide evidence of insurance coverage for the duration of their studies at Yale at the time of application.

Some departments at Yale have formal exchange agreements with universities in other countries that have been approved by the graduate school. Graduate students who are admitted to Yale under such approved exchange agreements may be registered as exchange scholars. Exchange scholars are not normally charged tuition. They may enroll in up to four courses per term for a maximum of two terms (one year). International exchange scholars must maintain a record of full-time enrollment for the duration of their program due to visa requirements, either by enrolling in four courses for credit if engaging solely in coursework, by engaging in a full-time program of research, or by engaging in a combination of coursework and research.

In rare circumstances, students may apply for a second year of registration in the DSR; however, cumulative enrollment is limited to two years. Students enrolled in the DSR who are subsequently admitted to degree programs in the graduate school may receive academic and tuition credit for no more than four courses completed while enrolled in the DSR, provided that the department recommends such credit and the appropriate academic dean approves.

INTERDISCIPLINARY STUDY

All graduate students are formally associated with one department or program, and in the case of students in combined-degree programs, with two. Students may, however, be encouraged to take one or more courses in related departments. Students are often advised by faculty members from more than one department during their dissertation research. Students in the graduate school, with permission of the director of graduate studies and the relevant school, may take advantage of particular course or research opportunities in Yale College and Yale's professional schools.

COMBINED- AND JOINT-DEGREE PROGRAMS

Students interested in African American Studies, Early Modern Studies, Film and Media Studies, and Women's, Gender, and Sexuality Studies pursue a combined Ph.D. with departments in related fields. In addition to these academic programs, there are several formal interdisciplinary Ph.D. programs in the graduate school listed under the appropriate departmental entries of this bulletin. Current students may not transfer to a combined Ph.D. program after they have advanced to candidacy. *Ad hoc*

programs may also be approved. A student who is interested in an *ad hoc* program should prepare a written proposal for review and approval by the relevant departments and academic dean before the student has advanced to candidacy. The proposal must include an agreed-upon listing of course and other requirements, along with a timeline for completion of the degree.

Students are encouraged to contact the appropriate directors of graduate studies about specific opportunities for interdisciplinary study throughout the graduate school and university.

The graduate school also participates in formal joint-degree programs with certain professional schools, including the J.D./M.A. and J.D./Ph.D. programs in cooperation with the Law School; the M.D./Ph.D. program in cooperation with the School of Medicine; and the Ph.D./M.B.A. program in cooperation with the School of Management. In addition, joint-degree programs with professional schools have been approved for master's students in Chemical & Environmental Engineering, European and Russian Studies, and International and Development Economics. These programs are described in the individual departmental listings.

For all joint-degree programs except the M.D./Ph.D., students are required to submit formal applications to both the professional school and the graduate school indicating their interest in enrolling in the joint program. Individuals interested in the M.D./Ph.D. program apply directly to the M.D./Ph.D. program. (See Requirements for Joint-Degree Programs, under Degree Requirements.)

COOPERATIVE DEGREE PROGRAM

Yale-University of Puerto Rico M.D./Ph.D. Cooperative Program

The Yale-UPR M.D./Ph.D Cooperative Program allows students to obtain an M.D. from the University of Puerto Rico Medical School (UPR-SOM) and a Ph.D. from the Yale Combined Program in the Biological and Biomedical Sciences (BBS) in approximately eight years. This program is targeted to those students who are committed to a research career in biomedical, translational, or health sciences, and who meet the requirements for admission to both the Ph.D. program at Yale and the M.D. program at UPR-MSC.

APPLICATION AND ADMISSIONS PROCESS

Prospective students apply simultaneously to UPR-SOM and to Yale through each institution's respective online application process. Students may also apply to the cooperative program during their first year at UPR-SOM. The admission process for UPR-SOM starts in December and ends by mid-March, by which time Yale usually provides its decision on admissions to the Ph.D. program. Students must be accepted by both programs to participate in the M.D./Ph.D. Cooperative Program. Admission to UPR-SOM or to Yale does not guarantee admission to the M.D./Ph.D. Cooperative Program.

PROGRAM DETAILS

Years One to Three: UPR-SOM

Students will complete the first three years of medical school at UPR-SOM. In the summer after year one they will conduct a lab rotation at Yale between the first week of June and July 29. Yale will cover the costs of round-trip airfare, housing, and living expenses during the summer rotations. In the summer after year two they will complete USMLE Step I. Students must pass the USMLE Step I and Step II prior to the start of the Ph.D. degree at Yale. USMLE Step II should be completed no later than the conclusion of the month of July at the end of the third year of medical school.

Years Four to Seven: Yale
Lab rotations will continue in the fall semester of the students' fourth year, and students will select a thesis lab by the start of the spring semester and join their thesis adviser's department. In years four and five they will complete course requirements for the Ph.D. degree, take a qualifying exam, and begin thesis research. At some point during years five through seven they will serve as teaching fellows for one semester. Academic progress will be monitored by each student's director of graduate studies, and research progress will be assessed by each student's thesis committee. At the end of each academic year, Yale BBS will provide a letter or report indicating that the student is in good standing and has completed all the milestones required for the Ph.D. as scheduled by the curriculum of the Ph.D. program. This will allow UPR-SOM to certify progress and ensure compliance with the requirements of the M.D./Ph.D. dual degree program at UPR-SOM. Students must include a Yale School of Medicine-designated faculty member on the thesis committee to help ensure that the students complete their theses in a timely fashion. Completion of the Ph.D. degree is estimated to take approximately four to five years. Students must remain in good standing at Yale during the Ph.D. training.

Year Eight: Return to UPR-SOM and Graduation
After receiving the Ph.D. from Yale University, students will return to UPR-SOM for the remainder of their medical training and to receive their M.D. degree. The expectation is that the M.D. degree will not be awarded prior to the completion of the Ph.D. requirements. It is anticipated that the Cooperative Program will generally require approximately eight to nine years to complete. The maximum time allowed for completion of both degrees is a total of ten years combined. Any exceptions to this timeline will be reviewed and determined on a case-by-case basis for any trainee who may need take a leave of absence during the program.

EXCHANGE SCHOLAR PROGRAM

http://gsas.yale.edu/ivyplus-exchange-scholar-program

Graduate students in Yale Ph.D. programs may petition to enroll full- or part-time for a term or an academic year as exchange scholars at the University of California at Berkeley, Brown, the University of Chicago, Columbia, Cornell, Dartmouth, Harvard, the Massachusetts Institute of Technology, the University of Pennsylvania, Princeton, and Stanford. The Exchange Scholar Program enables students to take advantage of educational opportunities not available at their home institutions. Applications are available at the website listed above. Please direct questions to Associate Dean Jasmina Besirevic (jasmina.besirevic@yale.edu). Applications must be received at least eight weeks prior to the beginning of the term for which the student is applying.

INTERNATIONAL GRADUATE STUDENT EXCHANGE AGREEMENTS

http://gsas.yale.edu/international-exchange-programs

The graduate school has established and continues to develop formal exchanges with a number of institutions internationally in cases where there are reciprocal academic benefits for faculty and graduate students. Yale doctoral students may participate in the international exchanges listed below. Most of them last one term or a full academic year, and a small number of exchanges are available for summers only.

All international exchange agreements must be approved in advance by the graduate school to ensure that they meet university policies and graduate school guidelines. Departments interested in establishing an exchange program must prepare a statement that demonstrates that there is a clear academic and reciprocal need for the program, and that the program will conform to the established guidelines for exchange agreements. Students and faculty interested in pursuing these exchanges should contact Associate Dean Jasmina Besirevic (jasmina.besirevic@yale.edu).

International Exchange Programs

Classics
Scuola Normale Superiore (SNS), Pisa, Italy

Economics
Aalto University, Helsinki, Finland; Institut d'Études Politiques de Paris ["Sciences Po"], France; Università Bocconi, Milan, Italy; Universität Bonn, Germany; Universität Mannheim, Germany

French
École Normale Supérieure-PSL, Paris, France; Institut d'Études Politiques de Paris ["Sciences Po"], France

Graduate School
Baden-Württemberg Exchange, Germany; Center for the Study of Medicine and the Body in the Renaissance (CSMBR), Pisa, Italy; Graduate Institute of International and Development Studies, Geneva, Switzerland; German Academic Exchange Service (DAAD), Germany; Hebrew University, Jerusalem, Israel; Kyoto Consortium for Japanese Studies (KCJS), Kyoto, Japan; Royal Holloway College, University of London, England; Università di Trento, Italy; University College London, England

History
Institut d'Études Politiques de Paris ["Sciences Po"], France

Italian Studies
Scuola Normale Superiore (SNS), Pisa, Italy

Political Science
Department of Politics and International Relations (DPIR), University of Oxford, England; Institut d'Études Politiques de Paris, France ["Sciences Po"]; Nuffield College, University of Oxford, England

Public Health
National and Kapodistrian University of Athens, Greece

Sociology
Institut d'Études Politiques de Paris ["Sciences Po"], France; University of Copenhagen, Denmark

SUMMER STUDY

http://summer.yale.edu

Doctoral students are funded year-round and are expected to make progress toward the completion of their degrees during the summer months. (See Summer Registration under Registration Status and Leaves of Absence, under Academic Regulations.) See individual departmental policies in this bulletin regarding specific expectations for degree programs during the summer. Although the graduate school does not offer academic courses in the summer, language for reading instruction is available through the Yale Summer Session, and doctoral students may wish to take advantage of these programs.

Degree Requirements

The requirements set forth in the pages that follow are the minimum graduate school degree requirements that apply to all degree candidates. Students should consult the listings of individual departments and programs for additional program-specific requirements.

- Requirements for the Degree of Doctor of Philosophy
- Requirements for the Degree of Master of Philosophy
- Requirements for the Degree of Master of Arts or Master of Science
- Requirements for Certificates
- Requirements for Joint-Degree Programs
- Responsible and Ethical Conduct in Research
- Petitioning for Degrees

REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Length of Study

In most fields of study, six years is normally sufficient for the completion of the Ph.D. Departments and programs make every effort to design a course of study and to provide advice and guidance to enable students to complete their work within six years. Normally three, or at most three and one-half, years are devoted to the completion of predissertation requirements (courses, examinations, and the selection of a dissertation topic). The remaining time, typically two to three years, is devoted to conducting research and writing the dissertation.

Residence Requirement

Students seeking the Ph.D. degree are required to be in residence in the New Haven area during at least three academic years. This is an academic requirement, distinct from and independent of the tuition requirement described below. The residence

requirement must normally be met within the first four years of study. Any exception to the residence requirement must be approved by the department and by the appropriate academic dean.

Tuition Requirement and the Continuous Registration Fee

All Ph.D. candidates are charged four years (eight terms) of full tuition, or proportionately less if all degree requirements, including submission of the dissertation, are completed in fewer than four continuous years of full-time study from the date of matriculation in the Ph.D. program.

Once the full-tuition obligation has been completed, registered students are charged the Continuous Registration Fee (CRF).

Transfer Credit/Course Waivers

The graduate school does not award transfer credit for graduate work completed before matriculation at Yale.

Non-Yale Courses A department may, with the approval of the graduate school, waive a portion of the Ph.D. course requirement (typically three courses) in recognition of previous non-Yale graduate-level work completed after receipt of the bachelor's or bachelor's-equivalent degree. Such a waiver does not affect the tuition requirement. Courses taken prior to matriculation at Yale will not appear on the student's graduate school transcript. The Yale courses waived will be recorded on the student's transcript and in the degree audit system as waived.

Yale Courses With the approval of the department, a doctoral student who is currently enrolled may petition to count up to one year of relevant coursework completed in a Yale master's or professional doctoral program as partial fulfillment of the Ph.D. course requirements. This petition must be received by the appropriate associate dean in the graduate school before the end of the student's first year of study in the Ph.D. program. The dean may reduce the four-year tuition requirement by either one or two terms, based on the number of courses accepted. The courses accepted will be listed on the student's transcript.

Waived courses are not counted in determining a student's eligibility for either terminal or en route M.A. or M.S. degrees.

Foreign Language Requirement

Language requirements are set by individual departments and programs and are explained in the individual department listings. All departmental requirements are subject to initial approval by the Executive Committee of the Graduate School and are monitored by the Degree Committee. A department cannot make exceptions to its own requirements without authorization by the Degree Committee.

Graduate students taking undergraduate language courses are graded according to the Yale College grading scale. Where applicable, language courses may count toward graduate degree requirements in some programs (see program descriptions). Undergraduate language courses do not count toward the Honors requirement.

The required level of proficiency in foreign languages, and the method for demonstrating it, are determined by the individual departments. Students are urged to be prepared to meet language requirements at the beginning of their first year of study.

Course, HP-Average, and Honors Requirements

The course requirements for the Ph.D. degree are set individually by each department or program. Each course offered in the graduate school counts for a single credit or, in rare cases, one-half credit. Only courses offered by the graduate school and officially numbered on the graduate level (i.e., 500 or higher), and receiving a qualitative grade of Honors, High Pass, or Pass, can fulfill requirements for the doctoral degree, with the exception of certain undergraduate language courses or where specified in advance by the department or program. Although departments may set more stringent requirements, to meet the minimum graduate school quality requirement for the Ph.D., students must achieve the grade of Honors in at least two one-credit graduate courses taken after matriculation in the graduate school and during the nine-month academic year and achieve an HP average in coursework required towards the Ph.D. The HP-average and Honors requirements must be met in courses other than those concerned exclusively with dissertation research and preparation.

A student who has not met the HP-average and Honors requirements at the end of the fourth term of full-time study will not be permitted to register for the fifth term. A student who is not in academic good standing with regard to course work or research, as defined by the minimum standards established by the graduate school and the expectations outlined by the student's department or program, may be dismissed from the graduate school. Such dismissal will be recorded on the student's transcript.

Qualifying Examination

Each Ph.D. student must pass a general examination, separate from course examinations, in a major subject and in such subordinate subjects as may be required by the department or program. Such examinations are described in the individual program listings. Students must assemble a qualifying examination committee in consultation with their program. Students unable to constitute a committee that satisfies the academic requirements of their program will normally be withdrawn from the graduate school at the end of year three. Students should consult with their director of graduate studies for further information about this requirement.

Committee Constitution Requirement

Each Ph.D. student must have a dissertation committee, including an adviser who is a member of the graduate school faculty faculty satisfactory to the student's department in order to register for the fourth year of study. Students without an approved committee will be withdrawn from their program.

Prospectus

The dissertation topic, in the form of a prospectus, must be approved by the department or program. Certification of this approval, together with a copy of the prospectus, must be filed with the graduate school registrar at least six months prior to the submission of the dissertation. By the time a prospectus is submitted, the program must approve a member of the graduate faculty to serve as the primary adviser for the

dissertation. Students who plan to submit the dissertation before the end of the fourth year of study should be sure to reserve time to satisfy this requirement.

The prospectus should be viewed as a preliminary statement of what the student proposes to do in the dissertation and not as an unalterable commitment. However, substantive deviation from the dissertation project outlined in a prospectus (as determined by the director of graduate studies and associate dean) will require that the student draft a new prospectus to be approved by the dissertation committee at least six months prior to the submission of the dissertation.

In consultation with their faculty advisers and directors of graduate studies, students should give serious thought to the scale of proposed dissertation topics. There should be a reasonable expectation that the project can be completed during the stipulated duration of the degree program.

The appropriate form and typical content of a prospectus inevitably vary from field to field. In most cases, however, a prospectus should contain the following information:

1. The name of the dissertation adviser.
2. A statement of the topic of the dissertation and an explanation of its importance. What in general might one expect to learn from the dissertation that is not now known, understood, or appreciated?
3. A concise review of what has been done on the topic in the past. Specifically, how will the proposed dissertation differ from or expand upon previous work? A basic bibliography should normally be appended to this section.
4. A statement of where most of the work will be carried out—for example, in a Yale library or another library or archive, in the laboratory of a particular faculty member, or as part of a program of fieldwork at specific sites in the United States or abroad.
5. If the subject matter permits, a tentative proposal for the internal organization of the dissertation—for example, major sections, subsections, sequence of chapters.
6. A provisional timetable for completion of the dissertation.

Dissertations are normally submitted in English. If there is a strong academic reason to submit all or a portion of the dissertation in a foreign language, students must petition to do so at the time of the submission of their prospectus. The petition should be submitted in the form of a letter explaining the academic reasons for using a foreign language and will be evaluated by the director of graduate studies and the appropriate dean. Petitions for writing and submitting a dissertation in a foreign language will not be accepted after students have advanced to candidacy.

Admission to Candidacy

Admission to candidacy indicates that the department and the graduate school consider the student prepared to do original and independent research. Students will be admitted to candidacy when they have completed all predissertation requirements, including the dissertation prospectus and excluding any required teaching. Admission to candidacy will normally take place by the end of the third year of study. Any programmatic variations from this pattern that have been approved by the Executive Committee of the Graduate School are described in the individual program statements.

Training in teaching can occur both before and after a student is admitted to candidacy. A student who has not been admitted to candidacy at the expected time will not be permitted to register for the following term and will be withdrawn from their program. At the time of advancement to candidacy, eligible students who have not petitioned for or received en route degrees (e.g., M.A., M.S., M.Phil.) will automatically be considered for such degrees. If a student advances to candidacy after the deadline to submit a petition for a degree in that term, the student will be considered for a degree in the following term.

Training in Teaching

The Teaching Fellow Program (TFP) is the principal framework at Yale in which graduate students learn to become effective teachers. Learning to teach and to evaluate student work is fundamental to the education of graduate students. Teaching is required in many departments and is an expectation for all doctoral students. All graduate students teaching for the first time at Yale are required to attend a "Teaching at Yale Day" (T@YD) orientation. The TFP provides opportunities for graduate students, under faculty guidance, to develop teaching skills through active participation in the teaching of Yale undergraduates. Teaching fellows who encounter problems or difficulties related to their teaching appointments are encouraged to meet with the appropriate dean. Only students registered for at least half-time study may serve as a teaching fellow (TF) or as a part-time acting instructor (PTAI). For a more detailed description of these types of appointments, see Teaching Fellow Levels in the Financial Aid section under Financing Graduate School. Students must complete the entire semester (or other relevant period) of teaching in order to receive academic credit for teaching and for a teaching experience in the TFP to appear on the transcript.

Faculty should clearly communicate to students and teaching fellows their expectations about the evaluation of work, feedback to students, and grading policies. Faculty are expected to prepare course syllabi, assignments, and examinations. Typically, they should not ask teaching fellows to give lectures when they are unable to attend class, although they are encouraged to offer occasional opportunities for student lectures when they can attend and advise. Teaching fellows may be asked to assist with administrative activities (such as placing course material on library reserve or online, making photocopies for class, ensuring that audiovisual resources are available and working, and the like). In general, however, the faculty member is responsible for such activities.

To avoid conflicts of interest, teaching fellows should not normally be assigned to evaluate the work of graduate student peers. However, in courses requiring extensive quantitative work, teaching fellows may score quantitative homework and exams submitted by graduate students, using nondiscretionary scoring keys approved by the faculty instructor. In these instances, the faculty member should review the teaching fellow's scoring and must assign the final grade. In courses that are double-titled with both graduate and undergraduate numbers, the same guidelines hold for the grading of assignments; all other grading of graduate students should be done by the faculty member.

The graduate school requires that all students who teach be in academic good standing. In addition, they must be fluent in English. Graduate students whose native language

is not English are required to meet the oral English proficiency standard before they may begin teaching. This includes teaching in foreign language courses. The standard may be met by (1) passing the Center for Language Study oral exam, (2) passing the speaking section of the iBT TOEFL, (3) passing the speaking portion of the IELTS exam, or (4) having received an undergraduate baccalaureate degree or its equivalent from an institution where the principal language of instruction is English and the student was in residence for at least three years. In some instances, a student's academic dean or director of graduate studies may require that students with an undergraduate degree from English-speaking institutions also pass an oral English exam to satisfy the language requirement. Doctoral students who have not met the oral English proficiency standard must enroll in at least one course offered by the Center for Language Study's English Language Program each term.

Dissertation

The dissertation should demonstrate the student's mastery of relevant resources and methods and should make an original contribution to knowledge in the field. Normally, it is expected that a dissertation will have a single topic, however broadly defined, and that all parts of the dissertation will be interrelated but can constitute essentially discrete units. Beyond this principle, the faculty will apply the prevailing intellectual standards and scholarly practices within their fields in advising students with regard to the suitable scope, length, and structure of the dissertation, including what constitutes an original contribution to that field.

In accord with the traditional scholarly ideal that the candidate for a doctorate must make a contribution to knowledge, all dissertations that have been accepted by the graduate school are published electronically through ProQuest and are deposited in the collection of the Sterling Memorial Library. As such, classified or restricted research is not acceptable as part of the dissertation. Exceptions must be approved in advance by the Degree Committee.

Dissertations must be written in and submitted in English except in some disciplines in which there are strong academic reasons for the submission of a dissertation in a foreign language. A dissertation may not be translated into English by someone other than the student.

Dissertations must be submitted to the graduate school by the respective deadlines in the academic calendar to be considered for December or May degrees. No exceptions are made to these deadlines, which have been established to allow sufficient time for departments to receive evaluations from readers and recommend students to the Degree Committee. Once the adviser and committee have approved a dissertation for submission and the director of graduate studies has been notified, the student submits the dissertation along with the degree petition and other forms based on the requirements set forth on the Dissertation Progress Reporting and Submission (DPRS) site (https://dissertation.yale.edu/dprs). The director of graduate studies must approve a complete list of dissertation readers for each dissertation on the Notification of Readers (NOR) link on the DPRS site.

Registered doctoral candidates must have a principal adviser with an appointment to the graduate school faculty. The graduate school requires that each dissertation be read by at least three people but not more than five, at least two of whom hold faculty

appointments in the graduate school. All readers must hold the Ph.D. degree as well as a faculty position or be considered otherwise qualified to evaluate the dissertation. The process for assigning readers is determined by the department, which is responsible for confirming the qualifications, contact information, and availability of all readers before notifying the graduate school of these appointments. All appointments of readers are subject to review by the associate dean. The department is responsible for reassigning readers as necessary, and this process will not extend the deadline for readers' reports to be returned to the graduate school. Once all readers' reports have been submitted, students may view them in the DPRS system. Readers' reports become part of the student's permanent academic record.

Award of the Ph.D. will be considered by the Degree Committee only if all readers' evaluations have been received by the graduate school and are positive, all other degree requirements have been met, and the department has recommended the awarding of the degree. Should a reader indicate that a dissertation contains significant errors in typing, grammar, spelling, reference citations, or other textual matters, the student will be required to revise the dissertation by a date provided by the registrar. A new pdf of the dissertation must be uploaded in the DPRS system. The graduate school must receive approval from the director of graduate studies indicating that the student has addressed the readers' concerns before the dissertation can be recommended for a degree. In the event that a dissertation is evaluated by any reader as Not Acceptable, the dissertation will be administratively withdrawn from submission. Departmental practice determines the number of reevaluations normally permitted. If reevaluation is permitted, the student must resubmit the dissertation in a subsequent degree cycle.

The graduate school does not require departments to evaluate the dissertations of degree candidates who are no longer registered. The decision to review such dissertations rests entirely with the respective department or program.

REQUIREMENTS FOR THE DEGREE OF MASTER OF PHILOSOPHY

The Master of Philosophy is awarded en route to the Ph.D. in many departments and programs. The minimum general requirements for this degree are that a student shall have completed all requirements for the Ph.D. except required teaching, the prospectus, and dissertation. Students will not generally have satisfied the requirements for the Master of Philosophy until after two years of study, except where graduate work done before admission to Yale has reduced the student's graduate course work at Yale. In no case will the degree be awarded for less than one year of residence in the Yale graduate school.

Not all programs offer the M.Phil. degree. Information regarding special requirements for the degree, if any, are stated in the individual program listings.

REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS OR MASTER OF SCIENCE

Except in the case of programs listed below under Terminal M.A./M.S. Degrees, students are not admitted as candidates for the Master of Arts or Master of Science degree. However, students in doctoral program may be awarded the M.A. or M.S. en route to the Ph.D. degree if offered by their program.

Although departments may set more stringent requirements, the minimum general requirements must comply with the credit hour standards set by the U.S. Department of Education and include the (1) completion of a minimum of seven one-credit graduate courses leading to the Ph.D. or the equivalent of such courses, with grades that satisfy departmental requirements; (2) completion of one academic year in full-time residence or the equivalent at Yale; (3) recommendation by the department for award of the degree, subject to final review and approval by the Degree Committee. In no case may courses taken prior to matriculation in the graduate school, or in Yale College or other summer programs, be applied toward the requirements for the M.A. or M.S. degree.

Some departments do not offer the M.A. or M.S. en route to the Ph.D., or award it only to students who are withdrawing from the Ph.D. program. For information about this or any other special requirements additional to the general requirements stated above, see the program listings.

Students enrolled in a Ph.D. program may receive a master's degree from another program provided that it is in a related field of study and deemed necessary for the completion of the proposed dissertation research but may only earn one en route M.A. or M.S. degree during their doctoral studies. The student's proposed program of study must receive formal approval in writing from the directors of graduate studies in both programs and the appropriate associate dean prior to enrollment in courses that will fulfill master's degree requirements in another program. Courses taken toward a master's degree in another program must be part of the student's course requirement for the Ph.D., as approved by the directors of graduate studies in both programs. However, such course work cannot also be counted toward a master's degree in the program to which the student was admitted. A student may not advance to candidacy until all requirements have been completed for both the en route master's degree in the program to which the student was admitted and the proposed master's degree in a related field. Students who wish to obtain a master's degree in a field that is not directly related to the doctoral degree must apply for a personal leave from the Ph.D. program and submit an application for admission to the master's program. Any financial aid offered to the student for a Ph.D. program may not be transferred to a master's degree course of study. Students enrolled in combined programs normally receive combined en route degrees, if the en route is offered individually by both programs.

Terminal M.A./M.S. Degrees

The M.A. and M.S. degrees are offered as terminal degrees in twenty-three departments and programs, including African Studies, American Studies, Applied Physics, Archaeological Studies, Computational Biology and Biomedical Informatics, Computer Science, East Asian Studies, Engineering & Applied Science, English, European and Russian Studies, History, History of Science and Medicine, International and Development Economics (IDE), Medieval Studies, Music, Near Eastern Languages and Civilizations, Personalized Medicine & Applied Engineering, Public Health, Statistics, and Statistics and Data Science.

The residence and tuition requirements for a terminal M.A./M.S. degree are a minimum of one year of full tuition and course work in residence in one-year programs, or a minimum of two years of full tuition and course work in residence in

two-year programs. For information about departments that offer one-year or two-year programs, see the program listings. Students who extend their program solely to retake a class or finish a master's thesis in order to be eligible to graduate and who have met the tuition requirement will be charged the Continuous Registration Fee.

With the approval of the program and the appropriate academic dean, a student may be admitted for part-time study toward a master's degree. In that case, tuition will be charged on a per-course basis. Part-time study does not change the one- or two-year full-tuition obligation described above. Part-time students must complete all degree requirements within five years of matriculation. Part-time status may affect a student's eligibility for Yale Health coverage.

Individual programs establish the specific course and language requirements for these degrees. Although programs may set more stringent requirements, the minimum graduate school requirement for students admitted for M.A./M.S. degrees is an overall grade average of High Pass, including a grade of Honors in at least one one-credit graduate course (for students enrolled in one-year programs), or in at least two one-credit graduate courses (for students enrolled in two-year programs). In order to maintain the minimum average of High Pass, each grade of Pass on the student's transcript must be balanced by one grade of Honors. Each grade of Fail must be balanced by two grades of Honors. If a student retakes a course in which the student has received a failing grade, only the newer grade will be considered in calculating this average. The initial grade of Fail, however, will remain on the student's transcript. A grade awarded at the conclusion of a full-year course in which no grade is awarded at the end of the first term would be counted twice in calculating this average.

Each course offered in the graduate school counts for one or one-half credit. Only courses offered by the graduate school and officially numbered on the graduate level can fulfill requirements for the master's degree, with the exception of certain language courses or when specified in advance by the department or program. A student who has not fulfilled the course requirements for the degree at the conclusion of the standard duration of the program can, at the discretion of the department and associate dean, be granted one additional term to fulfill degree requirements. If the student has not taken the requisite number of courses but has fulfilled the tuition requirement, the student will be charged the Continuous Registration Fee. If the student must take additional courses beyond the number required, the student will be charged tuition on a per-course basis.

No credit will be awarded toward the M.A./M.S. degree for courses taken prior to matriculation in the graduate school or taken in Yale or other summer programs. Students in one of Yale's professional schools who matriculate in the graduate school to complete a joint master's degree may, however, with the permission of their director of graduate studies, count courses already completed in their professional school program toward the joint degree. See the individual program or department listings.

The master's degree may also be earned jointly with the B.A./B.S. in certain departments by students enrolled in Yale College. For further information, see *Yale College Programs of Study,* available from the Office of the Dean of Yale College.

REQUIREMENTS FOR CERTIFICATES

The graduate school offers a number certificate programs through which graduate school students may gain secondary competency in a related field. There are two types of certificates: academic program certificates and certificates in training.

Academic Program Certificates

Academic program certificates allow graduate school students to develop an area of expertise that will complement and enhance their degree program. Certificate requirements vary by program, but typically include required courses that demonstrate competency in an area of study, participation in a colloquium, and sometimes research and teaching expectations. Students interested in pursuing a certificate should contact the program director or DGS of the relevant program (see below) and must apply separately to enroll in a certificate program. Each course offered in the graduate school counts for one or one-half credit. Only courses offered by for credit at a graduate level can fulfill requirements for a graduate certificate. No credit will be awarded toward the certificate for courses taken prior to matriculation in the graduate school or taken during a summer session. Current certificates offered are:

- Archaia (Graduate Certificate in the Study of Ancient and Premodern Cultures and Societies)
- Brains, Minds, and Machines
- Environmental Humanities
- Ethnicity, Race, and Migration
- Film and Media Studies
- Leadership and Research Management for Physician-Scientists
- MacMillan Center for International and Area Studies (Graduate Certificates of Concentration in Area Studies)
  - African Studies
  - European and Russian Studies
  - Latin American and Iberian Studies
  - Modern Middle East Studies
- Material Histories of the Human Record
- Medical Research Scholars Program
- Physical and Engineering Biology (PEB)
- Public Humanities
- Quantum Materials Science and Engineering
- Translation Studies
- Women's, Gender, and Sexuality Studies

Certificates in Training

Certificates in training provide Ph.D students with professional skills that will dovetail with their research interests. The Center for Language Study and the Poorvu Center for Teaching and Learning offer the following certificates in training:

- Public Communication Certificate
- Certificate of College Teaching Preparation (CCTP)
- Certificate in Second Language Acquisition (SLA)

REQUIREMENTS FOR JOINT-DEGREE PROGRAMS

Students who are candidates for degrees in any of the joint programs sponsored by the graduate school and Yale's professional schools must meet the requirements established by each school for the degree they are seeking. Degree requirements in the graduate school include both the graduate school's general requirements and any special requirements set by the relevant department or program. In all cases the Honors requirement must be fulfilled in non-research courses offered primarily for graduate school students, taken after matriculation in the graduate school.

In addition to the J.D./Ph.D., J.D./M.A., M.D./Ph.D., and Ph.D./M.B.A. programs described below, joint-degree programs with other professional schools have been approved for students in Chemical and Environmental Engineering, European and Russian Studies, and International and Development Economics. These programs are described in the individual department listings.

J.D./Ph.D. and J.D./M.A. Programs

Admission to the graduate school joint-degree programs with the Law School, described below, requires separate admission to both schools as well as approval by the appropriate associate dean in each school, and by the director of graduate studies in the student's graduate school department. Students must apply for admission to a joint program no later than their first year of study in a J.D., Ph.D., or two-year M.A. program, and must matriculate in the joint program no later than the beginning of their second year. Students wishing to pursue a J.D./M.A. in a one-year M.A. program must matriculate in the M.A. program as a joint-degree candidate.

In the J.D./Ph.D. program, the first year of study is spent principally in the Law School. The second and third years are combined according to the interest of the student. As many as six term courses, designated by the student at the beginning of the term, may be counted toward both degrees. During this time all course work and language requirements for the Ph.D. program are normally completed. The J.D. should be completed by the end of the fourth year. During the fifth year the student is expected to complete all remaining predissertation requirements and be admitted to candidacy. The teaching requirement for the Ph.D. will normally be completed by this time. Any exception to this pattern of study must be approved by the appropriate associate dean.

The minimum residence requirement in the J.D./Ph.D. program is four years. The tuition requirement is two and one-half years in the Law School and three and one-half years in the graduate school. Financial aid for tuition is provided by each school according to its own criteria, typically for two and one-half years in the Law School and three and one-half years in the graduate school, and is awarded by each school during the terms in which the student pays tuition in that school. Students are not eligible for financial aid from the graduate school during terms in which they are registered at another school.

In the J.D./M.A. program, the J.D. and M.A. degrees are awarded simultaneously at the end of the fourth year of study in one-year M.A. programs and at the end of four

and one-half years of study in two-year M.A. programs. The graduate school residence and tuition requirement for J.D./M.A. students in one-year M.A. programs is one year; students in two-year M.A. programs have a one and one-half year tuition and residence requirement in the graduate school. In all cases students pay three years of tuition in the Law School. Students in J.D./M.A. programs, like other students in M.A. programs, are not ordinarily eligible for University Fellowship aid through the graduate school. Students usually enroll in the Law School during the first year of study. The pattern of enrollment in subsequent years depends on whether the M.A. program is a one-year or a two-year program.

M.D.-Ph.D. Program

This program is sponsored jointly by the graduate school and the School of Medicine. Applications for admission to the joint program are reviewed by a committee composed of faculty members and deans from both schools. Normally, admission to the program includes simultaneous admission to both schools. However, students may apply to the joint program normally by October 15 of their second year of study in either the M.D. or Ph.D. program, and they must matriculate in the joint program no later than the beginning of the following year.

Students request affiliation with a particular department or program in the graduate school by the beginning of their third year of study in the joint program, after their course and research interests have been defined. Although students usually pursue their research in one of the biological sciences, those interested in earning the Ph.D. through work in another department may do so under certain circumstances, with the approval of the M.D.-Ph.D. committee and of the relevant department or program. At the time of the student's affiliation with a non-biological/biomedical science department or program, permission for any adjustment to the teaching requirement must be obtained from the graduate school. Requests for adjustments to the program's teaching requirement should be submitted by the director of graduate studies and by the director of the M.D.-Ph.D. program, as part of a student's proposed plan of study, to the associate dean for graduate student advising and academic support.

The residence requirement in this program is seven years. The tuition requirement is three and one-half years in the School of Medicine and two and one-half years in the graduate school. To qualify for the M.D. and Ph.D. degrees, students must satisfy all degree requirements of both schools. Normally, a student admitted to this joint program must satisfy the graduate school Honors requirement and all predissertation requirements within four terms of affiliation with the Ph.D. department. This schedule may be adjusted for students who have been enrolled in either the School of Medicine or the graduate school before admission to the M.D.-Ph.D. program.

Ph.D./M.B.A. Program

The joint-degree program combines the two-year M.B.A. degree from the School of Management (SOM) with the six-year Ph.D. It allows students to complete requirements for both degrees in roughly seven years rather than the eight or more years that would be required if the degrees were pursued separately. Both degrees will be awarded simultaneously once the student has fulfilled the degree requirements of both programs. Like all graduate students, joint-degree students receive a full financial aid package from the graduate school during the terms registered there.

For students in the humanities and social sciences, this includes four years of tuition fellowship, five years of stipend, and health fellowship for Yale Health coverage for each term registered. Funding for students in the sciences reflects standard, departmental packages. Students will pay one and one-half years of tuition for the three terms registered at SOM.

The SOM and the graduate school use independent admissions processes and make independent admissions decisions. Applicants must submit the results of the GMAT and, if required by the prospective Ph.D. program, the results of the GRE. Prospective students who are not currently enrolled in either the graduate school or SOM may apply to both schools simultaneously. Students already enrolled in the graduate school normally apply to SOM after taking one course at SOM and apply to matriculate at SOM any time after they have passed their Ph.D. qualifying examinations at the graduate school but prior to beginning the fifth year of study. This pattern, however, is flexible, and students interested in the joint degree should consult the websites of their departments or programs for further information. Students enrolled at SOM may apply to the graduate school during the first year of study at SOM. Following admission to both programs, each student must complete a form requesting joint-degree status. The form must be signed by the appropriate associate dean at the graduate school and at SOM and the student's director of graduate studies.

A student in the graduate school who wishes to pursue the joint degree will normally be required to take one course at SOM before applying there. To enroll in the course, the student will need to obtain the permission of the SOM instructor and state the intention to apply to the joint-degree program. The graduate school will waive one course during the term in which the student takes this preliminary course at SOM. For students in some disciplines, this prerequisite to admission will be waived. The student is expected to complete the qualifying exams and prospectus according to the standard schedule set by the graduate school. The student will normally begin study at SOM after completing the departmental Ph.D. qualifying examinations at the graduate school, but there are exceptions to this pattern described on the departmental websites. Upon admission to SOM, the joint-degree student will register at SOM for the first-year core of courses. Students may not fulfill any graduate school requirements during this time, nor may they serve as teaching fellows in the graduate school in any capacity. The student must register for a third term at SOM and complete four additional courses, normally prior to the beginning of the sixth year of study at the graduate school. Depending on the schedule of individual students, they may or may not complete all four of these remaining courses within a single term at SOM. If they do not, they may complete outstanding courses while registered at the graduate school, but in all circumstances, students are required to pay a third term of tuition to SOM.

A student who has been admitted to the graduate school while completing the first-year core at SOM may begin course work in the graduate school the following year. Once a joint-degree student has matriculated at the graduate school, it is expected that the student remain registered continuously until completing the qualifying exams. During this time, the student may undertake limited course work at SOM, but may not register there for the third and final term until the student has passed qualifying exams at the graduate school. Prospective students who apply simultaneously may start the joint degree at either school and follow the schedules outlined above.

All joint-degree students are subject to the codes of conduct published in the bulletins of their respective programs. Joint-degree students will receive separate transcripts from SOM and the graduate school. Each transcript will list the courses required for the respective school's portion of the joint degree. Each course taken may be counted toward one degree only. Students' transcripts will reflect the joint-degree status. A joint-degree student who decides not to complete both degrees may petition both schools to receive a single degree if the requirements for the single degree, including the two-year tuition requirement at SOM, are met.

RESPONSIBLE AND ETHICAL CONDUCT IN RESEARCH

Responsible and Ethical Conduct in Research (RECR) training is intended to establish a basis of understanding among graduate students concerning their rights and obligations as scholars and researchers, as noted below.

Master's and Ph.D. Students

At the start of their first year of study, all master's and Ph.D. students are required to attend sessions on professional ethics, including academic integrity, prevention of sexual misconduct, and discrimination and harassment reporting. Students must also complete an approved online RECR training module in professional ethics before they can register for the second term of their first year.

Additional requirements: (1) Students in the natural sciences must complete a department-based RECR course by the end of their first year of study. Master's students in the natural sciences will not be charged tuition for this course; (2) Students in the humanities and social sciences who receive funding from a U.S. government grant or fellowship are required to complete an online RECR course offered by CITI within one month of the start of the funding.

Students in the Division of Special Registration (DSR)

All DSR students in the natural sciences, and DSR students in the humanities and social sciences who receive funding from a U.S. government grant or fellowship, are required to complete an online RECR course. This requirement must be fulfilled within one month of receiving a Yale NetID and even if RECR training was completed at another university.

Additional requirements: (1) All DSR students registered in the fall term must complete an approved online RECR training module before they can register for the spring term; (2) DSR students in the natural sciences who intend to study at Yale for one year or more are required to complete, at no charge, the department-based RECR course taken by degree-seeking students.

PETITIONING FOR DEGREES

Graduate school degrees are awarded twice each year, at Commencement in May and at the end of the fall term (normally in December, depending on the schedule of the Yale Corporation). Degrees are not granted automatically. Students must file a petition for each degree by the appropriate date. (See Schedule of Academic Dates and Deadlines.) Petitions that have received favorable recommendations from the student's department are reviewed by the Degree Committee. When the Degree Committee has given its

approval, the petition is forwarded to the faculty of the graduate school and then to the Yale Corporation for approval.

Students enrolled in Ph.D. programs should not petition for en route degrees (e.g., M.A./M.S. and M.Phil.) until after the term in which requirements for the degree are completed (e.g., students completing degree requirements during the spring term should petition for award of the degree the following fall). Students who have not petitioned for or received en route degrees (e.g., M.A., M.S., M.Phil.) will automatically be considered for such degrees in the term following advancement to candidacy. Students in terminal M.A./M.S. programs may petition for their degrees in the term in which they expect to complete their degree requirements.

Academic Regulations

- Registration
- Course Enrollment
- Grades
- Registration Status and Leaves of Absence
- Personal Conduct and Academic Integrity Standards
- Freedom of Expression
- Recordings by Faculty, Staff, Students and Invited Guests
- Postering, Chalking, and Publicity Policy

REGISTRATION

Only registered students may attend classes, receive financial aid, or use the facilities of the university. Students must register every term for the duration of their degree program (normally six years or fewer for Ph.D. programs and one or two years for students in M.A./M.S. programs). This regulation applies to all students, whether engaged in course work, preparation for qualifying examinations, or dissertation research, and, in the case of students in Ph.D. programs, whether study is in residence or in absentia. Students who do not register for any term for which they have not been granted a leave of absence (see Leaves of Absence, under Registration Status and Leaves of Absence, below) will be considered to have withdrawn from the graduate school. Privileges associated with registered status (i.e., library privileges, health care coverage, and email accounts) will likewise be withdrawn.

Unless otherwise noted in the letter of admission, students are expected to register on a full-time basis. Part-time employment at the university or elsewhere should not conflict with the obligations of the degree program or interfere with academic progress. Part-time employment beyond an average of ten hours per week requires permission of a student's director of graduate studies in consultation with the appropriate associate dean. Part-time employment includes teaching outside of the graduate school's Teaching Fellow Program. International students must consult OISS regarding their eligibility for employment while in the United States.

No student may register for any term unless the student is making satisfactory progress toward the degree and has been cleared by the Office of Student Financial Services to register. Students who are not compliant with Yale's vaccination requirements will

not be allowed to register; see Required Immunizations under Health Services in the chapter Yale University Resources and Services.

Satisfactory progress means that the student has met all graduate school and departmental requirements normally expected for each stage of the student's program. For Ph.D. students before admission to candidacy and for M.A./M.S. students, this includes satisfactory completion of courses from the preceding term(s). As indicated in the sections on Course and Honors Requirements and Admission to Candidacy, under Degree Requirements, students in Ph.D. programs must satisfy the Honors requirement before beginning the fifth term of study and must be admitted to candidacy by the appropriate time. In addition to satisfying these general graduate school requirements, students must meet any additional requirements specified by their departments. Students who fail to make satisfactory progress may be placed on a probationary status pending satisfactory completion of requirements. Ph.D. students who have been admitted to candidacy must continue to demonstrate satisfactory progress toward the degree in the annual Dissertation Progress Report (DPR). Students who fail to meet departmental or graduate school requirements by the designated deadlines, and students who have been admitted to candidacy who fail to submit the annual DPR, will be administratively withdrawn.

Students must register each term until the dissertation is submitted or until six years (twelve terms) of study have been completed. Registered students who submit dissertations after the close of the add-drop period will remain registered until the end of the term (i.e., through December for those submitting during the fall term, through May for those submitting before the spring degree deadline, and through August for those submitting after the spring degree deadline) and will retain all privileges of registration (e.g., library privileges, health care coverage, and email accounts). Students who complete all Ph.D. requirements within four continuous years of full-time study in the Ph.D. program will be registered and charged full tuition only through the term in which the dissertation is submitted. Students who have registered part-time or taken a leave of absence must complete the four-year, full-tuition obligation, regardless of when they submit the dissertation.

Students are expected to complete the dissertation within six years of study or fewer. Students who have not submitted the dissertation by the end of the sixth year of study may do so subsequently, at the discretion of the department, without registering or may request a period of extended registration by petitioning for extended registration. Prior to petitioning, students must submit the standard DPR that is required annually by May 1 of all students admitted to candidacy. Before a seventh year of registration is approved, the student and the student's adviser, as well as the director of graduate studies, must complete the DPR specifying the progress the student has made in writing the dissertation and present a detailed plan for completing the dissertation in the seventh year. Seventh-year registration petitions are decided on by departments and programs. Very rarely, students may request an eighth year of registration due to serious circumstances beyond their control that have prevented them from completing the dissertation by the end of the seventh year of study. Eighth-year registration petitions are recommended by the program and must be approved by the graduate school deans. Students who are approved for extended registration must register each term and are normally expected to be in residence.

Dissertation Completion Status Alternatively, a doctoral student who is not eligible for full-time registration may request to enroll with the status "Dissertation Completion." This part-time status enables advanced students to maintain an active NetID in order to access electronic library resources and their Yale email accounts while completing their dissertations under the supervision of a member of the graduate school faculty. A student will be charged the Continuous Registration Fee (CRF) each term and may normally hold this status for a maximum of four consecutive terms. Students on this status are not eligible to teach in the Teaching Fellow Program or to purchase health coverage as Yale affiliates. Once a student enters this status, the student may not petition to register as a full-time student in a subsequent term.

Noncumulative Registration In certain areas of study, it may be necessary for a registered doctoral student to acquire an academic or methodological skill, such as knowledge of a foreign language, that is essential for a degree requirement or for research in a particular field and for the overall progress of the dissertation, but is not an inherent part of the dissertation itself. A student may request up to one year of "noncumulative registration." General study in a field related to or parallel with the topic of the dissertation is not appropriate for noncumulative registration.

A student who wishes to have a specific period of study designated as "noncumulative" must discuss the reasons for such a period of study with and secure prior approval from the appropriate associate dean. If prior authorization has been given by the graduate school, the period of time spent acquiring the necessary academic skill will not be counted as part of the student's six-year period of registration. Noncumulative registration does not affect the four-year full-tuition obligation. The tuition charge and any university stipend will be postponed if a student registers noncumulatively before the four-year full-tuition obligation has been satisfied. While registered noncumulatively, students pay the CRF. Doctoral students who register noncumulatively will receive a fellowship to cover the cost of the CRF and will continue to receive a Health Award from the graduate school.

COURSE ENROLLMENT

Any student who wishes to enroll in courses during a term must register through the online course selection process. Students will register for a subsequent term in the term immediately preceding through Yale Course Search. The deadlines for registration each term are listed in the Schedule of Academic Dates and Deadlines. Students who submit course enrollment forms after the appropriate deadline will be assessed a fee.

No student may attend any class unless officially registered in the course. No credit will be given for work done in any course for which a student is not officially registered, even if the student entered the course with the approval of the instructor and the director of graduate studies. Graduate students who wish to register for courses that are offered on both the graduate and undergraduate levels must register with the graduate-level course number (i.e., 500 or higher) in order to receive credit toward their degrees. In rare instances, a graduate student may be granted permission to register for an undergraduate course that will count toward the fulfillment of course requirements for the student's graduate degree. In such cases, the student must file an approved Graduate Credit Request form (https://registrar.yale.edu/forms-petitions) with the Registrar's Office by the end of the registration period. Graduate students may not utilize the "Credit/D/Fail" option within the Yale College grading scale. Students

enrolling in courses offered by a Yale professional school are subject to all policies and deadlines of both the professional school and the graduate school. Graduate students taking a course at the SOM register through the SOM registration site. Graduate students registering for courses through the Law School must submit a Law School Permission Form. Permission must be obtained within two weeks of the close of the add/drop period at the graduate school.

A student who wishes to audit a course must receive permission from the instructor (as not all faculty permit auditors in their classes) and register for the course as an auditor. The minimum general requirement for auditing is attendance in two-thirds of the class sessions; instructors may set additional requirements for auditing their classes. Audited courses appear on the student's transcript.

Course Changes

Once the registration or add/drop process has closed for a given term, all subsequent changes must be made using the Course Schedule Change Notification Form, approved by the student's director of graduate studies, and filed with the registrar. At or near the beginning each term, the registration system will open for an add/drop period for all students to adjust and finalize their schedules. Registration deadlines are published in the Schedule of Academic Dates and Deadlines. If a student is enrolled in a professional school course, all changes in enrollment status must be reported to the registrar of that school as well as to the graduate school. Forms for reporting changes to the graduate school are available online at http://registrar.yale.edu/forms-petitions.

The dates for changing enrollment in a course from Credit to Audit or Audit to Credit and for withdrawing from a course are listed in the Schedule of Academic Dates and Deadlines. If a student officially withdraws from a course by the stated deadline, the course will be removed from the student's transcript. If a student ceases to participate in a course without officially withdrawing from that course by the stated deadline, it is at the instructor's discretion to assign an appropriate qualitative grade or a grade of "Incomplete."

GRADES

The grades assigned in the graduate school are:

H	Honors
HP	High Pass
P	Pass
F	Fail
TI	Temporary Incomplete
I	Incomplete

A mark of "Y" is assigned as the grade for the first term of a full-year course and will be converted to a standard grade once both terms are completed, depending on the number of credits the course fulfills.

Marks of Satisfactory/Unsatisfactory may be assigned only when the department sponsoring the course has designated such marks. In such cases, the grading mode is the same for all students enrolled in the course.

The graduate school does not calculate grade-point averages, nor does it assign numerical or letter equivalents to graduate school grades. Grades assigned according to grading scales other than those described above will be returned to the instructor for conversion. If a student retakes a course, both grades remain on the transcript, but only the higher grade is counted toward the program requirements. Students do not receive credit for courses in which they receive a grade of Failure (F).

The Schedule of Academic Dates and Deadlines indicates the dates on which grades are due for the current year. Instructors have the responsibility for assigning dates for submitting course work in order to meet grade deadlines. If a student and instructor have agreed that an extension is appropriate, the student must submit to the Registrar's Office a request for the Temporary Incomplete (TI) (See http://registrar.yale.edu/forms-petitions) with the intended completion date, signed by the instructor and the director of graduate studies. Only one TI in a single term is permitted. Temporary Incompletes received in an academic year must be converted to final grades normally by October 1 of the following academic year. If a grade is not received by the registrar by this date, the TI will be converted to a permanent Incomplete (I) or Failure (F) on the student's record, as indicated in advance by the instructor on the TI form.

In certain extraordinary circumstances, such as serious illness or a family emergency, and on the recommendation of the student's department, the appropriate academic dean may grant an additional extension. A written request for such an extension must be made by the director of graduate studies on the student's behalf within two weeks of the grade submission deadline. The request should indicate the special circumstances and suggest a date by which the student will complete the work. If the request is approved, the academic dean will inform the student and instructor. If the grade is submitted to the registrar by the new deadline approved by the academic dean, it will replace the TI. If a grade is not received by the registrar by this date, a Temporary Incomplete (TI) will be converted to a permanent Incomplete (I) or Failure (F) on the student's record, as indicated in advance by the instructor on the TI form.

"Provisional" or "temporary" grades (as opposed to Incompletes) are not permitted. Once submitted to the Registrar's Office, a grade may be changed only in cases of arithmetical or clerical error on the part of the instructor and only with the approval of the appropriate associate dean. If the registrar has not received a given grade from an instructor within two weeks of the stated deadline for the submission of grades, the student will be assigned a grade of "Incomplete" for that course.

When students are charged with academic integrity violations, grades in any relevant courses will be withheld until a formal finding has been made or the case is otherwise closed.

Students are reminded that the policies stated above are the graduate school minimum general requirements. Departments or individual instructors may have more stringent policies, and students should consult their departmental handbooks and directors of graduate studies about such requirements.

REGISTRATION STATUS AND LEAVES OF ABSENCE

Registration in Residence

Students who are studying on campus, attending classes, and using university facilities are considered to be in residence. All M.A./M.S. and nondegree (DSR) students must register in residence each term, as do most students in Ph.D. programs (see also Registration in Absentia and CRF, below, and the Schedule of Academic Dates and Deadlines). Students who will be in residence during any term are required to register by the beginning of that term. (See the Schedule of Academic Dates and Deadlines.) Ph.D. students who are not registered in absentia to perform required fieldwork, research, or study are expected to register in residence.

A fee will be charged to students who register in residence after the add/drop period in each term. Late fees may be waived only if the registrar receives written notification from the student or director of graduate studies before the start of the registration period that the student will register late because of participation in an academic program, such as a summer language course or professional meeting that coincides with the registration period. A student who cannot register during the registration period because of a sudden serious illness or family emergency should contact the assistant university registrar at gsas.registrar@yale.edu as soon as possible.

Registration in Absentia

Ph.D. students whose program of study requires full-time dissertation research, full-time fieldwork, or full-time study at another academic institution outside the New Haven area may request to be registered in absentia. Such registration requires the recommendation of the director of graduate studies. Forms for requesting registration in absentia can be found online at http://registrar.yale.edu/forms-petitions and should be filed at least one month before the beginning of the term during which the student expects to be studying away from New Haven. A student who has not completed the three-year residence requirement will be permitted to register in absentia for compelling academic reasons only, and normally only if the student has completed all other predissertation requirements. Registration in absentia does not reduce the four-year full-tuition or three-year residence requirements. For additional information, see Eligibility for Fellowships under Financing Graduate School.

Students who are enrolled in Yale Health and are registering in absentia should consult the staff of the Member Services Department at Yale Health about the policies governing coverage while they are away from New Haven. Yale University provides ISOS Travel Assistance at no cost to all current students (https://ogc.yale.edu/erm/ISOS). ISOS provides international and domestic emergency medical, security, and travel assistance services anywhere in the world. Students traveling internationally should register their locations at https://world-toolkit.yale.edu/resources-topic/travel to facilitate communication with the university in case of an emergency.

Continuous Registration Fee

Ph.D. students who have completed the tuition and residence requirements described above must continue to register each term through the sixth year whether in residence or in absentia, or until they submit the dissertation, whichever occurs first. Students

who have met the tuition requirement are charged a Continuous Registration Fee (CRF) for each term in which they remain registered. Students who are granted permission to register beyond the sixth year are also charged the CRF. The graduate school will provide a fellowship to cover the cost of the CRF for Ph.D. students registered full-time in year seven in any term in which they serve as Teaching Fellows in the TFP.

Summer Registration

Ph.D. students receive funding and are expected to continue full-time study or research during the summer. Continuing students who were registered during the preceding spring term remain registered through August 31. Ph.D. students who wish to interrupt their studies during the summer (e.g., to accept an internship) must notify the associate dean prior to May 1.

Many M.A./M.S. students continue full- or half-time independent study or research during the summer. Continuing students who were registered during the preceding spring term remain registered through August 31.

Summer Internships

Normally, full-time students who take time off from their studies to work full-time must take a leave of absence for the term or terms in which they are employed. However, certain summer internship opportunities may be beneficial to a student's academic development and career prospects. Therefore, under certain circumstances students may be permitted to remain registered at Yale while engaged in summer internships. To be eligible, the internship must meet several requirements:

- Continuous registration while participating in an internship requires the permission of the director of graduate studies.
- The internship should serve one of two functions: either the student is learning and developing techniques or acquiring data that will be used in the dissertation, or the internship is exposing the student to a potential field of employment following completion of the degree.
- The internship must start after the end of the spring term and be completed before the start of the fall term. If an internship opportunity overlaps with the fall or spring term, students must request a leave of absence. If a Ph.D. student begins an internship before June 1, they will forfeit the final pay period of their spring stipend (May 16–May 31). Stipend payments in the final pay period cannot be prorated.
- Doctoral students participating in a summer internship normally forgo their summer stipendiary funding from the graduate school. The sole exception is if the internship is unpaid and the student is generating data that will be used in the dissertation or obtaining technical or methodological skills necessary for the dissertation. In this case, the student may request to receive summer support from the graduate school. In most cases, doctoral funding will terminate at the end of May and resume on September 1.
- Students will be limited to two summer internship opportunities. If a student wishes to pursue additional internships, the student will normally apply for a leave of absence.

- Students on internships who remain registered full-time will continue to receive a Health Award (if applicable) and other benefits of registration. Internships do not stop a student's "academic clock."
- Doctoral students wishing to pursue internships undertaken primarily for exposure to potential fields of employment are eligible to do so only after they have advanced to candidacy.

To apply for a summer internship:

1. Complete the Request for Summer Internship form (available online at https://registrar.yale.edu/forms-petitions). Submit this form with a letter to the director of graduate studies describing the nature of the internship and work to be done. Include the name of the employer, location and dates of employment, contact information, and salary or benefits provided by the internship. If the internship restricts the student's rights to use and publish information produced during the experience, a copy of the employer's intellectual property rights agreement or proprietary data agreement should also be submitted. Explain the goals of the internship and how the experience will advance the dissertation research or promote career goals.
2. With the form and letter, students should submit a research plan for the coming year that describes their goals, steps for achieving those goals, and the role of the internship in their plans. Students who have been admitted to candidacy and who have included the internship in their annual Dissertation Progress Report (DPR) may refer to the DPR instead of submitting a new research plan.
3. The student's adviser must include a letter of support explaining how the student will benefit from this internship.
4. The director of graduate studies should recommend or disapprove the plan. Recommended plans should be forwarded to the associate dean for final review. The director of graduate studies should certify that the type of experience gained is consistent with the educational goals of the department.
5. Students on U.S. visas wishing to pursue internships should contact OISS at least eight to ten weeks prior to the start of the proposed internship, as they will require permission for "practical training" from the U.S. government.

Leaves of Absence

Students who wish or need to interrupt their study temporarily may request a leave of absence. There are three types of leave—personal, medical, and parental—all of which are described below. The general policies that apply to all types of leave are:

1. All leaves of absence must be approved by the appropriate associate dean on the recommendation of the department. Medical leaves also require the written recommendation of a Yale Health medical director or their designee, as described below.
2. Students in Ph.D. programs may be granted a leave for one term or one academic year. A leave extends the eligibility for fellowship aid by a time equal to the duration of the leave, but not for partial terms. The expected last date of registration will be adjusted by one term for each term of the leave.

Students in one-year M.A./M.S. programs may be on leave for a maximum of one term. Students in one-and-a-half or two-year M.A./M.S. programs may be on leave for a maximum total of one year.

In exceptional circumstances, renewal of a one-term or one-year leave, to a cumulative maximum total of two years of personal and medical leave, may be granted for students in Ph.D. programs. Ph.D. students completing a degree program at another institution may petition for an exceptional third year of leave, subject to the approval of the director of graduate studies and the appropriate associate dean. Leaves of absence for students in M.A./M.S. programs are not renewable. The duration of a parental leave is typically one term or one year, renewable for each birth or adoption event.

3. Students on U.S. visas who apply for a leave of absence must consult with OISS regarding their immigration status.
4. While on leave, students are not expected to participate in the academic life of their program, including any teaching through the TFP. Students on leave may complete outstanding work in courses for which they have been granted approved Temporary Incompletes. They may not, however, fulfill any other degree requirements during the time on leave. (Students who intend to work toward the degree while away from the university must request registration in absentia.) Students who make progress toward the degree while on leave will have their registration changed retroactively to in absentia for the period of the leave.
5. A leave of absence does not exempt the student from meeting the tuition requirement (payment of eight terms of full tuition in Ph.D. programs, or the appropriate established tuition requirement in M.A./M.S. programs) or from paying the CRF (if appropriate), but merely postpones the required charges.
6. A student on leave of absence is not eligible for financial aid, including loans; and in most cases, student loans will not be reported with an eligible in-school status. Loan borrowers may enter their grace period of repayment during times of nonenrollment. For the purposes of Title IV aid, the date the leave of absence began will be reported to lenders as a date of withdrawal, and the student may be subject to a Title IV recalculation.
7. A student on leave of absence is not eligible for the use of any university facilities available to enrolled students.
8. A student on leave of absence may continue to be enrolled in Yale Health by purchasing coverage through the Student Affiliate Coverage plan. To secure continuous coverage from Yale Health, enrollment in this plan must be requested prior to the beginning of the term in which the student will be on leave or, if the leave commences during the term, within thirty days of the date the registrar was notified of the leave. Coverage is not automatic; enrollment forms are available from the Member Services Department of Yale Health, 203.432.0246.
9. Students living in university housing units are encouraged to review their housing contract and the related policies of the Graduate Housing Office before applying to the graduate school for a leave of absence.
10. Students on leave of absence do not have to file a formal application for readmission. However, they must notify the associate dean for academic support

in writing of their intention to return. Such notification should be provided at least eight weeks prior to the end of the approved leave.

11. Students who fail to register for the term following the end of the approved leave will be administratively withdrawn from the graduate school.

Personal Leave of Absence A student who wishes or needs to interrupt study temporarily because of personal exigencies may request a personal leave of absence. The general policies governing all leaves of absence are described above. A student who is current with degree requirements is eligible for a personal leave after satisfactory completion of at least one term of study. Normally, students in Ph.D. programs are not eligible for personal leaves after the fourth year of study. In certain exceptional cases, however, personal leaves may be granted to students beyond the fourth year of study. Personal leaves cannot be granted retroactively and normally will not be approved after the fifteenth day of a term.

To request a personal leave of absence, the student must complete the appropriate form (available online at http://gsas.yale.edu/forms) before the beginning of the term for which the leave is requested, explaining the reasons for the proposed leave and stating both the proposed start and end dates of the leave and the address at which the student can be reached during the period of the leave. If the dean finds the student to be eligible and the department approves, the leave will be granted. In any case, the student will be informed in writing of the action taken. Students who do not apply for a personal leave of absence, or whose application for a personal leave is denied, and who do not register for any term, will be administratively withdrawn from the graduate school.

Medical Leave of Absence A student who must interrupt study temporarily because of illness or injury may be granted a medical leave of absence with the approval of the appropriate associate dean, on the written recommendation of a Yale Health medical director or their designee. A student who wishes to take a medical leave of absence may request it from a clinician at Yale Health and from the office of the associate dean for academic support. The general policies governing all leaves of absence are described above. A student who is making satisfactory progress toward degree requirements is eligible for a medical leave any time after matriculation. The final decision concerning a request for a medical leave of absence will be communicated in writing by the appropriate associate dean. To return from an approved medical leave, at least six weeks prior to the proposed return, students must (1) complete an academic assignment tailored to the student's stage of study as assigned by the student's DGS in consultation with the appropriate academic dean and (2) receive approval from an appropriate medical director or their designee at Yale Health.

The graduate school reserves the right to place a student on a mandatory medical leave of absence when, on recommendation of the director of Yale Health or the chief of the Mental Health and Counseling department, the dean of the School determines that, because of a medical condition, the student is a danger to self or others, the student has seriously disrupted others in the student's residential or academic communities, or the student has refused to cooperate with efforts deemed necessary by Yale Health and the dean to make such determinations. Each case will be assessed individually based on all relevant factors, including, but not limited to, the level of risk presented and the availability of reasonable modifications. Reasonable modifications do not include fundamental alterations to the student's academic, residential, or other relevant

communities or programs; in addition, reasonable modifications do not include those that unduly burden university resources. An appeal of such a leave must be made in writing to the dean of the school no later than seven days from the effective date of the leave. An incident that gives rise to voluntary or mandatory leave of absence may also result in subsequent disciplinary action.

A student who is placed on medical leave during any term will have tuition adjusted according to the same schedule used for withdrawals. (See Schedule of Academic Dates and Deadlines). Before re-registering, a student on medical leave must secure written permission to return from a Yale Health director or their designee.

Eligible Ph.D. students will receive a Health Award from the graduate school to cover the cost of the Student Affiliate Coverage plan for the remainder of the coverage period in which the medical leave begins, if they apply for this coverage through Yale Health within thirty days of the start of their leave. In addition, Ph.D. students who extend their medical leave for a second term will receive a Health Award from the graduate school to cover the cost of Student Affiliate Coverage for one additional term. Yale Health's fall coverage ends January 31 and spring coverage ends July 31. Ph.D. students on a medical leave in the fall term who are cleared to register for the following fall term will receive a graduate school Health Award for the month of August once their fall return has been officially approved. Ph.D. students may apply for and receive the graduate school Family Support Subsidy during the term in which a medical leave begins, but not beyond.

Parental Leave of Absence A student who wishes or needs to interrupt study temporarily to care for a child or children may be granted a parental leave of absence. The general policies governing all leaves of absence are described above. A student who is making satisfactory progress toward degree requirements is eligible for parental leave any time after matriculation.

Eligible Ph.D. students will receive a Health Award from the graduate school to cover the cost of the Student Affiliate Coverage plan for the remainder of the coverage period in which the parental leave begins, if they apply for affiliate coverage through Yale Health within thirty days of the start of their leave. In addition, Ph.D. students who extend their parental leave for a second term will receive a Health Award from the graduate school to cover the cost of Student Affiliate Coverage for one additional term. Yale Health's fall coverage ends January 31 and spring coverage ends July 31. Ph.D. students on a parental leave in the fall term who are cleared to register for the following fall term will receive a graduate school Health Award for the month of August once their fall return has been officially approved. Ph.D. students may apply for and receive the graduate school Family Support Subsidy during the term in which a parental leave begins, but not beyond.

Parental Support and Relief

Registered Ph.D. students who wish to modify their academic responsibilities because of the birth or adoption of a child may request parental support and relief during or following the term in which a birth or adoption occurs. Ph.D. students who become foster parents and are in the process of adopting a foster child are also eligible for parental relief in the term in which the prospective adoption relationship begins or the term that immediately follows. For the whole of the term in which the support and

relief are granted, the student's academic clock stops, effectively adding an additional term to the total time to degree. During this period students remain registered full-time, receive a standard financial aid stipend and Health Award, and receive modified departmental academic expectations that best suit the specific situation. The precise nature of the academic responsibilities undertaken or suspended during this period should be a matter of consultation between the adviser and the student, with the understanding that students are entitled to full relief from responsibilities for at least an eight-week period. Parental relief may not be combined with other funding. To request parental relief, a student should contact the relevant associate dean prior to the term of a birth or adoption. This benefit is limited to two birth or adoption events. If both parents are Ph.D. students at Yale, both may receive this benefit per birth or adoption event.

Graduate students in terminal M.A./M.S. programs may modify their academic responsibilities because of the birth or adoption of a child. They should contact the associate dean for academic support the term before the planned modifications would occur.

Withdrawal and Readmission

A student may withdraw from a program of study voluntarily or may be administratively withdrawn for cause. A student who wishes to terminate a program of study should confer with their director of graduate studies and the appropriate associate dean regarding withdrawal; their signatures are required on an official withdrawal form. (See http://registrar.yale.edu/forms-petitions.) Upon consultation with the department, the associate dean will determine the effective date of the withdrawal. The student's university identification card must be submitted with the approved withdrawal form in order for their withdrawal to be recorded.

Students who are not in academic good standing will be withdrawn for cause, unless an extension or exception has been granted by the appropriate dean or the Degree Committee. Such withdrawals are noted on the student's transcript.

Students who do not register for any fall or spring term, and for whom a leave of absence has not been approved by the appropriate academic dean, will be administratively withdrawn from the graduate school.

A student who discontinues a program of study during the academic year without submitting an approved withdrawal form and university identification card will be liable for the tuition charge (or CRF) for the term in which the withdrawal occurs. Tuition charges for students who withdraw will be adjusted as described in the Schedule of Academic Dates and Deadlines. The CRF for the term is not canceled if a student withdraws after the fourteenth day of the term. Health service policies related to withdrawal and readmission are described under Health Services, below.

Only students who have withdrawn from the graduate school in good standing may apply for readmission. Normally, students seeking readmission must do so within three years of the original withdrawal. Neither readmission nor financial aid is guaranteed to students who withdraw. The deadline for making application for readmission is January 2 of the year in which the student wishes to return to the graduate school. The student's application will be considered by the department, which will make

a recommendation for review by the appropriate academic dean. The student's remaining tuition obligation will be determined at the time of readmission. Students may seek readmission only once. If subsequent to a readmission they must again withdraw, they are ineligible for readmission.

U.S. Military Leave Readmissions Policy

Students who wish or need to interrupt their studies to perform U.S. military service are subject to a separate U.S. military leave readmissions policy. In the event a student withdraws or takes a leave of absence from the graduate school to serve in the U.S. military, the student will be entitled to guaranteed readmission under the following conditions:

1. The student must have served in the U.S. Armed Forces for a period of more than thirty consecutive days.
2. The student must give advance written or oral notice of such service to the appropriate dean. In providing the advance notice the student does not need to indicate an intent to return. This advance notice need not come directly from the student, but rather, can be made by an appropriate officer of the U.S. Armed Forces or official of the U.S. Department of Defense. Notice is not required if precluded by military necessity. In all cases, this notice requirement can be fulfilled at the time the student seeks readmission, by submitting an attestation that the student performed the service.
3. The student must not be away from the graduate school to perform U.S. military service for a period exceeding five years (this includes all previous absences to perform U.S. military service but does not include any initial period of obligated service). If a student's time away from the graduate school to perform U.S. military service exceeds five years because the student is unable to obtain release orders through no fault of the student or the student was ordered to or retained on active duty, the student should contact the appropriate dean to determine if the student remains eligible for guaranteed readmission.
4. The student must notify the graduate school within three years of the end of the U.S. military service of the intention to return. However, a student who is hospitalized or recovering from an illness or injury incurred in or aggravated during the U.S. military service has up until two years after recovering from the illness or injury to notify the graduate school of the intent to return.
5. The student cannot have received a dishonorable or bad conduct discharge or have been sentenced in a court-martial.

A student who meets all these conditions will be readmitted for the next term, unless the student requests a later date of readmission. Any student who fails to meet one of these requirements may still be readmitted under the general readmission policy but is not guaranteed readmission.

Upon returning to the graduate school, the student will resume education without repeating completed course work for courses interrupted by U.S. military service. The student will have the same enrolled status last held and with the same academic standing. For the first academic year in which the student returns, the student will be charged the tuition and fees that would have been assessed for the academic year in which the student left the institution. Yale may charge up to the amount of tuition

and fees other students are assessed, however, if veteran's education benefits will cover the difference between the amounts currently charged other students and the amount charged for the academic year in which the student left.

In the case of a student who is not prepared to resume studies with the same academic status at the same point at which the student left or who will not be able to complete the program of study, the graduate school will undertake reasonable efforts to help the student become prepared. If after reasonable efforts, the graduate school determines that the student remains unprepared or will be unable to complete the program, or after the graduate school determines that there are no reasonable efforts it can take, the graduate school may deny the student readmission.

PERSONAL CONDUCT AND ACADEMIC INTEGRITY STANDARDS

Yale graduate school is an academic community dedicated to the advancement of learning. Its members freely associate themselves with the university and in doing so affirm their commitment to cultivating an environment of tolerance and respect for all members of the community. They pledge to help sustain the intellectual integrity of the university and to uphold its standards of honesty, free expression, and inquiry. They are expected to abide by the regulations of the university, including these graduate school Personal Conduct and Academic Integrity Standards. Because students are expected to show good judgment and use common sense at all times, not all kinds of misconduct or behavioral standards are codified here. Other actions on the part of students that may in the judgment of the Dean warrant disciplinary action because they may imperil the integrity and values of the Yale community or the well-being of its members may be brought forward. Students are also expected to obey local, state, and federal laws, and violations of these may be cause for discipline by the graduate school. Students are required to report misdemeanor and felony charges to the dean's office.

Personal Conduct Standards

The graduate school specifically prohibits the following forms of behavior by graduate students:

1. Physical restriction, assault, or any other act of violence or use of physical force against any member of the community, or any act that threatens the use of violence or physical force.
2. Acts of harassment, intimidation, or coercion, including the harassment of a university community member on the basis of race, color, religion, sex, gender identity or expression, sexual orientation, age, status as a veteran, disability, or national or ethnic origin.
3. Any sexual activity for which positive, unambiguous, and voluntary consent has not been given in advance; any sexual activity with someone who is incapable of giving valid consent because, for example, that individual is sleeping or otherwise incapacitated due to alcohol or drugs; any act of sexual harassment, intimate partner violence, or stalking. Sexual misconduct includes nonphysical actions such as digital media stalking, cyberbullying, and nonconsensual recording of a sexual nature. Sexual harassment consists of nonconsensual sexual advances, requests for sexual favors, or other verbal or physical conduct of a sexual nature. For a fuller

description of sexual misconduct, sexual consent, and sexual harassment see the Title IX website (https://titleix.yale.edu). Sexual misconduct violations shall be addressed by the University-Wide Committee on Sexual Misconduct (UWC) and governed by its procedures.

4. Engaging in a relationship with a student while serving as the student's teaching fellow or in any other direct supervisory role over the student (as outlined in the university's policy prohibiting Teacher-Student Consensual Relations).
5. Disruption of a legitimate function or activity of the university community, including disrupting classes and meetings, blocking entrances and exits to university buildings, unauthorized occupation of any space on the Yale campus, or preventing the free expression or dissemination of ideas.
6. Refusal to comply with the direction of a university police officer or other university official, including a member of the faculty, acting in the performance of their duties.
7. Misuse, alteration, or fabrication of university credentials or documents, such as an identification card or transcript, including grade lists submitted by teaching fellows.
8. Misrepresentation or lying to university officials, including during a formal inquiry.
9. Misrepresentation in applying for admission or financial aid.
10. Recording course lectures without explicit permission of the instructor, or selling or distributing for commercial purposes notes, transcriptions, or outlines of class lectures, or any course materials, in any course of instruction.
11. The misuse of university funds, or willful damage of university property.
12. Misuse of the materials or facilities of the university libraries.
13. Unauthorized use of university services, equipment, or facilities, such as telephones and photocopying equipment.
14. Violation of university rules for using information technology services and facilities, including computers, the university network, software systems, and electronic mail.
15. Trespassing on university property to which access is prohibited.
16. Possession or use of explosives, incendiary devices, or weapons on or about the campus.
17. Interference with the proper operation of safety or security devices, including fire alarms, electronic doors or gates, fire extinguishers, and sprinkler systems.
18. Unlawful manufacture, possession, use, or distribution of drugs or alcohol, including serving underage minors, on university property or as part of any university activity. Yale is a drug-free campus.
19. Use of tobacco products on any location on campus, including outdoor spaces. Yale is a tobacco-free institution.
20. Violation of university policies for the safeguarding of children and youth on campus whereby minors are put at risk due to action or inaction.

Academic Integrity Standards

The graduate school prohibits academic dishonesty, a term that encompasses making any claim within or about your research or scholarship that is untrue. The following are some forms of academic dishonesty:

1. Plagiarism, that is, the failure to acknowledge ideas, research, or language taken from others, whether intentional or unintentional. The graduate school requires citations whenever students either directly quote or indirectly draw upon and benefit from the work or scholarship of others. This requirement applies equally to all academic work by students, including a paper or an examination for a course, a presentation in class or at a conference, a prospectus or dissertation, or a manuscript for publication. This requirement also applies to drafts of written work.
2. The unauthorized collaboration with others on graded course work (including problem sets, lab reports, take-home examination questions, and papers) without express permission from the instructor.
3. Cheating on examinations, problem sets, or any other form of assessment.
4. The falsification, fabrication, or misuse of data.
5. Submitting work or substantially the same work, from one course for a grade or credit in another, without first obtaining express written permission from both course instructors.

A note on artificial intelligence (AI) tools: Inserting AI-generated text into an assignment without proper attribution is a violation of academic integrity, and using AI tools in a manner that was not authorized by your instructor may also be considered a breach of academic integrity. How and whether instructors permit you to use AI writing tools at Yale will vary widely from course to course and is always subject to each instructor's authority and policy. Always check with your instructor before using these tools to produce your Yale coursework. Guidelines about these practices may change over time, so be sure to ask for the most up-to-date policy.

Procedures of the Graduate School Committee on Regulations and Discipline

All graduate students are governed by the graduate school's Personal Conduct and Academic Integrity Standards ("The Standards") described above. The procedures of the Graduate School Committee on Regulations and Discipline will be used when there appears to have been a breach of these regulations, except in cases of allegations that a graduate student has committed academic fraud (including falsification or fabrication of data and plagiarism) in the course of proposing, conducting, or reporting research supported by the U.S. federal government. In such cases, the allegation will instead be addressed under Dealing with Allegations of Academic Misconduct (https://provost.yale.edu/policies/academic-integrity/dealing-allegations-academic-misconduct)

A. Composition of the Committee on Regulations and Discipline

1. Members of the Committee on Regulations and Discipline are appointed by the dean of the graduate school. The voting members of the committee will have a minimum of four members of the graduate school faculty, four graduate students, and two deans of the graduate school. Should an occasion arise when, as a result of the conflict-of-interest provisions of these procedures or other unavailability of members, a quorum (see 2.c below) cannot be gathered from regular voting members, the dean of the graduate school will appoint a member or members

from the faculty, deans or senior staff, and the graduate student body ad hoc to participate in the business then before the committee.

2. In addition to the regular voting members, there will be three officers of the committee who are also members: chair, vice-chair, and secretary. They will be appointed annually by the dean of the graduate school and will be charged with particular responsibilities. The dean of the graduate school may also appoint co-chairs and co-vice chairs, as needed. Committee hearings will be conducted by a panel drawn from the membership of the Committee on Regulations and Discipline.
   a. The chair will be either a tenured member of the graduate school faculty or an associate dean of the graduate school. The chair, with the assistance of the secretary, will coordinate all activities of the committee, will preside at meetings or designate the vice chair to preside, and will organize the conduct of meetings or designate the vice chair to do so. In hearings, the chair or vice chair, whoever of the two is presiding, will vote as a regular voting member.
   b. The vice chair will be either a tenured member of the graduate school faculty or an associate dean of the graduate school. The vice chair will assist the chair in the coordination of committee activities and will preside at meetings when designated by the chair.
   c. A hearing panel will have a minimum of four members, including the secretary (or dean's designate) who does not typically vote. Voting members of the panel must include the chair or vice chair, one faculty member and/or dean of the graduate school, and one student member. The presence of three voting members will constitute a quorum, provided that at least one student member is present. A majority vote will decide questions before the hearing panel. In the event of a tie vote, the secretary will cast a deciding vote.
   d. The secretary will normally be an assistant or associate dean of the graduate school. This person will assist the chair in the committee business, keep committee records, handle official correspondence for the committee, and help ensure that all required procedural steps are taken. The secretary will attend all hearings and will vote only to break a tie.
   e. The chair, vice chair, and secretary will constitute the Coordinating Group of the committee. In the absence of one of the three officers, the remaining officers will constitute the Coordinating Group.
3. In evaluating allegations of misconduct, the committee may request the assistance of a faculty adviser who has knowledge of a particular subject matter or issue in question, and/or a fact finder, who is responsible for gathering relevant facts. The faculty adviser and/or fact finder will produce a written report for the committee, detailing the results of any investigation or analysis and any opinions reached. The report will be provided to the voting members and responding student(s) prior to any hearing. When practical, advisers and fact finders will attend the hearing and be available to answer questions regarding the report.
   a. (a) The faculty adviser is a member of the graduate school faculty who assists the work of the committee as an expert in a particular academic field. They are appointed ad hoc by the Coordinating Group.
   b. (b) In complex cases—usually involving multiple parties—the chair or secretary may appoint a fact finder to conduct an investigation of the incident(s). The

fact finder may be a graduate school faculty member, a staff member, or an investigator engaged by the graduate school to conduct the investigation

There will be a Graduate School Committee of Review which in circumstances described below (see C.10) may review decisions of the Committee on Regulations and Discipline.

B. Submission of Matters

Concerns regarding graduate student conduct that may violate the Standards, academic or nonacademic, will initially be referred to the secretary of the committee. A report should be made in writing and should detail the conduct in question and provide all available and relevant evidence.

1. Reports of possible academic violations.
   a. A member of the faculty finding evidence of academic misconduct will bring the matter to the secretary of the Committee on Regulations and Discipline. The faculty member must provide a written statement explaining the reason for concern about the integrity of the academic work. The faculty member should also provide copies of the student work that allegedly violates the regulations, along with any apparent source materials or other relevant evidence. The secretary will keep the faculty member apprised of major developments in the case and may ask the faculty member to respond to student statements or other issues that may arise.
   b. If a student or a member of the Yale community becomes aware of an instance of possible academic misconduct, they can report the matter to the secretary of the Committee on Regulations and Discipline. The complainant must provide a written statement explaining the reason for concern about the integrity of the academic work. The complainant should also provide copies of the work that allegedly violates the regulations, and any apparent source materials or other relevant evidence.
2. Reports of possible personal conduct violations.
   a. Any member of the Yale community may bring allegations of an infraction to the attention of the secretary of the committee.
   b. In addition, the Coordinating Group will review reports of student misconduct lodged by the Yale Police Department. The Coordinating Group will take note of conduct in the reports that may be in violation of the#Standards#and refer matters in accordance with these procedures.
3. Initial referral of reports. The Coordinating Group will review all reports received by the secretary and will make one of the following judgments regarding each report:
   a. Reports for which sufficient information is available and which, if substantiated, would constitute a violation of Standards will proceed to a formal charge.
   b. If there is a need to locate documents, inquire further into matters of fact, or pursue additional information before an informed decision can be made by the Coordinating Group, the secretary will make preliminary inquiries. When deemed necessary, the chair or secretary will request that a faculty adviser or fact finder be appointed to conduct an investigation.

c. If, after an investigation or at any time during the disciplinary process, the Coordinating Group determines that there is insufficient information to reach a conclusion or that the act does not amount to a violation of the Standards, the Coordinating Group will dismiss the matter.

d. Reports that appear to involve sexual misconduct will be referred to the secretary of the University-Wide Committee on Sexual Misconduct#(UWC). In complex cases that combine allegations of sexual misconduct and other offenses, the secretary will consult with the chair of the UWC pursuant to the procedures of the UWC.

C. Procedures for Consideration of a Matter by the Committee

1. *Notification of the student*. The secretary will notify a student or students in writing of charges of alleged infractions and specify the regulation that has been allegedly violated. The notification will typically include a copy of the report that provides the basis for the allegation of misconduct. The secretary will also provide to the student a copy of these procedures. The secretary will simultaneously inform the relevant director of graduate studies and the dean of the graduate school. The secretary will familiarize the student with practical as well as procedural aspects of the disciplinary process.
2. *Adviser.* The student may choose an adviser, if desired; advisers are not required. The adviser may be a member of the graduate school faculty or staff without legal training. The adviser may not be a family member or relative of the student. The adviser is not an advocate, but rather a source of personal and moral support to the student. The adviser should aid the student in preparing to appear before the committee. The adviser may also accompany the student to a committee hearing and provide advice to the student. During a hearing, the adviser may unobtrusively suggest questions or issues for the student to raise with the committee. The student's adviser may not participate directly in the proceedings.
   a. The student will notify the secretary of the committee as soon as they have chosen an adviser. The secretary will provide the adviser with the relevant case materials.
   b. In a case where a criminal charge is pending against the student for the alleged conduct that is the subject of the case, they may have a legal adviser present at the hearing. In such cases, the student must notify the secretary in advance so that a representative of the Office of the General Counsel may also be present. The legal adviser and the representative of the general counsel's office may under no circumstances address the committee. The role of the legal adviser may not extend beyond quietly advising the student about their legal situation.
3. *Student statement*. Students will be asked to respond in writing to the allegation. Providing a written statement allows the student to present their perspective on events and any broader context or other information that will help the Coordinating Group and committee to better understand the situation. Written statements will ordinarily be due to the secretary two weeks after the student receives notification of the charge. In their statement, students should admit or deny allegations against them. In some cases, the student may admit responsibility for some portion of the allegations and deny others.

   a. Upon receiving the student's response, the secretary may consult with the Coordinating Group to determine whether the case should proceed. Upon reviewing the evidence and the student's response, the Coordinating Group may decide to dismiss the charges outright.
   b. If the case proceeds, the secretary will refer it according to the student's response. If: (i) the student admits responsibility, the case will be referred to the dean of the graduate school for a disposition without hearing (see below); (ii) the student denies responsibility, the case will be referred to the committee for a full hearing; or (iii) the student admits some portion of the charge and denies others, the admitted portion of the case may proceed to the dean for a disposition and the committee may meet for a full hearing on the charges that the student has denied.
   c. In instances where there are no factual disputes, and in order to expedite and more efficiently manage the resolution of disciplinary cases, the Coordinating Group, at its discretion, may offer students the option of a resolution via an agreement of responsibility.

4. *Disposition without hearing*. When a student admits a violation and requests a disposition without hearing (as provided in 3.b above), the dean of the graduate school will decide on the appropriate penalty for the violation and notify the student in writing. The dean will normally talk with the student before rendering a decision. In any event, if the student desires, they will have an opportunity to talk with the dean before the dean makes a penalty decision.
5. *Hearing*.
   a. The secretary will provide the student with copies of any additional written materials, beyond the original notification, that will be considered by the committee. These materials should be made available to the student no less than three business days prior to the hearing, except when the student requests that less time be allowed to schedule an earlier hearing.
   b. The chair may arrange for the appearance of witnesses. If so, their names will be made available to the student no less than five business days before the meeting. The student may also request to invite up to three witnesses to the hearing. The student must provide the name and relevance of any proposed witness to the secretary no less than five business days before the meeting. The invitation of any witness will be made at the discretion of the Coordinating Group. General character witnesses and character witness statements are not accepted.
   c. Access to materials. The secretary will provide access to all documents relating to the case to the committee prior to the hearing. These documents are confidential and will be shared via a secure digital platform.
   d. Excuse for conflicts of interest. The chair or secretary will ascertain whether any members should be excused because of a conflict of interest (see below).
6. *Procedures during the hearing*.
   a. Disciplinary hearings in the graduate school may be conducted electronically or in person.
   b. Conduct of the hearing. All persons attending the hearing may address the group only after being recognized by the chair. Questions regarding points of order and procedure will be decided by the chair.

c. Students are expected to tell the truth in all of their dealings with the committee. Lying to a fact finder or to the committee will be taken into account in determining a recommended penalty and could serve as the basis for additional charges as provided in The#Standards.
d. The student may make a brief opening statement.
e. If a fact finder or faculty adviser has conducted a review, the student or members of the committee may request the fact finder or faculty adviser to explain their report.
f. When invited to a hearing, witnesses or the reporting person will address the hearing panel and answer questions.
g. Committee members will pose questions to the student regarding the allegations.
h. The student may make a brief closing statement.

7. *Timing of hearings*. Hearings will take place only during regular sessions of the university, not during intersessions, summers, and recesses and must take place no later than the end of the semester after the one in which the student is notified of the charge, unless the student is on a leave of absence.
8. *Determination*. At the conclusion of the hearing, the committee will meet in an executive session to decide whether the conduct reported in fact occurred and whether it contravened the standards cited in the charge. The committee's decision will be made by a simple majority of voting members present. The secretary will vote only in the event of a tie. This decision will be made by a preponderance of the evidence, voted on by secret ballot, and will be final. If the committee decides that the conduct reported occurred and that it contravened the standards cited in the charge, based on the seriousness of the contravention, the committee will also recommend a sanction, if any, to the dean. The dean may either impose the recommended sanction or a lesser or greater one at their discretion.
9. *Assignment of a penalty*. The secretary will inform the committee of any previous infractions on the part of the student and will provide any relevant charging and penalty letter to the committee.
    a. The committee will discuss what penalty it should impose. If they have found that the student purposely misled the committee during its deliberations, the panel may consider that factor as grounds for imposing a more severe penalty. The voting members will vote by secret ballot. The chair (or vice-chair) votes with the panel. If the vote is a tie, there shall be further discussion and a second vote. If a second consecutive vote results in a tie, the secretary shall vote to break the tie.
    b. The secretary will promptly inform the student and their DGS of the committee's decision and the penalty determined by the dean.
    c. In cases of academic integrity violations, the secretary will notify the reporting faculty member of the committee's decision. The secretary may also send written notice of the decisions of the committee to the reporting person and/or the person who is the alleged victim of any crime of violence.
    d. The secretary may disclose to other universities and schools information concerning disciplinary action taken against a student for conduct that posed a

significant risk to the safety or well-being of that student, other students, or the university community.

10. *Appeals to the Committee of Review*. Decisions of the committee are final and take immediate effect, notwithstanding whether the student is applying to the Committee of Review for reconsideration of a decision as provided herein. The committee may also be requested by the Committee of Review to reconsider a decision (see below).
    a. There will be a Committee of Review, which may review and, when appropriate, request reconsideration of the decisions of the Committee on Regulations and Discipline. The Committee of Review will be composed of three persons, two of them members of the Yale graduate school faculty, appointed by the university president for a term of five years, one of whom will be designated by the president as chair of the committee. The Graduate Student Assembly will nominate a student member to serve on the committee.
    b. The Committee of Review will receive written appeals from a student or students who have been assigned a penalty. An appeal must be received by the Committee of Review no later than five business days after the decision of the committee and may be sent to the secretary. To review such appeals, the Committee of Review will have access to all the written records of the committee.
    c. In response to an appeal, the Committee of Review will have the right (i) to decline to take action; (ii) to request in writing a reconsideration by the Committee on Regulations and Discipline; and (iii) to publish commentary on the case which, while maintaining the confidentiality of the Committee on Regulations and Discipline's hearings, seeks to clarify the principles involved in the case and to offer useful counsel for future decisions.
    d. It is anticipated that in the great majority of cases, the Committee of Review will decline to take action. It will request reconsideration by the Committee on Regulations and Discipline only in cases where it believes that (i) some pertinent evidence was not taken into account; (ii) long-standing precedents, in decisions of culpability and the assignment of penalties, were ignored; (iii) errors in procedure may have substantially affected the decision; and/or (iv) certain key principles of the university were not sufficiently considered in the original decision.
    e. The Coordinating Group will have the authority, on behalf of the full Committee on Regulations and Discipline, to grant or deny a request for reconsideration. In the case where the Coordinating Group has granted the request to reconsider, the chairs of the Committee on Regulations and Discipline and the Committee of Review will discuss appropriate procedures for the reconsideration. The committee or the Coordinating Group will be free either to alter or to confirm its original decision. It may not, however, make a finding of culpability where it had previously exonerated a student, or assign a penalty more serious than that originally assigned.
11. *Withdrawal*. A student who withdraws from the graduate school rather than face disciplinary charges that are pending will not be eligible for re-enrollment or a Yale graduate school degree, and a notation to this effect will be entered on the student's transcript. If a disciplinary case brought against a graduating student is pending

at the time of graduation, the student's degree will be withheld until the case is resolved.

D. Matters Before the Committee Respecting Cases Before the Courts

When a report alleging an infraction of the Standards relates to a case that either will be or is in process of adjudication by the courts, the committee may address the matter by one of the following procedures:

1. If in the judgment of the Coordinating Group sufficient information is available to consider the matter, the committee may consider it in the normal manner.
2. The Coordinating Group may decide to defer consideration of the matter until after the case has been adjudicated by the courts. When the Coordinating Group so defers consideration, it will decide whether to permit the student to continue in regular enrollment. A decision favorable to the student in the courts will not necessarily exonerate them from having committed the alleged infraction of The Standards of the graduate school.

E. Confidentiality in Committee Matters

The committee#and all members of the Yale community who are involved in a matter before the committee are expected to maintain the confidentiality of its proceedings and any information circulated in regard to those proceedings.

All documents and materials prepared by, prepared for, or received from the committee#in connection with a disciplinary proceeding must be held in strict confidence.#Students may not disclose committee materials to anyone other than their advisers in the#committee#proceeding, their directors of graduate studies and academic advisers, family members, and attorneys.#Students must inform these recipients that committee materials and documents are strictly confidential and may not be further disclosed.

Disciplinary action may be taken against a student who discloses any committee documents or materials in violation of these procedures or who is responsible for the improper disclosure of such documents or materials by others. In addition, whether or not a committee document has been disclosed, disciplinary action may be taken against a student who breaches confidentiality in order to retaliate against a person for their participation in a disciplinary proceeding.

F. Conflict of Interest

Members of the committee should be alert to potential conflicts of interest between themselves and the persons bringing matters to the committee or the student against whom a matter has been brought.

1. Committee members having past or present ties of kinship, marriage, or other very close personal relationships to any of the parties involved in the matter should notify the chair that a conflict of interest exists and should be automatically excused from participation. The nature of the relationship need not be disclosed to the chair.
2. Committee members having some form of close professional relationship to one or more of the parties involved in the matter (e.g., collaboration or cooperation in research, writing, or teaching with a colleague or service as an ongoing academic

adviser to the student) should notify the chair that a potential conflict of interest exists and may request to be excused from participation.

3. A committee member should inform the chair that they are in some manner involved in the specific details of the matter and may request to be excused from participation.
4. A member of the committee should inform the chair that the nature of the matter creates an occasion for a conflict of interest and may request to be excused from participation.
5. The student against whom a matter has been brought, or the reporting party, may request that a committee member be excused because of a proven conflict of interest as provided in the foregoing provisions.
6. Should one of the members of the Coordinating Group be excused for a conflict of interest, another member of the committee will carry out the responsibilities of that member of the Coordinating Group in regard to the matter under consideration.
7. All issues relating to conflict of interest should be raised and settled before the committee begins consideration of the matter. Questions relating to conflict of interest may not be raised after the committee has reached decisions, nor may they be grounds for reconsideration of committee decisions.
8. The foregoing provisions are intended not to be inclusive of all possible situations of conflict of interest, but rather to provide guidance. It is the intention of these provisions to enable the committee to avoid both the appearance and the reality of conflict of interest, so that the community will have confidence in the fairness of the proceedings. In case of doubt, the chair and committee members should assume that a potential conflict of interest exists.

G. Records of the Committee

The records of the Committee on Regulations and Discipline are of three types. The first two (described in#sections 1 and 2 below) are unavailable to the public unless subpoenaed by the court or other government agency and should be stored securely by the graduate school dean's office. The third type of record (described in section 3 below) will be made available to students and other members of the Yale community. The Committee of Review will have access to all records of the Committee on Regulations and Discipline. The committee may share records internally with other administrators in the graduate school.

1. The secretary will maintain a record of all matters acted on by the committee. This record will include the original written report, any forms or statements signed or submitted by the student and all materials submitted to the committee prior to the hearing, including the report of the fact finder, should there be one.
2. The secretary will keep a record of minutes from each hearing of the committee. These need not be a verbatim transcript, but they should reflect a record of the statements of witnesses and substance of the discussions and decisions of the committee. Minutes will not be kept of the private committee discussion prior to reaching a decision by vote on the substance of the allegation or the assessment of the penalty.
3. The secretary will prepare a brief narrative of each decision of the committee, describing the alleged act(s), the alleged violation, the committee's finding, and

the penalty, if any. The report should be written so as not to reveal, directly or indirectly, the identities of the individuals involved in the case. Because the reports are summaries, they do not contain all the relevant considerations in every case. For that reason, students should rely on them only for general guidance, not as binding precedent.

PENALTIES

The following penalties are among those which may be imposed by the Committee on Regulations and Discipline. The committee may also require students to participate in relevant education and training.

Reprimand A reprimand is a written warning and is a matter of internal record only. A reprimand is not noted on a student's academic transcript. If a student who has been reprimanded is later found responsible for another disciplinary violation, the reprimand will be taken into account in assigning a penalty in future cases.

Restriction Denial of the use of certain university facilities or of the right to participate in certain activities or to exercise certain privileges.

Probation A cautionary period during which the student's continued enrollment is conditional on adherence to university and graduate school regulations. The commission of a serious offense while on probation will normally result in suspension or dismissal. Probation may include a prohibition on participating in university activities, applying for university fellowships and grants, and holding leadership, officer, or fellow positions in any organization that receives university funds. Additional terms of probation may be enforced by the Committee in individual cases. The penalty of probation is recorded on a student's academic transcript.

Suspension A suspension is a separation from all programs and activities of the university for a stated period of time. A suspended student forfeits all privileges of enrollment, including on-campus residence, eligibility for health coverage and financial aid, attendance at classes, student visa sponsorship, participation in any Yale-sponsored activities or groups, access to Yale IT resources, and use of university libraries as well as of athletic and other facilities. A suspension is recorded on a student's academic transcript. A suspended student is specifically prohibited from:

1. making academic progress towards a Yale degree, including
   a. enrolling in any university courses or completing university coursework;
   b. using non-Yale course credits earned during the period of suspension towards a Yale degree;
   c. preparing for qualifying examinations;
   d. researching or writing a prospectus;
   e. conducting dissertation or thesis research; and
   f. writing a dissertation or thesis;
2. returning to Yale's campus during the period of suspension for any reason;
3. accessing all Yale IT systems (intranet, shared drives, Yale-hosted databases, etc.) except for a yale.edu email account; and
4. representing themself as a Yale graduate student.

Emergency Suspension The dean of the graduate school, or a delegate of the dean, may place a student on an emergency suspension from residence or academic status when (1) the student has been arrested for or charged with serious criminal behavior by law enforcement authorities; or (2) the student allegedly violated a disciplinary rule of the graduate school and the student's presence on campus poses a significant risk to the safety or security of members of the community. Following an individualized risk and safety analysis, the student will be notified in writing of the emergency suspension. A student who is notified of an emergency suspension will have twenty-four hours to respond to the notice. The emergency suspension will not be imposed prior to an opportunity for the student to respond unless circumstances warrant immediate action for the safety and security of members of the community. In such cases, the student will have an opportunity to respond after the emergency suspension has been imposed. When a student in the graduate school is placed on an emergency suspension, the matter will be referred for disciplinary action in accordance with school policy. Such a suspension may remain in effect until disciplinary action has been taken with regard to the student; however, it may be lifted earlier by action of the dean or dean's delegate, or by the disciplinary committee after a preliminary review.

Dismissal Dismissal is a permanent separation from the university and is recorded on a student's academic transcript. A student dismissed for academic misconduct will not receive a degree from the graduate school regardless of requirements fulfilled before the infraction occurred.

Fines Yale reserves the right to impose fines as appropriate, in addition to requiring payment for costs resulting from or associated with the offenses.

Rustication In certain cases, the committee may decide to require the student in question to live off campus, either for a specified period or permanently. This penalty is called "rustication." Rusticated students may be denied access to university facilities. When a student is rusticated, no rebate of on-campus housing charges will be granted for the period of rustication. Violations of the penalty of rustication may also be referred to the Committee on Regulations and Discipline.

A separate process and procedures apply to reports pertaining to sexual misconduct and violations of the Teacher-Student Consensual Relations Policy—the University-Wide Committee on Sexual Misconduct Policies and Procedures. Another policy also applies to reports pertaining to discrimination and/or harassment, as defined on the Yale University website (https://student-dhr.yale.edu/policies-definitions). Incidents of discrimination and harassment should be reported to either a graduate school discrimination and harassment resource coordinator (https://dhr.yale.edu/discrimination-and-harassment-resource-coordinators) or the Office of Institutional Equity and Access (https://oiea.yale.edu) for support, investigation, and resolution (https://student-dhr.yale.edu/complaint-resolution). In some cases, conduct reported as discrimination and harassment may violate the Personal Conduct Standards, and students will be referred to the Committee on Regulations and Discipline. Students found responsible for violating the Personal Conduct and Academic Integrity Standards may be subject to penalties, including, but not limited to, one or more of the following: reprimand, probation, suspension, dismissal, fines, restitution, and restriction.

Penalties of suspension or dismissal will be noted on the student's transcript. Pending disciplinary charges will be noted on a student's transcript if the student withdraws

from the graduate school after being formally charged but before such charges have been resolved. A student who has petitioned for a degree will not receive the degree while charges are pending or while serving a suspension. A student who has been dismissed for a disciplinary violation may petition for a degree, to be awarded at the discretion of the Degree Committee, based on work completed before the infraction occurred.

A student dismissed for academic misconduct will not receive a degree from the graduate school regardless of requirements fulfilled before the infraction occurred. The graduate school reserves the right to impose fines as appropriate, in addition to requiring payment for costs resulting from or associated with the offenses. In addition to imposing these penalties for offenses subject to disciplinary action, the university may refer students for prosecution, and students found guilty of unlawful possession, use, or distribution of illicit drugs or alcohol on university property or as part of any university activity may be required to complete an appropriate rehabilitation program.

Office of Institutional Equity and Accessibility

Students who believe that a student, faculty member, or staff member has engaged in discrimination or harassment other than gender discrimination or sexual misconduct may report their concerns to the Office of Institutional Equity and Accessibility, a university-wide office that assists with dispute resolution and investigates reports of discrimination and harassment. For additional information, see https://student-dhr.yale.edu/complaint-resolution. Complaints of sexual misconduct, which includes sexual harassment and sexual assault, may be brought to a Title IX coordinator or to the University-Wide Committee on Sexual Misconduct (UWC). For more information on the university's Title IX coordinators or the UWC, please see Resources to Address Discrimination and Harassment Concerns, Including Sexual Misconduct under Yale University Resources and Services.

FREEDOM OF EXPRESSION

The Yale graduate school is committed to the protection of free inquiry and expression in the classroom and throughout the school community. In this, the School reflects the university's commitment to and policy on freedom of expression as eloquently stated in the Woodward Report (Report of the Committee on Freedom of Expression at Yale, 1974), which states, in part:

> The primary function of a university is to discover and disseminate knowledge by means of research and teaching. To fulfill this function a free interchange of ideas is necessary not only within its walls but with the world beyond as well. It follows that the university must do everything possible to ensure within it the fullest degree of intellectual freedom. The history of intellectual growth and discovery clearly demonstrates the need for unfettered freedom, the right to think the unthinkable, discuss the unmentionable, and challenge the unchallengeable. To curtail free expression strikes twice at intellectual freedom, for whoever deprives another of the right to state unpopular views necessarily also deprives others of the right to listen to those views.
>
> We take a chance, as the First Amendment takes a chance, when we commit ourselves to the idea that the results of free expression are to the general benefit

in the long run, however unpleasant they may appear at the time. The validity of such a belief cannot be demonstrated conclusively. It is a belief of recent historical development, even within universities, one embodied in American constitutional doctrine but not widely shared outside the academic world, and denied in theory and in practice by much of the world most of the time.

Because few other institutions in our society have the same central function, few assign such high priority to freedom of expression. Few are expected to. Because no other kind of institution combines the discovery and dissemination of basic knowledge with teaching, none confronts quite the same problems as a university.

For if a university is a place for knowledge, it is also a special kind of small society. Yet it is not primarily a fellowship, a club, a circle of friends, a replica of the civil society outside it. Without sacrificing its central purpose, it cannot make its primary and dominant value the fostering of friendship, solidarity, harmony, civility, or mutual respect. To be sure, these are important values; other institutions may properly assign them the highest, and not merely a subordinate, priority; and a good university will seek and may in some significant measure attain these ends. But it will never let these values, important as they are, override its central purpose. We value freedom of expression precisely because it provides a forum for the new, the provocative, the disturbing, and the unorthodox. Free speech is a barrier to the tyranny of authoritarian or even majority opinion as to the rightness or wrongness of particular doctrines or thoughts.

If the priority assigned to free expression by the nature of a university is to be maintained in practice, clearly the responsibility for maintaining that priority rests with its members. By voluntarily taking up membership in a university and thereby asserting a claim to its rights and privileges, members also acknowledge the existence of certain obligations upon themselves and their fellows. Above all, every member of the university has an obligation to permit free expression in the university. No member has a right to prevent such expression. Every official of the university, moreover, has a special obligation to foster free expression and to ensure that it is not obstructed.

The strength of these obligations, and the willingness to respect and comply with them, probably depend less on the expectation of punishment for violation than they do on the presence of a widely shared belief in the primacy of free expression. Nonetheless, we believe that the positive obligation to protect and respect free expression shared by all members of the university should be enforced by appropriate formal sanctions, because obstruction of such expression threatens the central function of the university. We further believe that such sanctions should be made explicit, so that potential violators will be aware of the consequences of their intended acts.

In addition to the university's primary obligation to protect free expression there are also ethical responsibilities assumed by each member of the university community, along with the right to enjoy free expression. Though these are much more difficult to state clearly, they are of great importance. If freedom of expression is to serve its purpose and thus the purpose of the university, it should seek to enhance understanding. Shock, hurt, and anger are not consequences to be weighed lightly. No member of the community with a decent respect for others

> should use, or encourage others to use, slurs and epithets intended to discredit another's race, ethnic group, religion, or sex. It may sometimes be necessary in a university for civility and mutual respect to be superseded by the need to guarantee free expression. The values superseded are nevertheless important, and every member of the university community should consider them in exercising the fundamental right to free expression.
>
> We have considered the opposing argument that behavior which violates these social and ethical considerations should be made subject to formal sanctions, and the argument that such behavior entitles others to prevent speech they might regard as offensive. Our conviction that the central purpose of the university is to foster the free access of knowledge compels us to reject both of these arguments. They assert a right to prevent free expression. They rest upon the assumption that speech can be suppressed by anyone who deems it false or offensive. They deny what Justice Holmes termed "freedom for the thought that we hate." They make the majority, or any willful minority, the arbiters of truth for all. If expression may be prevented, censored, or punished, because of its content or because of the motives attributed to those who promote it, then it is no longer free. It will be subordinated to other values that we believe to be of lower priority in a university.
>
> The conclusions we draw, then, are these: even when some members of the university community fail to meet their social and ethical responsibilities, the paramount obligation of the university is to protect their right to free expression. This obligation can and should be enforced by appropriate formal sanctions. If the university's overriding commitment to free expression is to be sustained, secondary social and ethical responsibilities must be left to the informal processes of suasion, example, and argument.

See also https://studentlife.yale.edu/guidance-regarding-free-expression-and-peaceable-assembly-students-yale.

RECORDINGS BY FACULTY, STAFF, STUDENTS, AND INVITED GUESTS

The purpose of this policy is to foster a spirit of trust, to promote the open exchange of viewpoints and ideas within the graduate school, and to protect the privacy of community members.

Prohibition on Surreptitious Recordings

It is expected that faculty, staff, students, and invited guests of the graduate school will engage openly and forthrightly with others in educational settings and in the workplace. To that end, this policy prohibits all forms of recording that are illegal under Connecticut law. In addition, this policy prohibits the surreptitious recording of meetings and activities within the graduate school and its programs and departments, whether by telephone, audio, video, Zoom, or another virtual platform technology or other recording device. Recording devices may only be used in an overt and conspicuous manner so that it readily is apparent to all parties that a recording or record of an event is being made. Recording for research purposes is subject to requirements, approval, and consent in accordance with university research policies.

Recording of Classes

Students may not record Yale University course content, such as lectures, discussions, presentations, critiques, or performances, unless they obtain the instructor's written permission before recording. In the event a faculty member gives permission, recordings must not be transmitted or distributed without the written consent of all participants who are recorded. Recordings of a class made by Yale University and provided to a student by the university are for private study use only and are not to be shared, altered, or posted.

POSTERING, CHALKING, AND PUBLICITY POLICY

Posters must be confined to bulletin boards, kiosks, display cases, and other spaces that the graduate school has specifically designated for postering. Chalking must be confined to walkways directly open to the weather. Other forms of non-electronic publicity on campus grounds or buildings at the graduate school is prohibited. The following regulations apply to postering and chalking on campus:

1. Posters may not exceed 11x14 inches. Only one copy of each poster may be placed on the same bulletin board.
2. Posters for an event must provide the name of the event, its date, time, and location, the name of its sponsoring organization, and the email address or phone number of its organizers.
3. The dean of the graduate school may impose additional requirements or exceptions. Before posting in a particular Yale building, the applicable poster policy should be reviewed.
4. Authorized staff members typically remove all posters from bulletin boards and other designated spaces once a week. Posters improperly placed in other locations (interior or exterior walls, doors, signs, trees, utility poles, etc.) or that otherwise do not comply with this policy will be subject to immediate removal.
5. Unless by authorized staff members in the course of their duties, the removal, defacing, destroying, or postering over of existing posters is prohibited.
6. Students may use chalk on walkways to advertise events, but such markings are permitted only to the extent that they are temporary. Chalking must be on areas that are directly open to the sky and the weather. Walkways cannot be marked under overhangs, archways, or other covered areas. Chalk may not be applied to walls or other vertical surfaces. Chalk notices must be limited in size to 4x4 feet, and not more than one chalk announcement for a single event may be visible from any single point. Only water-soluble chalk may be used. Spray chalk is strictly prohibited.
7. Glue, staples, and tape of any variety (e.g., Scotch tape, masking tape, duct tape) are damaging and may not be used on any Yale property. Thumbtacks or pushpins should be used on bulletin boards but may not be used on any interior or exterior woodwork or interior wall covering.

Violation of these regulations may result in an organization's loss of official recognition and consequent loss of funding opportunities. Violations may also subject individuals to discipline under other university or school regulations. Students or organizations

may be charged for the costs of removing improperly posted materials and repairing any damaged property.

FINANCING GRADUATE SCHOOL

Tuition and Fees

TUITION, 2025–2026*

Full-time study, per term: $25,450

Full-time study in IDE, per term: $25,950

Half-time study, per term: $12,725

Master's programs, less than half-time per term

One-quarter time study, per term: $6,362.50

Division of Special Registration (DSR, nondegree study)

Coursework, per course, per term (including audited courses): $6,362.50

Visiting Students, per term: $25,450

Visiting Assistants in Research, per month: $425

FEES, 2025–2026†

Continuous Registration Fee (CRF), per term‡: $850

Yale Health Hospitalization & Specialty Care Coverage, twelve months§: $3,422

* It is anticipated that tuition will be increased in subsequent years.

† It is anticipated that the Continuous Registration Fee will be increased in subsequent years.

Other fees are subject to change without notice. For fees relating to registration and course enrollment, see Course Enrollment, under Academic Regulations.

‡ See Registration Status and Leaves of Absence, under Academic Regulations.

§ Hospitalization fees are for single students. Rates are higher for students needing dependent coverage. Hospitalization/Specialty Coverage includes prescription coverage.

Appointment to a university post does not exempt a student from registration and payment of other fees. Full-time (and certain part-time) Yale managerial and professional employees and their spouses, postdoctoral appointees and their spouses, as well as the spouses of Yale faculty, are eligible for a tuition reduction in the DSR and master's programs. They should consult Human Resources for details. Postdoctoral appointees (whose appointments are at least half-time) may only receive tuition benefits if the classes taken are consistent with their educational training. With the permission of the instructor, full-time faculty members and their spouses, emeritus faculty and their spouses, postdoctoral appointees and their spouses, and university employees may audit courses without charge. Audited courses are not recorded on graduate school transcripts. Classes audited by postdoctoral appointees should be consistent with the appointees' training objectives, and appointees should discuss their

plans with their mentors to ensure that the course work does not interfere with their research activities.

Candidates for degrees in the graduate school, nondegree students paying full tuition, and spouses of full-time candidates for degrees in the graduate school may audit courses without charge provided that they have received the approval of the course instructor.

Student Accounts and Billing

Student accounts, billing, and related services are administered through the Office of Student Accounts, located at 246 Church Street. The office's website is http://student-accounts.yale.edu.

The Student Account is a record of all the direct charges for a student's Yale education such as tuition, housing, meals, fees, and other academically related items assessed by offices throughout the university. It is also a record of all payments, financial aid, and other credits applied toward these charges.

Students and student-designated proxies can view all activity posted to their Student Account in real time through the university's online billing and payment system, YalePay (https://student-accounts.yale.edu/yalepay). At the beginning of each month, email reminders to log in to YalePay to review the Student Account activity are sent to all students at their official Yale email address and to all student-designated YalePay proxies. Payment is due by 4 p.m. Eastern Time on the first of the following month.

Yale does not mail paper bills or generate monthly statements. Students and their authorized proxies can generate their own account statements in YalePay in pdf form to print or save. The statements can be generated by term or for a date range and can be submitted to employers, 401K plans, 529/College Savings Plans, scholarship agencies, or other organizations for documentation of the charges.

Students can grant others proxy access to YalePay to view student account activity, set up payment plans, and make online payments. For more information, see Proxy Access and Authorization (http://student-accounts.yale.edu/understanding-your-bill/your-student-account).

The Office of Student Accounts will impose late fees of $125 per month (up to a total of $375 per term) if any part of the term bill, less Yale-administered loans and scholarships that have been applied for on a timely basis, is not paid when due. Students who have not paid their student account term charges by the due date will also be placed on Financial Hold. The hold will remain until the term charges have been paid in full. While on Financial Hold, the university will not provide diplomas and reserves the right to withhold registration or withdraw the student for financial reasons.

PAYMENT OPTIONS

There are a variety of options offered for making payments toward a student's Student Account. Please note:

- Check, money order, or online eCheck payments must be in U.S. currency. International payment options via Flywire are available in YalePay.
- Yale does *not* accept credit or debit cards for Student Account payments.

- Payments made to a Student Account in excess of the balance due (net of pending financial aid credits) are not allowed on the Student Account. Yale reserves the right to return any overpayments.

Online Payments through YalePay

Yale's recommended method of payment is online through YalePay (https://student-accounts.yale.edu/yalepay). Online payments are easy and convenient and can be made by anyone with a U.S. checking or savings account. There is no charge to use this service. Bank information is password-protected and secure, and there is a printable confirmation receipt. Payments are immediately posted to the Student Account, which allows students to make payments at any time up to 4 p.m. Eastern Time on the due date of the bill, from any location, and avoid late fees.

For those who choose to pay by check, a remittance advice and mailing instructions are available on YalePay. Checks should be made payable to Yale University, in U.S. dollars, and drawn on a U.S. bank. To avoid late fees, please allow for adequate mailing time to ensure that payment is received by 4 p.m. Eastern Time on the due date.

Cash and check payments are also accepted at the Office of Student Accounts, located at 246 Church Street and open Monday through Friday from 8:30 a.m. to 4:30 p.m.

Yale University partners with Flywire, a leading provider of international payment solutions, to provide a fast and secure way to make international payments to a Student Account within YalePay. Students and authorized proxies can initiate international payments from the Make Payment tab in YalePay by selecting "International Payment via Flywire" as the payment method, and then selecting the country from which payment will be made to see available payment methods. International payment via Flywire allows students and authorized proxies to save on bank fees and exchange rates, track the payment online from start to finish, and have access to 24/7 multilingual customer support. For more information on making international payments via Flywire, see International Payments Made Easy at https://student-accounts.yale.edu/paying-your-bill/payment-options.

A processing charge of $25 will be assessed for payments rejected for any reason by the bank on which they were drawn. In addition, for every returned ACH payment due to insufficient funds made through YalePay, Flywire will charge a penalty fee of $30 per occurrence. Furthermore, the following penalties may apply if a payment is rejected:

1. If the payment was for a term bill, late fees of $125 per month will be charged for the period the bill was unpaid, as noted above.
2. If the payment was for a term bill to permit registration, the student's registration may be revoked.
3. If the payment was given to settle an unpaid balance for purposes of receiving a diploma, the university may refer the account to an attorney for collection.

YALE PAYMENT PLAN

A Yale Payment Plan provides parents and students with the option to pay education expenses monthly. It is designed to relieve the pressure of lump-sum payments by allowing families to spread payments over a period of months without incurring any

interest charges. Participation is optional and elected on a term basis. The cost to sign up is $50 per term.

Depending on the date of enrollment, students may be eligible for up to five installments for the fall and spring terms. Payment Plan installments will be automatically deducted on the 5th of each month from the bank account specified when enrolling in the plan. For enrollment deadlines and additional details concerning the Yale Payment Plan, see https://student-accounts.yale.edu/paying-your-bill/yale-payment-plan.

BILL PAYMENT AND PENDING MILITARY BENEFITS

Yale will not impose any penalty, including the assessment of late fees, the denial of access to classes, libraries, or other facilities, or the requirement that a student borrow additional funds, on any student because of the student's inability to meet their financial obligations to the institution, when the delay is due to the delayed disbursement of funding from VA under chapter 31 or 33.

Yale will permit a student to attend or participate in their course of education during the period beginning on the date on which the student provides to Yale a certificate of eligibility for entitlement to educational assistance under chapter 31 or 33 and ending on the earlier of the following dates: (1) the date on which payment from VA is made to Yale; (2) ninety days after the date Yale certifies tuition and fees following the receipt of the certificate of eligibility.

Interruption or Temporary Suspension of University Services or Programs

Certain events that are beyond the university's control may cause or require the interruption or temporary suspension of some or all services and programs customarily furnished by the university. These events include, but are not limited to, epidemics or other public health emergencies; storms, floods, earthquakes, or other natural disasters; war, terrorism, rioting, or other acts of violence; loss of power, water, or other utility services; and protest disruptions, strikes, work stoppages, or job actions. In the face of such events, the university may provide substitute services and programs, suspend services and programs, or issue appropriate refunds. Such decisions shall be made at the sole discretion of the university.

Financial Aid

Financial assistance is provided in the form of Yale University Fellowships, tuition fellowships, teaching fellowships, traineeships, and research assistantships. The nature of the assistance varies among the divisions and departments. In most departments and programs, doctoral students are guaranteed five years of twelve-month stipend and tuition support. Applicants for admission to Ph.D. programs will automatically be considered for all Yale fellowships, traineeships, research assistantships, and teaching fellowships for which they are eligible. These awards of financial aid are announced in letters of admission, which are usually sent during the month of February. Students are strongly encouraged to seek financial support from external sources (see External Fellowships and Combined Award Policy).

In addition to grants and fellowships for tuition and living costs, Yale Health Basic Coverage is provided at no cost to students enrolled at least half-time in degree-granting programs.

Eligible Ph.D. students also receive a Health Award, which covers the full cost of student's elected health coverage, including Student + Spouse, Student + Child(ren), and the Family Plan. Eligible Ph.D. students with a child will also receive an annual Student Family Support subsidy in the amount of $7,500, issued in installments of $3,750 per term. The annual subsidy will increase by $2,500 ($1,250 per term) for each additional child under the age of six.

Students who do not participate in Yale Health Hospitalization/Specialty Coverage will not be provided with Health Awards. The graduate dental and vision plans are options that eligible students may choose to purchase for themselves and their dependents and are not covered by the Health Award. (For further information regarding health care options through Yale Health, see Health Services under Yale University Resources and Services.)

UNIVERSITY AND TEACHING FELLOWSHIPS

The graduate school provides all Ph.D. students with a minimum level of support as outlined in the letter of admission. Fellowships are awarded at admission to entering students on the basis of merit and recommendations made by individual departments. In most departments, the source of stipend support will change after the first or second year of study to a teaching fellowship or research assistantship. Students who teach outside of the standard departmental pattern defer their University Fellowships to a later year and do not receive more than the standard departmental stipend while teaching. University and Teaching Fellowships may not be deferred beyond the sixth year of registration.

Students awarded a University and Teaching Fellowship may not accept any other award without the permission of the appropriate associate dean. The graduate school is the final authority on University Fellowships and any combination of university funding with other sources of financial aid. (See External Fellowships and Combined Award Policy.)

Because the graduate school considers teaching experience to be an integral part of graduate education, doctoral students receive financial aid packages that include teaching fellowships. In many programs, there are specific years when students are expected to teach. For example, most humanities and social science students will teach in their third, fourth, and sixth years. In the natural sciences, the timing of teaching may be earlier or flexible over several years. When requested by the student for compelling academic reasons, these patterns may be adjusted with the permission of the director of graduate studies contingent on the student's satisfactory academic progress and sufficient course enrollment.

If the associate dean and director of graduate studies determine that no suitable teaching is available in a term in which a student is expected to teach, the student will continue to receive the standard departmental stipend that term. Stipend support will be withheld if a student elects not to teach in a term in which the student is expected to teach as part of the student's funding package.

The financial aid packages of many students, particularly in the science departments, may include non-university funds. Should these non-university funds become unavailable, additional university support may be provided. Doctoral students who receive additional university support during their first six years of registration will be required to do additional terms of teaching, if necessary. This additional teaching will typically be at the TF20 level and will be required in each term that the student receives university support. Students will not be required to teach more than the equivalent of six terms at the TF20 level during their first six years of registration. Students in good standing who require additional university support but who have already completed six terms of teaching at the TF20 level will receive university funds with no teaching obligation. Students receiving university funds are ineligible to seek additional teaching assignments that would be paid beyond the standard stipend.

Late-stage students in the sciences should confer with their adviser(s) and DGS to create a mutually agreed-upon schedule to complete their academic requirements, including the dissertation. They should also discuss whether and for how long in the semester the student might remain in the lab after dissertation completion to finish a project. Students who are still registered full time in years four through six, and making satisfactory academic progress, should be funded through the date on which they submit the dissertation to the graduate school.

Access to Teaching Fellowships

When departments are considering applications for teaching fellowships, priority is given to qualified graduate students who are expected to teach as part of their funding package. Students in years two through six who have completed their required teaching may teach if enrollments permit. In the humanities and social sciences, students who are on funding extensions are expected to teach at the TF20 level. In cases where an appointing department must choose between two or more graduate students who are each well qualified to teach a particular course, the student or students who have not yet had a chance to teach or who have taught the least will be given preference.

Limits on Teaching

Except when specified in their letters of admission, first-year doctoral students may be appointed as teaching fellows only in exceptional cases, and only after prior approval by their director of graduate studies and the associate dean. Students in the humanities and social sciences may teach during their second year only when such teaching is permitted by their department. Students in years one through six may teach no more than one TF20 assignment (up to twenty hours per week) per term. Students teaching above the requirement in the biological, physical, and engineering and applied sciences are limited to one TF10 assignment per term. Seventh-year students may teach up to three TF20 assignments per year.

Students who have met their program's teaching expectation and who are supported by non-university funds may seek additional teaching assignments at the TF10 level. Students who are teaching to fulfill a funding or academic requirement will have priority for available teaching assignments over those who are seeking additional teaching assignments. Students may not be appointed as lecturers while registered in the graduate school.

Students seeking TF appointments outside of their departments should discuss their plans with their director of graduate studies well in advance of the start of a term.

Students with outside fellowships may be eligible to serve as TFs according to the policies of the graduate school and the conditions of their outside awards.

Assignment Letters

Letters of assignment are sent to graduate students via the online Teaching Fellow System (TFS) indicating the course in which a graduate student is expected to teach and the level of the assignment. An assignment is not official until the electronic assignment letter has been transmitted via the online TFS.

Teaching Fellow Levels

All teaching fellows teach at one of two effort levels. TF levels represent the average workload over the course of the term, with the understanding that some weeks may require fewer hours due to minimal duties, while others may demand additional hours to complete assignments. Students assigned at the TF10 level are expected to teach an average of six to ten hours per week. Students assigned at the TF20 level are expected to teach an average of fifteen to twenty hours per week. Science students engaged in required teaching and doctoral students in the humanities and social sciences who teach in years one through six receive the standard departmental stipend irrespective of the assignment level. Doctoral students in the humanities and social sciences are typically expected to perform required teaching at the TF20 level. All students, including master's and professional school students, who are teaching outside of a doctoral financial aid package receive $5,673 for a TF10 assignment and $11,347 for a TF20 assignment.

TRAINEESHIPS AND ASSISTANTSHIPS IN RESEARCH

Traineeships (National Research Service Awards) from the National Institutes of Health are available in most of the biological sciences and in some other departments. These awards support full-time Ph.D. study by U.S. citizens, noncitizen nationals of the United States, and permanent residents. In combination with university and departmental supplements, they provide payment of tuition, a monthly stipend, and the hospitalization premium. Federal rules require that trainees pursue their research training on a full-time basis. In some instances, there is a federal payback provision, which is ordinarily satisfied by serving in health-related research or teaching at the conclusion of training. Information about this obligation and other matters relating to traineeships is available from the director of graduate studies or the principal investigator of the specific training grant in question.

RESEARCH APPOINTMENTS

Doctoral students in departments where the faculty receive research grants or contracts may be eligible for appointments as assistants in research (AR). In most of the science departments, advanced Ph.D. students are normally supported as ARs by individual faculty research grants. An assistantship in research provides a monthly salary at a rate agreed upon by the department and the graduate school. It is understood that the work performed not only is part of the faculty principal investigator's research project but also is the student's dissertation research and therefore in satisfaction of a

degree requirement. For a standard AR appointment, in addition to the salary, the grant pays half of the tuition or the full CRF. When the appointee is eligible for a University Fellowship, the other half of tuition is covered by a fellowship.

An appointment as a project assistant (PA) is intended for a student who performs services for projects that are not a part of the student's degree program. A project assistant may normally work no more than ten hours per week. With the permission of the director of graduate studies and the appropriate associate dean, a student may receive a combination of project assistant and assistant in research appointments.

Questions about AR or PA appointments should be directed to the director of graduate studies or the appropriate associate dean in the graduate school.

External Fellowships and Combined Award Policy

To benefit both their current work and their future career prospects, students are strongly encouraged to seek funding from external agencies through grants and fellowships. These awards, sponsored by both public and private agencies, confer distinction on a student who wins an award in a national competition. Students must report to the Office of Financial Aid any scholarship or fellowship received from an outside agency or organization.

Stipends provided to Ph.D. students by the graduate school are intended to be a form of financial aid. As such, external fellowships which support student stipends will replace the Yale stipend. As an incentive to pursue external funding, students will be permitted to combine their external fellowships with a portion of Yale's financial support as described below. Alternatively, students in a teaching year may replace the Yale stipend and accompanying teaching commitment with an external fellowship, subject to the conditions described below.

Grants, awards, prizes, or fellowships which support non-stipend expenses (research, equipment, travel) are not subject to the Combined Award Policy and may be held concurrently with a Yale stipend. If external support includes both a stipend and a non-stipend component, only the stipend component is used for the purpose of calculating the combined award.

COMBINING EXTERNAL SUPPORT WITH THE YALE STIPEND

Students receiving external awards may combine the outside award with a university stipend. These combined awards are capped at a level equal to the department or program stipend plus $4,000. Students will first receive the full value of the external fellowship, and the university will then provide supplemental support, up to a cap of $4,000 above the department or program stipend. The university supplement will come from either a research assistantship, university fellowship, or teaching fellowship, depending on the financial support remaining from the student's financial package awarded at the time of admission. The total value of the combined award will be pro-rated for fellowships awarded for less than one year. If the external fellowship stipend exceeds the department or program stipend, but is less than the combined award cap (stipend plus $4,000), the graduate school will provide the difference, up to the combined award cap. In this case, the top-up will not count against the financial aid

package offered at admission. If the external fellowship stipend exceeds the value of the combined award cap, the recipient will retain the full external fellowship funding and will receive no university supplement.

No university support may be deferred beyond the end of the sixth year.

EXTERNAL FELLOWSHIP COMBINED WITH TEACHING FELLOWSHIPS

Students who wish to combine their external fellowship with a year of university teaching support awarded at the time of admission may do so, with the following provisions:

1. If the annual value of the external fellowship, plus the value of the teaching at current teaching rates, exceeds the standard stipend, students may convert one term of teaching fellowship into a university fellowship and still receive the full value of the combined award (e.g., if the stipend is $50,000, and a student with an external award equaling $30,000 is expected to teach two TF-20s at $11,000 per course, the total value of the award and the teaching equals $52,000). Since this exceeds the stipend, the student may waive one term of financial teaching and still receive the full value of the combined award ($54,000). However, teaching that is part of an academic requirement may not be converted to a university fellowship. The teaching to be waived may be concurrent with the fellowship or a future term of teaching. One term of teaching fellowship may be converted to a university fellowship for each year of fellowship support.
2. If a student has only teaching fellowships remaining in their financial aid package, and they win an external fellowship that requires them to be in residence at a site away from Yale such that it is not possible to teach, the university will provide a supplement to the fellowship up to the standard stipend. This benefit will apply only to fellowships that support at least 50 percent of the standard stipend. Please note that this benefit applies only to residential fellowships that require a student's presence at a particular institution, not to standard research or travel grants that may allow a student to travel abroad for field work.

REPLACING THE YALE STIPEND WITH EXTERNAL SUPPORT

Students who wish to reduce their financial teaching obligation may accept an external award in lieu of university support. Students who choose this option will not receive any stipend from Yale for the term or year in which they are not teaching. However, students may not reduce teaching that is an academic requirement unless the Ph.D. program guidelines specifically allow this.

If a fellowship provides stipend support for the summer, and the student has a guarantee of only five summers of support from Yale, the student may choose to forfeit the combined award over the summer and instead defer the university support to their sixth summer. No university support may be deferred beyond the end of the sixth year.

FELLOWSHIP BUDGETS

In rare cases, students may win a fellowship whose terms state that the university may not reduce its financial aid package to the student, in contradiction of this Combined Award Policy. If such an award allows students to designate some portion of the award for travel, supplies, or research expenses that would not be considered stipend, students

are required to submit a fellowship budget that, to the degree possible, complies with the Combined Award Policy. In order to maximize the amount of stipend that a fellow receives, no more than $4,000 per year should be designated for stipend support (unless they are designating additional stipend support for an unfunded summer, as described in the previous paragraph), and the remaining fellowship award should be budgeted for non-stipend purposes. This will allow a fellow to receive the maximum stipend allowed under the Combined Award Policy, and to use the rest of the fellowship for travel and research. Such budgets, if not already required and approved by the funding agency, will require approval of the dean. This budget should be submitted to the Financial Aid Office along with the notice of award. In these cases, if the fellowship funds are awarded to the university, they will be paid out to the student based on the approved budget. If the funds are awarded directly to the student, the student is expected to use the funds as designated in the budget.

Eligibility for Fellowships

Students who hold Yale-administered fellowships are required to be engaged in full-time study. No fellowships will be paid for any period when a student is not registered.

Students are not eligible for stipend support from the graduate school after six years of study but may apply for student loans as long as they are enrolled at least half-time.

A fellowship will be withdrawn and a stipend withheld if the recipient's activities become detrimental to the purpose for which the fellowship was granted or if a student becomes ineligible to register for any reason.

Other Means of Financing Graduate Education

PART-TIME EMPLOYMENT

Unless otherwise noted in the letter of admission, students are expected to register on a full-time basis. Part-time employment at the university or elsewhere may not conflict with the obligations of the degree program or interfere with academic progress. International students must consult the Office of International Students and Scholars (OISS) regarding their eligibility for employment while in the United States.

Part-time employment beyond an average of ten hours per week requires permission of the director of graduate studies in consultation with the appropriate associate dean.

International students on U.S. student visas are limited by U.S. immigration regulations to twenty hours of on-campus employment while school is in session. On-campus employment may include required teaching assignments and other optional on-campus employment. J-1 students sponsored by Yale must also report in advance any employment opportunity to the OISS. Part-time on-campus employment opportunities may be found at https://yalestudentjobs.org or occasionally through the student's academic department.

LOANS AND STUDENT EMPLOYMENT

U.S. citizens and permanent residents may be eligible to borrow from the Federal Direct Loan Program. Eligibility is based on federal regulations and university policies. Information is available from the Office of Financial Aid (gradfinaid@yale.edu).

On-campus student employment opportunities can be found at https://www.yalestudentjobs.org. All students applying for federal loan programs must fill out a Free Application for Federal Student Aid (FAFSA). Information on loan programs is contained in *Financial Information for Entering Graduate Students*, included with the student's letter of admission. These documents are available from the Office of Financial Aid. Information and FAFSA applications are also available at the website of the United States Department of Education (https://studentaid.gov).

Yale currently offers a loan for international students. Features of the Yale International Loan include no requirement for a co-signer and a ten-year repayment period. Students may apply for the Yale Graduate and Professional International Loan or any other loan of their choice. Students are encouraged to identify a loan that best suits their needs.

Two Federal Regulations Governing Title IV Financial Aid Programs

SATISFACTORY ACADEMIC PROGRESS

All degree seeking students in the Graduate School of Arts and Sciences must be making satisfactory academic progress in order to be eligible for any type of financial aid (includes federal Title IV). The following provisions are the general definition of satisfactory academic progress. Specific department provisions are included in the department section of the bulletin (https://catalog.yale.edu/gsas/degree-granting-departments-programs).

In each of the first two years, students must:

- Meet the High Pass average requirement for graduate level courses
- Satisfy academic degree requirements as defined by the academic program (see individual department requirements at https://catalog.yale.edu/gsas/degree-granting-departments-programs)
- Complete at least 50 percent of the cumulative attempted program courses for which a student has registered in a semester.

A student who is not in good academic standing with regard to coursework or research as defined by the standards above and the expectations outlined by the student's department or program may be dismissed from the graduate school.

DEPARTMENT OF EDUCATION REFUND POLICY

Students receiving Title IV financial assistance who withdraw during a term will have their Title IV assistance adjusted according to a formula specified by the Department of Education. Please consult the Office of Financial Aid, 246 Church St.

YALE UNIVERSITY RESOURCES AND SERVICES

Identification Cards

Yale University issues identification (ID) cards to students, faculty, and staff. ID cards support the community's safety and security by allowing access to many parts of campus: dining halls and cafés, residential housing, libraries, athletic centers, workspaces, labs, and academic buildings. Cultivating an environment of public safety requires the entire community to work together to ensure appropriate use of our spaces, as well as to foster a sense of belonging for all members of our community.

University policies, regulations, and practice require all students, faculty, and staff to carry their Yale ID card on campus and to show it to university officials on request. Yale ID cards are not transferable. Community members are responsible for their own ID card and should report lost or stolen cards immediately to the Yale ID Center (https://idcenter.yale.edu).

Members of the university community may be asked to show identification at various points during their time at Yale. This may include, but not be limited to, situations such as: where individuals are entering areas with access restrictions, for identification in emergency situations, to record attendance at a particular building or event, or for other academic or work-related reasons related to the safe and effective operation and functioning of Yale's on-campus spaces.

For some members of our community, based on the needs and culture of their program, department, or characteristics of their physical spaces, being asked to show an ID card is a regular, even daily, occurrence. However, for others it may be new or infrequent. For some, being asked to produce identification can be experienced negatively, as a contradiction to a sense of belonging or as an affront to dignity. Yale University is committed to enhancing diversity, supporting equity, and promoting an environment that is welcoming, inclusive, and respectful. University officials requesting that a community member show their ID card should remain mindful that the request may raise questions and should be prepared to articulate the reasons for any specific request during the encounter. In addition, individuals requesting identification should also be prepared to present their own identification, if requested.

Health Services

https://yalehealth.yale.edu

Yale Health operates a multispecialty group practice on campus through its state-of-the-art medical center, Yale Health Center, located at 55 Lock Street. Yale Health Center offers a wide variety of on-site health care services including primary care, specialty care, acute care, mental health and counseling, radiology, blood draw, pharmacy, eye care, infusion and medication administration center, and a seventeen-bed inpatient care unit. Nearly all care is provided by Yale Health staff; when a student's condition requires more specialized care or a hospitalization, there is an extensive network of

specialists drawn largely from Yale School of Medicine or other in-network contracted providers. Yale Health's network hospital is Yale-New Haven Hospital. With Yale Health Hospitalization & Specialty Care Coverage, emergency care is covered anywhere in the world. Yale Health's services are detailed in A Student's Guide to Yale Health, available through the Yale Health Member Services Department, 203.432.0246, or online at https://yalehealth.yale.edu/resource/student-guide-yale-health.

ELIGIBILITY FOR SERVICES

The university provides eligible degree-candidate student enrolled half-time or more with primary care services at the Yale Health Center through Yale Health Basic Student Health Services. These services are free and automatically provided; no enrollment or forms are required. For new students and newly eligible students, basic services are available on the date the student is required to be on campus for orientation and continue through July 31, providing they remain eligible. Basic Student Health Services includes preventive health, blood draw, and medical services in student health, gynecology, mental health and counseling, nutrition, acute care, and inpatient care. For returning students, access to Basic Student Health Services begins August 1 and ends July 31, providing they remain eligible. Please note that this is not an insurance plan. For full details, see Yale Health Basic Student Health Services at https://yalehealth.yale.edu/topic/health-care-overview-students-yale-health.

Students on leave of absence, on extended study and paying less than half tuition, or enrolled per course credit are not eligible for Yale Health Basic Student Health Services but may enroll in Yale Health Student Affiliate Coverage. Students enrolled in the Division of Special Registration as nondegree special students or visiting scholars are not eligible for Yale Health Basic Student Health Services but may enroll in the Yale Health Billed Associates Plan and pay a monthly fee. Associates must register for a minimum of one term within the first thirty days of affiliation with the university.

Students not eligible for Yale Health Basic Student Health Services may also use the services on a fee-for-service basis. Students who wish to be seen fee-for-service must register with the Member Services Department. Enrollment applications for the Yale Health Student Affiliate Coverage, Billed Associates Plan, or Fee-for-Service Program are available from the Member Services Department.

Most students meet the university requirement for hospitalization and insurance coverage by subscribing to Yale Health Hospitalization & Specialty Care Coverage, which provides coverage for all approved hospitalizations, specialty care services, and prescription medications. If you are an eligible degree-candidate student enrolled half-time or more, you are automatically enrolled in and billed for this coverage. Full-year coverage dates are identical to those for Yale Health Basic Student Health Services. However, Yale Health Hospitalization & Specialty Care Coverage may also be purchased for either the fall term only or spring term only. All students who remained enrolled in and do not waive Yale Health Hospitalization & Specialty Care Coverage (https://yalehealth.yale.edu/student-coverage) can use specialty and ancillary services at Yale Health Center. Upon referral, Yale Health will cover the cost, minus any applicable copayments, of specialty and ancillary services for these students. Students with an alternate insurance plan should seek specialty services from a non-Yale Health provider who accepts their alternate insurance.

HEALTH COVERAGE ENROLLMENT

A student's status as an eligible Yale University undergraduate, graduate, or professional student automatically makes them eligible for Yale Health Basic Student Health Services. If they are eligible for Yale Health Basic Student Health Services, the university requires them to obtain adequate insurance coverage for hospitalization and specialty care. A student may purchase their hospitalization, specialty, and prescription coverage through Yale Health or through another insurer. Students may remain enrolled in Yale Health Hospitalization & Specialty Care Coverage or waive the plan if they have other hospitalization coverage, such as through a spouse or parent. The waiver must be renewed annually, and the student must confirm receipt of the waiver by the university's deadlines noted below.

Yale Health Hospitalization & Specialty Care Coverage

For a detailed explanation of this plan, which includes coverage for prescriptions, see *A Student's Guide to Yale Health*, available at https://yalehealth.yale.edu/resource/student-guide-yale-health.

Students are automatically enrolled and charged a fee each term on their Student Financial Services bill for Yale Health Hospitalization & Specialty Care Coverage. Students with no break in coverage who are enrolled during both the fall and spring terms are billed each term and are covered from August 1 through July 31. For students entering Yale for the first time, readmitted students, and students returning from a leave of absence who have not been covered during their leave, Yale Health Hospitalization & Specialty Care Coverage begins on the day the dormitories officially open or when orientation requires students to be on campus. A student who is enrolled for the fall term only is covered for services through January 31; a student enrolled for the spring term only is covered for services through July 31.

Waiving Yale Health Hospitalization & Specialty Care Coverage Students can waive Yale Health Hospitalization & Specialty Care Coverage by completing an online waiver form that demonstrates proof of alternate coverage. Students are responsible for reporting any changes in alternate insurance coverage to the Member Services Department within thirty days. Students are encouraged to review their present coverage and compare its benefits to those available under Yale Health. The waiver form must be filed annually and received by September 15 for the full year or fall term or by January 31 for the spring term only.

Revoking the Waiver Students who waive Yale Health Hospitalization & Specialty Care Coverage but later wish to be covered must complete and send a form voiding their waiver to the Member Services Department by September 15 for the full year or fall term, or by January 31 for the spring term only. Students who wish to revoke their waiver during the term may do so, provided they show proof of loss of the alternate insurance plan and enroll within thirty days of the loss of this coverage. Yale Health fees will not be prorated.

Yale Health Student Dependent Plans

A student may enroll the student's lawfully married spouse or civil union partner and/or legally dependent child(ren) under the age of twenty-six in one of three student dependent plans: Student + Spouse, Student + Child/Children, or Student Family

Plan. These plans include services described in both Yale Health Basic Student Health Services and Yale Health Hospitalization & Specialty Care Coverage. Coverage is not automatic, and enrollment is by application. Applications are available from the Member Services Department or can be downloaded from the website (https://yalehealth.yale.edu/forms-and-guidelines) and must be renewed annually. Applications must be received by September 15 for full-year or fall-term coverage, or by January 31 for spring-term coverage only.

Yale Health Student Affiliate Coverage

Students on leave of absence, on extended study, or enrolled per course per credit; students paying less than half tuition; students enrolled in the EMBA program; students enrolled in the Broad Center M.M.S. program; students enrolled in the PA Online program; students enrolled in the M.S.N. Nursing Online program; and students enrolled in the EMPH program may enroll in Yale Health Student Affiliate Coverage, which includes services described in both Yale Health Basic Student Health Services and Yale Health Hospitalization & Specialty Care Coverage. Graduate and professional school students should use the Student Enrollment Change Application available from the Member Services Department or at https://yalehealth.yale.edu/student-coverage. It must be received by September 15 for full-year or fall-term coverage, or by January 31 for spring-term coverage only.

ELIGIBILITY CHANGES

Withdrawal Withdrawing from the university directly impacts a student's Yale Health Hospitalization & Specialty Care Coverage. The timing of the student's withdrawal can impact whether they can get a refund for their health coverage or be billed for health services they used. Note: Tuition and Yale Health coverage fees are billed separately and considered separately in the withdrawal policies. Students should Contact Yale Health Member Services (203.432.0246; member.services@yale.edu) or the student health care navigator (yhstudentnavigator@yale.edu) for guidance or questions about their specific situation.

For students who withdraw on or before the fifteenth day of classes:

- They will receive a full refund for the Yale Health Hospitalization & Specialty Care Coverage fee if they did not waive coverage; if they waived coverage, they would not get a refund since they were not billed for coverage.
- Their Yale Health membership will end retroactively to the start of the insurance term (fall or spring) in which they have withdrawn, as if they were never covered by Yale Health Hospitalization & Specialty Care Coverage or Basic Health Services.
- They will not be eligible for any Yale Health coverage and unable to access services moving forward.
- If they have already used health services, those services will be billed directly to the student by Yale Health.
- They cannot enroll in Student Affiliate Coverage to extend their insurance.

For students who withdraw more than fifteen days after the first day of classes:

- They will still have access to Yale Health services for thirty days after their withdrawal date.

- During those thirty days, the student will have access to the same services they had before withdrawing.
- If they waived coverage, then they will still have access to Yale Health Basic Health Services for thirty days.
- If they did not waive coverage, they will remain insured by Yale Health with Hospitalization & Specialty Care with prescription benefits.
- However, fees for Yale Health Hospitalization & Specialty Care Coverage won't be refunded nor prorated. Students are responsible for the semester charge on their student account, even if their tuition has been refunded.
- They cannot enroll in Student Affiliate Coverage to extend their insurance.

If a student is unsure about their options or how these policies apply to their situation, contact Yale Health Member Services (member.services@yale.edu) or the student health care navigator (yhstudentnavigator@yale.edu).

Leaves of Absence Taking a leave of absence (LOA) from the university directly impacts a student's Yale Health Hospitalization & Specialty Care Coverage. The timing of a student's LOA can impact whether they can get a refund for their health coverage received or be billed for health services they used. Students granted a leave of absence (non-medical or medical) can purchase Student Affiliate Coverage. Note: Tuition and Yale Health coverage fees are billed separately and considered separately in the LOA policies. Students should contact Yale Health Member Services (203.432.0246; member.services@yale.edu) or Student Heath Care Navigator (yhstudentnavigator@yale.edu) for guidance or questions about your specific situation.

If the registrar is notified of a student's LOA on or before the first day of classes:

- The student's Yale Health Hospitalization & Specialty Care Coverage will end retroactively to the start of the insurance term (fall or spring) in which they have taken a LOA, as if they were never covered by Yale Health Hospitalization & Specialty Care Coverage or Basic Student Health Services.
- The student will get a full refund for the Yale Health Hospitalization & Specialty Care Coverage fee if they did not waive coverage; if they waived coverage, they would not get a refund.
- The student may be eligible for Student Affiliate Coverage and have thirty days to enroll (see How to Enroll in Student Affiliate Coverage below).
- If the student waived coverage and does not enroll in Student Affiliate Coverage, they will not be eligible for any Yale Health services and coverage moving forward, and if they have already used health services, those services will be billed directly to them by Yale Health.

If the registrar is notified of a student's LOA after the first day of classes:

- The student's Yale Health Hospitalization & Specialty Care Coverage ends on the day the registrar is notified of their LOA.
- If the student waived coverage, then their access to Yale Health Basic Health Services ends on this date, and if they have already used health services, those services will not be billed directly to them by Yale Health.

- If the student did not waive coverage, then their insurance, Yale Health Hospitalization & Specialty Care with prescription coverage, ends on this date. If they have already used health services, those services will not be billed directly to them by Yale Health. However, any fees for Yale Health Hospitalization & Specialty Care Coverage will not be refunded nor prorated.
- The student may be eligible for Student Affiliate Coverage and have thirty days to enroll.

To enroll in Student Affiliate Coverage (enrollment isn't automatic), a student will need to complete and submit the enrollment/change form available from the Member Services Department or at https://yalehealth.yale.edu/student-coverage.

- Fees that have already been paid for Yale Hospitalization & Specialty Coverage will be applied to the cost of Student Affiliate Coverage; the full fee will still be charged to the student's account; however, they will only be charged the difference in the fee.
- Regardless of what point in the semester the student enrolls, fees will not be prorated or refunded.

For more information, contact Yale Health Member Services (member.services@yale.edu) or the student health care navigator (yhstudentnavigator@yale.edu).

Extended Study or Reduced Tuition Students who are granted extended study status or pay less than half tuition are not eligible for Yale Health Hospitalization & Specialty Care Coverage. They may purchase Yale Health Student Affiliate Coverage during the term(s) of extended study. This plan includes services described in both Yale Health Basic and Yale Health Hospitalization & Specialty Care Coverage. Coverage is not automatic, and enrollment forms are available at the Member Services Department or can be downloaded from the website (https://yalehealth.yale.edu/forms-and-guidelines). Students must complete an enrollment application for the plan prior to September 15 for the full year or fall term, or by January 31 for the spring term only.

Per Course Per Credit Students who are enrolled per course per credit are not eligible for Yale Health Hospitalization & Specialty Care Coverage. They may purchase Yale Health Student Affiliate Coverage during the term(s) of per course per credit enrollment. This plan includes services described in both Yale Health Basic and Yale Health Hospitalization & Specialty Care Coverage. Coverage is not automatic, and enrollment forms are available at the Member Services Department or can be downloaded from the website (https://yalehealth.yale.edu/forms-and-guidelines). Students must complete an enrollment application for the plan prior to September 15 for the full year or fall term, or by January 31 for the spring term only.

REQUIRED IMMUNIZATIONS

All new students are required to complete these requirements by August 1, 2025. Key information and a description of student health requirements may be found at https://yalehealth.yale.edu/new-student-health-requirements. This page may be periodically updated and should be considered the most up-to-date source of information. All requirements are to be completed through Health On Track (https://

healthontrack.yale.edu/s/), Yale's portal for tracking health requirements. Specific requirements are outlined below.

Required for All Students

Requirement	Description	Alternate
MMR: measles, mumps, and rubella	MMR vaccine for anyone born after 1/1/1957 without evidence of immunity. Two doses of MMR vaccine at least 28 days apart. Dose 1 on or after first birthday	Laboratory documentation of immunity to measles, mumps, and rubella
Varicella	Varicella vaccine: two doses (age 12–15 months and 4–6 years). Adolescent catch-up: 2 doses 4–8 weeks apart	Laboratory evidence of immunity or health care provider documentation of disease
Meningitis quadrivalent ACWY*	Menveo, Menactra, MenQuadfi and Nimenrix, Penbraya (single dose at or after age 16). Vaccine must be given within 5 years of matriculation	ACWY polysaccharide vaccine is acceptable if conjugate vaccine unavailable
Tdap	Single booster dose within the past 10 years	
TB Screening questionnaire†	Complete the questionnaire. If identified as high risk, TB screening test must be submitted. If result is positive, a chest X-ray and record of any treatment must be submitted	

* only for students residing in university housing

† only for non-health-care-profession students

Additional Requirements for Health-Care-Profession Students

Requirement	Description	Alternate
Influenza	Single dose of seasonal flu vaccine annually between August 1 and December 1	
TB screening	Quantiferon or T-spot blood test within past 6 months. Positive test requires documentation of asymptomatic status and chest X-ray result	
Hepatitis B vaccine and titer	Heplisav-B (2 doses), Energix B, Recombivax HB (3 doses). Completion of series and quantitative titer demonstrating immunity following vaccination	Twinrix (Hep A and B) at appropriate intervals

Student Accessibility Services

https://sas.yale.edu
sas@yale.edu
203.432.2324

To ensure that all students have an equal opportunity to make the most of their Yale education, the Student Accessibility Services office (SAS) facilitates individual accommodations for students with disabilities. SAS promotes equitable access to education and student life for students with disabilities and fosters a campus environment of belonging, inclusion, and respect. Students requesting accommodations should complete an accommodation request form (https://yale-accommodate.symplicity.com/public_accommodation) to initiate the interactive process. Students may upload supporting documentation regarding their condition and request for accommodations with their accommodation request form. Documentation guidelines are available on the SAS website at https://sas.yale.edu/students/documentation-guidelines.

Engagement with SAS is confidential. Faculty and staff are notified of approved accommodations on a need-to-know basis only, except when required by law for health and safety reasons. Generally, a student requiring reasonable accommodations needs to renew accommodations with SAS at the start of each term and should complete this step as soon as their schedule is finalized. At any time during a term, students with a newly diagnosed disability or recently sustained injury requiring accommodations should contact SAS to discuss accommodation options.

Office of International Students and Scholars

http://oiss.yale.edu
203.432.2305

The Office of International Students and Scholars (OISS) coordinates services and support for more than 8,000 international students, faculty, staff, and their dependents at Yale. OISS assists international students and scholars with issues related to employment, immigration, and personal and cultural adjustment and serves as a source of general information about living at Yale and in New Haven. As Yale University's representative for immigration concerns, OISS helps students and scholars obtain and maintain legal nonimmigrant status in the United States.

OISS programs, like daily English conversation groups, the Understanding America series, DEIB workshops, bus trips, and social events provide an opportunity to meet members of Yale's international community and become acquainted with the many resources of Yale University and New Haven. Spouses and partners of Yale students and scholars will want to get involved with the International Spouses and Partners at Yale (ISPY) community, which organizes a variety of programs and events.

The OISS website provides useful information to students and scholars prior to and upon arrival in New Haven as well as throughout their stay at Yale. International students, scholars, and their families and partners can connect with OISS and the Yale international community virtually through Yale Connect, Facebook, and Instagram.

OISS is a welcoming venue for students and scholars who want to check their email, grab a cup of coffee, and meet up with a friend or colleague. The International Center is OISS's home on Yale campus and is located at 421 Temple Street. The International Center provides meeting space for student groups and a venue for events organized by both student groups and university departments. For more information about our hours, directions, and how to reserve space at OISS, please visit https://oiss.yale.edu/about/hours-directions-parking.

Resources to Address Discrimination, Harassment, and Sexual Misconduct

Yale is a community committed to fostering an environment of mutual respect and intellectual discovery in which all members of the community can thrive. Acts of discrimination, harassment, and sexual misconduct are contrary to the community standards and ideals of our university. Staff in the following offices work within the Yale community to promote an environment free from discrimination, harassment, and sexual misconduct and are available to talk through situations you have witnessed or experienced, as well as to provide guidance.

When you have concerns or questions related to discrimination, harassment, or sexual misconduct, you have a wide range of choices for support. You can reach out to a discrimination and harassment resource coordinator, deputy Title IX coordinator or others, such as a residential college dean, dean of student affairs, the Office of Institutional Equity and Accessibility, or the Title IX office.

DISCRIMINATION AND HARASSMENT RESOURCE COORDINATORS

Office hours: 9 a.m.–5 p.m., M–F
https://oiea.yale.edu/contact-us/dhrc

Discrimination and harassment resource coordinators (DHRCs) have been identified by the deans of Yale College, the Graduate School of Arts and Sciences, and the professional schools as community members with the responsibility to receive concerns and offer advice and guidance related to diversity and inclusion, discrimination and harassment, and equal opportunity. Discrimination and harassment resource coordinators may also help facilitate informal resolution. This may be an individual's best "first stop" in discussing a concern related to discrimination, harassment, or retaliation, particularly as discrimination and harassment resource coordinators will be knowledgeable about resources specific to their school or college.

OFFICE OF INSTITUTIONAL EQUITY AND ACCESSIBILITY

Office hours: 9 a.m.–5 p.m., M–F
203.432.0849
https://oiea.yale.edu

Any individual who would like to report a concern of discrimination, harassment, and/or retaliation may contact the Office of Institutional Equity and Accessibility (OIEA). OIEA staff are available to discuss concerns, university resources, and options for resolution, including informal resolution. Where appropriate, OIEA staff are also available to conduct investigations into complaints of discrimination, harassment, and/or retaliation. Talking with someone at OIEA about a concern or making a complaint does not generally launch an investigation. It can, however, be an important step to alerting the university about a concern and getting assistance to resolve it.

SHARE: INFORMATION, ADVOCACY, AND SUPPORT

55 Lock Street, Lower Level
Appointments: 9 a.m.–5 p.m., M–F
24/7 on-call service (for time-sensitive matters): 203.432.2000
https://sharecenter.yale.edu

SHARE, the Sexual Harassment and Assault Response and Education Center, has trained counselors available to members of the Yale community who wish to discuss any current or past experience of sexual misconduct involving themselves or someone they care about. SHARE services are confidential and can be anonymous if desired. SHARE can provide professional help with medical and health issues (including accompanying individuals to the hospital or the police), as well as ongoing counseling and support for students. SHARE works closely with the University-Wide Committee on Sexual Misconduct, the Title IX Office, the Yale Police Department, and other campus resources and can provide assistance with initiating a complaint.

If you wish to make use of SHARE's services, you can call the SHARE number (203.432.2000) at any time for a phone consultation or to set up an in-person appointment. Some legal and medical options are time-sensitive, so if you have

experienced an assault, we encourage you to call SHARE and/or the Yale Police as soon as possible.

TITLE IX COORDINATORS

203.432.6854
Office hours: 9 a.m.–5 p.m., M–F
https://titleix.yale.edu

Title IX of the Education Amendments of 1972 protects people from sex discrimination in educational programs and activities at institutions that receive federal financial assistance. Sex discrimination includes sexual harassment, sexual assault, and other forms of sexual misconduct. The university is committed to providing an environment free from discrimination on the basis of sex or gender.

Yale College, the Graduate School of Arts and Sciences, and the professional schools have each designated one or more deputy Title IX coordinators, who work closely with the university Title IX Office and university Title IX Coordinator Elizabeth Conklin. Coordinators respond to and address concerns, provide information on available resources and options, track and monitor incidents to identify patterns or systemic issues, deliver prevention and educational programming, and address issues relating to sex-based discrimination and sexual misconduct within their respective schools. Coordinators also work with pregnant and parenting students to coordinate needed accommodations and to respond to instances of discrimination. Discussions with a deputy Title IX coordinator are private and information is only shared with other university officials on a need-to-know basis. In the case of imminent threat to an individual or the community, the coordinator may need to consult with other administrators or take action in the interest of safety. The coordinators also work closely with the SHARE Center, the University-Wide Committee on Sexual Misconduct, and the Yale Police Department.

UNIVERSITY-WIDE COMMITTEE ON SEXUAL MISCONDUCT

203.432.4449
Office hours: 9 a.m.–5 p.m., M–F
https://uwc.yale.edu

The University-Wide Committee on Sexual Misconduct (UWC) is an internal disciplinary board for complaints of sexual misconduct available to students, faculty, and staff across the university, as described in the committee's procedures. The UWC provides an accessible, representative, and trained body to fairly and expeditiously address formal complaints of sexual misconduct. UWC members can answer inquiries about procedures and the university sexual misconduct policy. The UWC is composed of faculty, senior administrators, and graduate and professional students drawn from throughout the university. UWC members are trained to observe strict confidentiality with respect to all information they receive about a case.

YALE POLICE DEPARTMENT

101 Ashmun Street
24/7 hotline: 203.432.4400
https://your.yale.edu/community/public-safety/yale-police-department

The Yale Police Department (YPD) operates 24/7 and is composed of highly trained, professional officers. The YPD can provide information on available victims' assistance services and also has the capacity to perform full criminal investigations. If you wish to speak with the sensitive crimes and support coordinator, they can be reached at 203.432.9547. Informational sessions are available with the sensitive crimes and support coordinator to discuss safety planning, available options, etc. The YPD works closely with the New Haven State's Attorney, the SHARE Center, the Title IX Office, and various other departments within the university. Talking to the YPD does not commit you to submitting evidence or pressing charges; with few exceptions, all decisions about how to proceed are up to you.

THE WORK OF YALE UNIVERSITY

The work of Yale University is carried on in the following schools:

Yale College Est. 1701. Courses in humanities, social sciences, natural sciences, mathematical and computer sciences, and engineering. Bachelor of Arts (B.A.), Bachelor of Science (B.S.).

For additional information, please visit https://admissions.yale.edu, email student.questions@yale.edu, or call 203.432.9300. Postal correspondence should be directed to Office of Undergraduate Admissions, Yale University, PO Box 208234, New Haven CT 06520-8234.

Graduate School of Arts and Sciences Est. 1847. Courses for college graduates. Master of Arts (M.A.), Master of Science (M.S.), Master of Philosophy (M.Phil.), Doctor of Philosophy (Ph.D.).

For additional information, please visit https://gsas.yale.edu, email graduate.admissions@yale.edu, or call the Office of Graduate Admissions at 203.432.2771. Postal correspondence should be directed to Office of Graduate Admissions, Yale Graduate School of Arts and Sciences, PO Box 208236, New Haven CT 06520-8236.

School of Medicine Est. 1810. Courses for college graduates and students who have completed requisite training in approved institutions. Doctor of Medicine (M.D.). Postgraduate study in the basic sciences and clinical subjects. Five-year combined program leading to Doctor of Medicine and Master of Health Science (M.D./M.H.S.). Combined program with the Graduate School of Arts and Sciences leading to Doctor of Medicine and Doctor of Philosophy (M.D./Ph.D.). Master of Medical Science (M.M.Sc.) from the Physician Associate Program and the Physician Assistant Online Program.

For additional information, please visit https://medicine.yale.edu/edu, email medical.admissions@yale.edu, or call the Office of Admissions at 203.785.2643. Postal correspondence should be directed to Office of Admissions, Yale School of Medicine, 367 Cedar Street, New Haven CT 06510.

Divinity School Est. 1822. Courses for college graduates. Master of Divinity (M.Div.), Master of Arts in Religion (M.A.R.). Individuals with an M.Div. degree may apply for the program leading to the degree of Master of Sacred Theology (S.T.M.).

For additional information, please visit https://divinity.yale.edu, email div.admissions@yale.edu, or call the Admissions Office at 203.432.5360. Postal correspondence should be directed to Admissions Office, Yale Divinity School, 409 Prospect Street, New Haven CT 06511.

Law School Est. 1824. Courses for college graduates. Juris Doctor (J.D.). For additional information, please visit https://law.yale.edu, email admissions.law@yale.edu, or call the Admissions Office at 203.432.4995. Postal correspondence should be directed to Admissions Office, Yale Law School, PO Box 208215, New Haven CT 06520-8215.

Graduate Programs: Master of Laws (LL.M.), Doctor of the Science of Law (J.S.D.), Master of Studies in Law (M.S.L.). Doctor of Philosophy (Ph.D.) awarded by the Graduate School of Arts and Sciences. For additional information, please visit https://law.yale.edu, email gradpro.law@yale.edu, or call the Graduate Programs Office at 203.432.1696. Postal correspondence should be directed to Graduate Programs, Yale Law School, PO Box 208215, New Haven CT 06520-8215.

School of Engineering & Applied Science Est. 1852. Courses for college graduates. Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) awarded by the Graduate School of Arts and Sciences.

For additional information, please visit https://seas.yale.edu, email grad.engineering@yale.edu, or call 203.432.4252. Postal correspondence should be directed to Office of Graduate Studies, Yale School of Engineering & Applied Science, PO Box 208292, New Haven CT 06520-8292.

School of Art Est. 1869. Professional courses for college and art school graduates. Master of Fine Arts (M.F.A.).

For additional information, please visit http://art.yale.edu, email artschool.info@yale.edu, or call the Office of Academic Administration at 203.432.2600. Postal correspondence should be directed to Office of Academic Administration, Yale School of Art, PO Box 208339, New Haven CT 06520-8339.

School of Music Est. 1894. Graduate professional studies in performance and composition. Certificate in Performance (CERT), Master of Music (M.M.), Master of Musical Arts (M.M.A.), Artist Diploma (A.D.), Doctor of Musical Arts (D.M.A.).

For additional information, please visit https://music.yale.edu, email gradmusic.admissions@yale.edu, or call the Office of Admissions at 203.432.4155. Postal correspondence should be directed to Yale School of Music, PO Box 208246, New Haven CT 06520-8246.

School of the Environment Est. 1900. Courses for college graduates. Master of Forestry (M.F.), Master of Forest Science (M.F.S.), Master of Environmental Science (M.E.Sc.), Master of Environmental Management (M.E.M.). Doctor of Philosophy (Ph.D.) awarded by the Graduate School of Arts and Sciences.

For additional information, please visit https://environment.yale.edu, email admissions.yse@yale.edu, or call the Office of Admissions at 800.825.0330. Postal correspondence should be directed to Office of Admissions, Yale School of the Environment, 300 Prospect Street, New Haven CT 06511.

School of Public Health Est. 1915. Courses for college graduates. Master of Public Health (M.P.H.). Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) awarded by the Graduate School of Arts and Sciences.

For additional information, please visit https://publichealth.yale.edu, email ysph.admissions@yale.edu, or call the Admissions Office at 203.785.2844.

School of Architecture Est. 1916. Courses for college graduates. Professional and post-professional degree: Master of Architecture (M.Arch.); nonprofessional degree: Master

of Environmental Design (M.E.D.). Doctor of Philosophy (Ph.D.) awarded by the Graduate School of Arts and Sciences.

For additional information, please visit https://architecture.yale.edu, email gradarch.admissions@yale.edu, or call 203.432.2296. Postal correspondence should be directed to the Yale School of Architecture, PO Box 208242, New Haven CT 06520-8242.

School of Nursing Est. 1923. Courses for college graduates. Master of Science in Nursing (M.S.N.), Post Master's Certificate (P.M.C.), Doctor of Nursing Practice (D.N.P.). Doctor of Philosophy (Ph.D.) awarded by the Graduate School of Arts and Sciences.

For additional information, please visit https://nursing.yale.edu or call 203.785.2389. Postal correspondence should be directed to Yale School of Nursing, Yale University West Campus, PO Box 27399, West Haven CT 06516-0972.

David Geffen School of Drama Est. 1925. Courses for college graduates and certificate students. Master of Fine Arts (M.F.A.), Certificate in Drama, Doctor of Fine Arts (D.F.A.).

For additional information, please visit https://drama.yale.edu, email ysd.admissions@yale.edu, or call the Registrar/Admissions Office at 203.432.1507. Postal correspondence should be directed to David Geffen School of Drama at Yale University, PO Box 208325, New Haven CT 06520-8325.

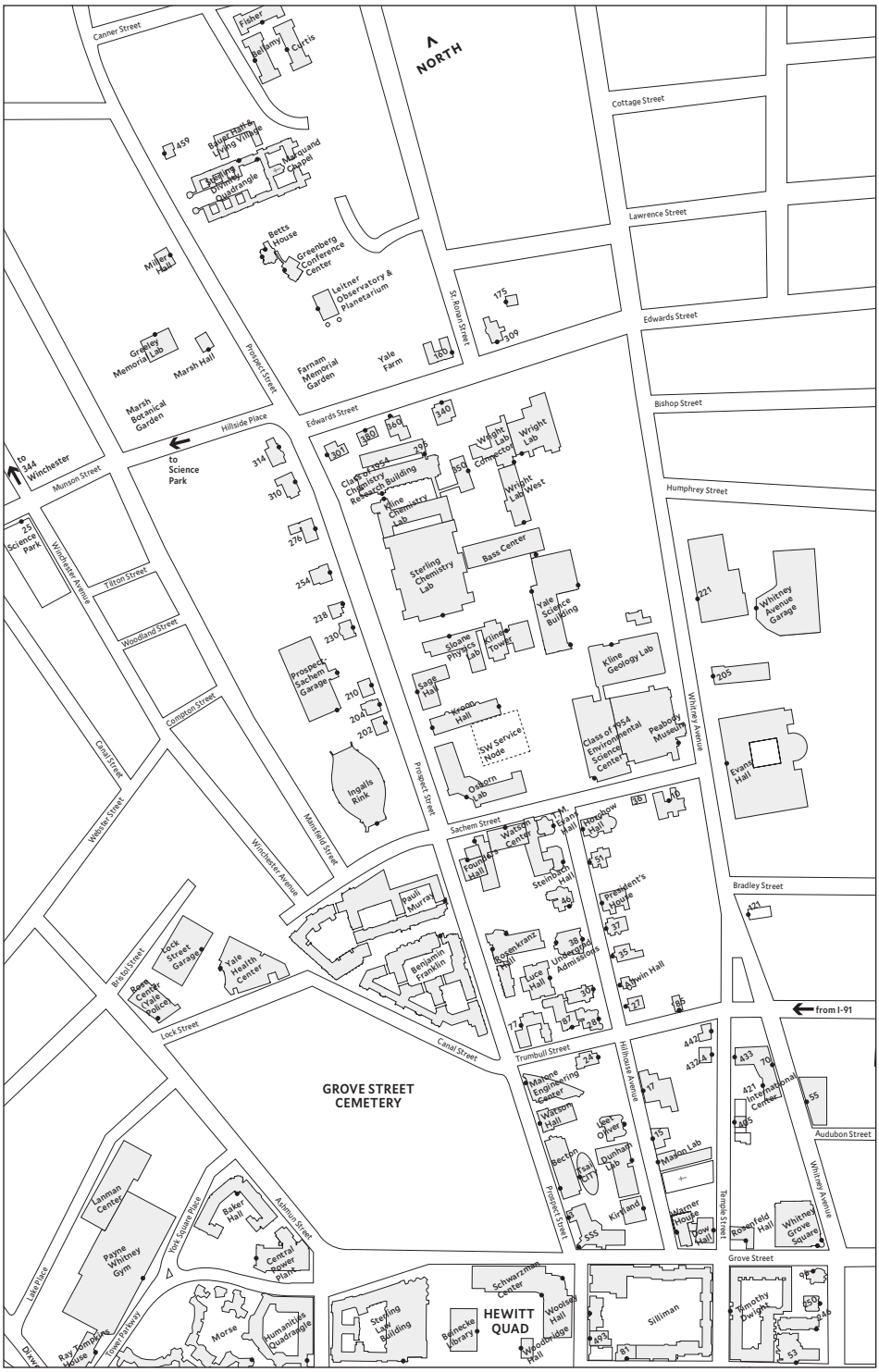
School of Management Est. 1976. Courses for college graduates. Master of Business Administration (M.B.A.), Master of Advanced Management (M.A.M.), Master of Management Studies (M.M.S.). Doctor of Philosophy (Ph.D.) awarded by the Graduate School of Arts and Sciences.

For additional information, please visit https://som.yale.edu. Postal correspondence should be directed to Yale School of Management, PO Box 208200, New Haven CT 06520-8200.

Jackson School for Global Affairs Est. 2022. Courses for college graduates. Master in Public Policy (M.P.P.) and Master of Advanced Study (M.A.S.).

For additional information, please visit https://jackson.yale.edu, email jackson.admissions@yale.edu, or call 203.432.6235.

YALE UNIVERSITY CAMPUS NORTH



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YALE UNIVERSITY CAMPUS SOUTH & YALE MEDICAL CENTER

© Yale University. Map not to scale

The university is committed to basing judgments concerning the admission, education, and employment of individuals upon their qualifications and abilities and seeks to attract to its faculty, staff, and student body qualified persons from a broad range of backgrounds and perspectives. Additionally, in accordance with Yale's Policy Against Discrimination and Harassment (https://your.yale.edu/policies-procedures/policies/9000-yale-university-policy-against-discrimination-and-harassment), Yale does not discriminate in admissions, educational programs, or employment against any individual on account of that individual's sex, sexual orientation, gender identity or expression, race, color, national or ethnic origin, religion, age, disability, status as a special disabled veteran, protected veteran status, or other protected classes as set forth in Connecticut and federal law.

Inquiries concerning this policy may be referred to the Office of Institutional Equity and Accessibility, 203.432.0849; equity@yale.edu. For additional information, please visit https://oiea.yale.edu.

Title IX of the Education Amendments of 1972 protects people from sex discrimination in educational programs and activities at institutions that receive federal financial assistance. Questions regarding Title IX may be referred to the university's Title IX coordinator, Elizabeth Conklin, at 203.432.6854 or at titleix@yale.edu, or to the U.S. Department of Education, Office for Civil Rights, 8th Floor, 5 Post Office Square, Boston MA 02109-3921; tel. 617.289.0111, TDD 800.877.8339, or ocr.boston@ed.gov. For additional information, including information on Yale's sexual misconduct policies and a list of resources available to Yale community members with concerns about sexual misconduct, please visit https://titleix.yale.edu.

In accordance with federal and state law, the university maintains information on security policies and procedures and prepares an annual campus security and fire safety report containing three years' worth of campus crime statistics and security policy statements, fire safety information, and a description of where students, faculty, and staff should go to report crimes. The fire safety section of the annual report contains information on current fire safety practices and any fires that occurred within on-campus student housing facilities. Upon request to the Yale Police Department at 203.432.4400, the university will provide this information to any applicant for admission, or to prospective students and employees. The report is also posted on Yale's Public Safety website; please visit http://your.yale.edu/community/public-safety.

In accordance with federal law, the university prepares an annual report on participation rates, financial support, and other information regarding men's and women's intercollegiate athletic programs. Upon request to the Director of Athletics, PO Box 208216, New Haven CT 06520-8216, 203.432.1414, the university will provide its annual report to any student or prospective student. The Equity in Athletics Disclosure Act (EADA) report is also available online at http://ope.ed.gov/athletics.

BULLETIN OF YALE UNIVERSITY
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