

PH.260 (MOLECULAR MICROBIOLOGY AND IMMUNOLOGY)

Courses

Course location and modality is found on the BSPH website (<https://publichealth.jhu.edu/courses/>).

PH.260.601. Vector-Borne Disease Control. 3 Credits.

Addresses various vector-borne disease control strategies that target any of the complex interactions between the pathogen, vector and host. Emphasizes on malaria, dengue and other arboviral diseases, as well as Chagas, leishmaniasis and schistosomiasis. Discusses some examples of control strategies such as current and future prophylactic, therapeutic and transmission-blocking vaccines and drugs, vector control, and vector-targeted pathogen transmission control. Addresses interactions between control methods and factors that influence efficacy.

PH.260.603. Biology of the Next Pandemic. 3 Credits.

PH.260.604. Academic and Career Essentials. 1 Credit.

Introduces participants to methods for building skills and mindsets needed to complete their thesis and future scientific writing projects. Supports participants in developing a research question, writing a project outline, writing thesis drafts, communicating with reviewers, and formatting the thesis with references. Emphasizes learning how to give and receive helpful feedback. Acquaints participants with the benefits of building peer support networks. Builds career development skills including conducting job searches, CV/resume writing, effective communication, writing a personal statement, and interviewing.

PH.260.605. Disaster Microbiology. 3 Credits.

PH.260.606. Major Global Infectious Diseases: Prospects for Control. 2 Credits.

Provides in-depth information on the basic pathogenic mechanisms of selected infectious diseases that continue to be of major public health importance worldwide, with an emphasis on underlying problems for development of effective public health interventions. Includes topics: HIV/AIDS, malaria, tuberculosis, measles, as well as infectious disease hazards that may become important in the future. Obtains a working knowledge of the biology of these diseases, including prospects for their effective management and control at both the individual and public health level, and of basic human immunology and vaccinology

PH.260.607. Methods in life sciences, literature and practice. 2 Credits.

Focuses on understanding laboratory research technologies and applying this knowledge to evaluate current scientific literature. Achieves these goals through in-depth small group discussions with a range of faculty expertise, weekly assigned reading, short projects, short writing assignments or other activities. Includes both faculty and student leaders for each session; some sessions held in Core facilities. Includes topic areas: molecular biology, genomics, protein structure and strategies to evaluate the literature (primarily term 1), microscopy technologies, image analysis, flow cytometry and lab notebook archiving (primarily in term 2), cell biology, organelle dynamics, cell signaling, data management and experimental design (primarily term 3).

PH.260.609. Career, Academic, & Research Essentials. 1 Credit.

Introduces participants to methods for building skills and mindsets needed to complete their thesis and future scientific writing projects. Supports participants in developing effective study skills. Emphasizes excellent writing practices including conducting comprehensive literature searches, using reference managers, outlining writing tasks, and organizing a laboratory-based thesis. Acquaints participants with the benefits of building peer networks. Builds career development skills including goals setting, using individual development plans, conducting job searches, considering career paths, and leveraging institutional career services.

PH.260.610. The Human Microbiome in Health and Disease. 2 Credits.

Introduces the students to the fascinating world of the human microbiome. Reviews current literature addressing the microbiome's role in healthy development and pathogenesis of conditions such as cardiometabolic disease, neurodegeneration, and cancer. Discusses current and up-and-coming therapeutics and diagnostic tools based on the microbiome, including personalized medicine. Prepares students to consider the role of the microbiome in their research.

PH.260.611. Principles of Immunology I. 4 Credits.

PH.260.612. Principles of Immunology II. 3 Credits.

Introduces biological concepts of immunology; molecular nature of antigens; molecular basis for antibody and T-cell receptor structure and diversity; complement; hypersensitivity reactions; cellular basis for the immune response; cell-mediated immunity; adhesion molecules and coreceptors cell activation; cytokines and other soluble mediators; major histocompatibility complex (MHC) antigens; tumor immunology; transplantation immunobiology; mechanisms of resistance to microorganisms; tolerance; autoimmunity; and immuno-deficiency.

PH.260.613. Techniques in Molecular Biology. 3 Credits.

During five days of intensive hands-on laboratory instruction, students develop skills in the use of modern laboratory investigative tools in the area of molecular biology. They learn how to perform polymerase chain reaction (PCR) DNA amplification, quantitative PCR, DNA and protein gel chromatography, Western blotting, transformation of bacteria, and expression of heterologous proteins by bacteria.

PH.260.615. Critically Reviewing the Scientific Literature. 2 Credits.

Unlike the typical literature review course, focuses specifically on literature that is flawed in the approach or methods used to examine a scientific question and examines how well the conclusions drawn are justified by the data. Oral discussions of assigned literature are accompanied by weekly 2-3 page written reviews, which provides opportunities for students to get feedback on their writing skills, as well as their critical reading skills.

PH.260.617. Scientific Grant Writing - Project Development. 3 Credits.

Emphasizes tailored guidance in the conceptualization of a new basic science research plan with potential to significantly advance current knowledge. Explores specific strengths of the participant's chosen field and current state of knowledge to design an innovative research plan that definitively addresses an important question using optimal experimental/computational strategies. Introduces participants to strategic approaches to formulate compelling experimental plans and to effectively express these in weekly short writing assignments. Acquaints participants with best practices and common pitfalls in research design and grant writing. Presents sample grant proposals to help participants gain a reviewer's perspective through small-group peer review sessions.

PH.260.618. Fluorescence Microscopy: Principles and Cell Biological Applications. 2 Credits.

Provides a fundamental understanding of the underlying principles and cell biological applications of fluorescence microscopy, using lectures and in-class activities. Emphasizes high-resolution widefield and confocal fluorescence imaging (fixed and live cells), with topics ranging from immunofluorescence, fluorescent probes, 3D and time-lapse imaging to advanced techniques for measuring dynamics (e.g., FRAP, FLIP) and molecular interactions (e.g., FRET, BiFC), and fluorescence lifetime imaging microscopy (FLIM). Introduces image processing and single-cell resolved quantitative image analysis using open-source software. Presents super-resolution imaging techniques and emerging technologies. Offers practical examples with a focus on organelle biology, cell signaling, and infectious disease.

PH.260.620. Molecular and Cellular Biology for Infectious Diseases. 3 Credits.

Presents the common and unique aspects of the cellular and molecular biology of the major viruses, prokaryotes, and eukaryotes that cause infectious diseases and how these processes influence host-pathogen interactions. Introduces fundamental principles of cellular and molecular biology, cellular metabolism, genome organization, transcription, translation, replication and DNA repair, and compares these processes between different organisms, including eukaryotic host cells within the context of infectious diseases. Discusses state of the art tools used in the study of cellular and molecular processes across different disease-causing taxa and how common and unique features of molecular and cellular biology are translated to treat and prevent diseases.

PH.260.621. Introduction to the Biomedical Sciences I. 2 Credits.**PH.260.622. Introduction to the Biomedical Sciences II. 2 Credits.**

Emphasizes tailored guidance in the conceptualization of a new basic science research plan with potential to significantly advance current knowledge. Explores specific strengths of the participant's chosen field and current state of knowledge to design an innovative research plan that definitively addresses an important question using optimal experimental/computational strategies. Introduces participants to strategic approaches to formulate compelling experimental plans and to effectively express these in short writing assignments. Acquaints participants with best practices and common pitfalls in research design and grant writing. Presents sample grants to help participants gain a reviewer's perspective through small-group peer review sessions.

PH.260.623. Fundamental Virology. 4 Credits.**PH.260.624. Advanced Virology. 4 Credits.****PH.260.625. Scientific Grant Writing - Build a Compelling Grant Proposal. 2 Credits.**

Covers the critical components of a scientific grant application, common errors in grantsmanship and how to avoid them, grant application review criteria, ethics related to grant writing and reviewing, and identification of funding sources. Students prepare a short (5-page) draft proposal and a revision of this proposal following review. Proposal topics are selected by the students and developed with the instructor. Students also prepare critiques of other students' anonymous, instructor-edited proposals for discussion in class.

PH.260.627. Pathogenesis of Bacterial Infections. 4 Credits.**PH.260.630. Science Diplomacy Seminar: Lessons Learned from Experience. 1 Credit.****PH.260.631. Immunology, Infection and Disease. 3 Credits.****PH.260.633. Autoimmune Diseases of the Endocrine Glands. 4 Credits.****PH.260.635. Biology of Parasitism. 5 Credits.**

Presents a biological basis of parasitic lifestyles with concurrent laboratory including host responses and parasite evasion of host defense mechanisms, transmission, epidemiology, diagnosis, clinical manifestations, pathology, treatment, and control of the major helminthic and protozoan infections of man

PH.260.636. Evolution of Infectious Disease. 3 Credits.**PH.260.650. Vector Biology and Vector-Borne Diseases. 3 Credits.**

Presents the principles of transmission of human and animal pathogens by insects, mites and ticks. Covers basic arthropod biology with special attention to biological properties of vectors and their interactions with pathogens, basic components of arthropod disease cycles and principles of pathogen transmission dynamics. Special topics include emerging pathogens, vector genetics, traditional and next generation control strategies and venomous arthropods.

PH.260.653. Molecular Biology Literature. 3 Credits.

Discusses over two sessions the assigned paper from historic or current scientific literature. Covers only the methodologies and how they work in the first session, the second covers the scientific advancements achieved with these methods. Includes both student and faculty discussion leaders for each session.

PH.260.654. Current Literature in Microbial Immunity. 1 Credit.

Current Literature in Microbial Immunity is designed primarily for Master's level students to provide an overview of the current state of research relating to topics in microbial immunity.

PH.260.655. Pandemics of the 20Th Century. 1 Credit.

Provides students with an overview of protein bioinformatics including computational and experimental approaches. Introduces amino acid and protein physical properties as well as the alignment and evolution of protein sequences. Presents protein structure and methods of structure determination as well as the use of protein databases and software for visualizing proteins and generating publication quality figures. Discusses methods for secondary and tertiary protein structure prediction including homology modeling. Also covers methods for modeling small/molecule-protein interactions within the context of rational drug discovery and design. Finally, introduces students to experimental and computational aspects of mapping protein interaction networks.

PH.260.656. Malariaology. 4 Credits.**PH.260.657. Vector Biology and Disease Ecology Literature. 1 Credit.****PH.260.658. Advanced Malariaology. 2 Credits.**

Presents current controversies and issues in malaria research and control in format of topical lecture and discussion each week. Weekly topics include Epidemiology, Pathogenesis, Mosquitoes, Drugs, Diagnostics, Vaccines, Elimination and Control and Economics of Different Interventions.

PH.260.660. Fungi: Friends or Foes?. 3 Credits.

Explores the fascinating world of fungi. Recognizes the role of fungi in various fields from understanding fungal diversity to diving into molecular mechanisms. Discovers why fungi make excellent model organisms, defines their cellular structures, and inspects topics like antifungal epidemics and their relevance in the context of recent pandemics. Recognizes the influence of fungi on mammalian evolution and their role in daily life, from food to biotechnologies. Offers a comprehensive journey into mycology with 14 engaging lectures by mycology experts, interactive discussions, and hands-on assessments.

PH.260.663. Biological Response to Biomaterials. 3 Credits.

PH.260.665. Biological Basis of Aging. 3 Credits.

Emphasizes the fundamental nature of the aging process, at the molecular, cellular, and organismal level and examines the principles of aging in other animal species which may apply to man. Presents the physiological aspects of the different organs/systems affected by the disease processes (e.g., cardiovascular, metabolic, immunological etc.) Discusses the theoretical models of aging.

PH.260.700. How Do We Know? - Theory, History, and Practice of Science. 3 Credits.

Examines the nature and philosophical foundations of science using an interdisciplinary approach that emphasizes critical thinking and storytelling; discusses the principles of good scientific practice – rigor, reproducibility and responsibility (the 3R's) - by exploring revolutionary discoveries in the life, public health and natural sciences; elaborates the relationship between theory, practice and serendipity in scientific discovery, and concludes with a discussion of the role of scientists in society.

PH.260.701. Anatomy of Scientific Error. 3 Credits.

Examines sources of error in scientific practice (misconduct or honest mistakes, methodological or systematic errors). Presents real-world examples to analyze errors that cause problems in science across the disciplines. Introduces methodological and mathematical approaches to error reduction. Explores the review- and retraction mechanisms for journal articles and grants as methods of science self-correction. Discusses historic and contemporary cases where errors constitute sources of innovation.

PH.260.704. Critical Dissection of the Scientific Literature: Taking the Scalpel to Journal Articles. 3 Credits.

Challenges the classical format of a journal club by preparing students to critically evaluate literature across the science disciplines. Acquaints students with concrete applications of the 3 R's of good scientific practice: rigor, responsibility, and reproducibility. Discusses techniques for effective research literature analysis and evaluation. Emphasizes in-depth understanding of journal article preparation, data evaluation, and the context of conclusions and discussion points within a given research field.

PH.260.705. Fundamentals of Quantitative Reasoning in the Biomedical and Health Sciences. 3 Credits.

Provides a broad introduction to interdisciplinary, scientific reasoning using current problems from science and society. Explores the fundamentals of basic probability and statistics using real-world datasets from a variety of basic science disciplines. Introduces data analysis and visualization in the natural and biomedical sciences. Explains the importance of computational and quantitative methods for hypothesis testing in science, technology, and daily life.

PH.260.706. Big Data Skills for Biomedical Scientists. 3 Credits.

Acquaints students with the history and development of big data, the end-to-end workflow from data acquisition to storage, and the application of FAIR guidelines for data management. Discusses ethical considerations, insights into reproducibility, and challenges faced in the realm of big data in infectious diseases. Explores fundamental steps for bioinformatic analysis of big data to help students plan their own analyses, visualize results, and communicate findings. Includes FAIR principles with respect to data storage and management guidelines.

PH.260.707. Evidence-Based Teaching in the Biomedical and Health Sciences: Foundations. 3 Credits.

Acquaints students interested in teaching in biomedical and health professional settings with the foundations of how adults learn as well as the science of learning. Explores practical applications of evidence-based teaching techniques most relevant to the biomedical and public health professions. Discusses a variety of assessment techniques, and their alignment with learning objectives and educational strategies using state of the art course design.

PH.260.708. Evidence-Based Teaching in the Biomedical and Health Sciences – Practice. 3 Credits.

Provides students interested in gaining hands-on teaching experience with opportunities to plan and develop classroom materials on self-selected topics and deliver them in an interdisciplinary classroom setting, mentored by professional educators. Explores evidence-based instructional and assessment strategies to meet identified learner needs in the life and health sciences. Introduces students to a growing community of educational practitioners and scholars across the JHBSPH departments and JH divisions.

PH.260.709. Evidence-Based Mentoring. 3 Credits.

Examines the literature on evidence-based mentoring. Introduces participants to authentic mentoring situations taken from real-life cases, enriched by practitioner interviews. Discusses responsibilities, reciprocities, and trust-building in mentor-mentee relationships. Emphasizes and nurtures mentorship practices based on self-responsibility, personal growth, active listening, social intelligence, mutual support, goal setting, ethics and equitable leadership, and cultural sensitivity. Focuses on collaborative, reflective practice with the goal of developing one's own, unique mentorship philosophy. Acquaints participants with the benefits of mutual peer support through an inclusive community of practice.

PH.260.710. Communication Practice for Health Science Professionals. 3 Credits.

Introduces students to current trends in presentation design and delivery. Focuses on narrative-oriented thinking to improve information dissemination. Emphasizes clarity and simplicity in communication practice in multiple settings, targeting both lay and interdisciplinary expert audiences.

PH.260.711. Principles of Neuroimmunology. 3 Credits.

Briefly covers the role of specific cells of the central nervous system (CNS), immune functions of CNS cells, and trafficking of leukocytes into the CNS, both in health and disease. Subsequently, it discusses various immune cells, e.g. monocytes, T cells, B cells, inflammatory molecules such as cytokines, chemokines, metalloproteinases, and prostaglandins in more detail, focusing on their role in either protecting from neurological disease or in causing CNS disease pathologies, including cognitive dysfunction. Presentations from experts in the field address topics and diseases, such as multiple sclerosis (MS), the blood brain barrier (BBB), HIV and other neurotropic microbes in eliciting neurological disease and emerging neurotropic infections.

PH.260.712. Clinical Immunology. 3 Credits.**PH.260.713. R3 Writing Seminar for Graduate Students. 1 Credit.**

PH.260.714. Data Visualization Practice for Non-Expert Audiences. 1 Credit.

Introduces students to Gestalt principles of visual perception and pre-attentive processing in service of creating data visualizations in Excel and presenting in PowerPoint to non-expert audiences. Utilizes multiple chart and graph types in Excel to create diverse visualizations for the general public. Focuses on storytelling in design and visualization techniques in service of creating effective data-driven presentations for non-expert audiences. Concepts around data visualization in Excel are transferrable to other platforms (e.g., Tableau).

PH.260.715. Unleash Your Writing Superpower: Crafting Clear, Concise and Persuasive Prose. 3 Credits.

Introduces a system of planning, organization, writing and revision. Emphasizes the importance of defining the message, audience and purpose for any piece of writing. Illuminates the basic elements of good writing. Focuses on clear, concise and persuasive writing. Explores the use of rhetoric and storytelling to maximize a piece of writing's impact. Emphasizes best practices in various forms of writing.

PH.260.717. Graduate Immunology: the Immune Response. 3 Credits.

PH.260.719. Equitable Leadership in the Biosciences. 3 Credits.
Addresses broad concepts of change leadership from a personal perspective by teaching emerging STEM leaders to begin their journey by changing themselves. Explores individual factors critical to self-awareness, such as true self, leadership style, and emotional intelligence. Acquaints participants with an intrinsic understanding of themselves as leaders, combined with interests, values, and motivations key to dispel raising misconceptions of scientists and mistrust in science. Focuses on peer coaching to expand and practice leadership skills of active listening, dialogue, and connection as they relate to building community and workplace culture. Presents various tangible role models from biomedicine to illustrate equitable leadership in scientific practice, redefining the concept of a scientist as a human and approachable individual driven by the joy of connecting with others to facilitate scientific collaborations, convey a scientific vision, and serve as a scientific ambassador.

PH.260.720. Communications Primer for the Public Health Sciences. 1 Credit.

Acquaints students with the basics of effective oral and written communications in the form of brief exercises. Focuses on clarity and simplicity in presentation practice across disciplines and cultures to emphasize central messages. Introduces students to writing succinctly for advocacy using "compelling writers strategies" for opinion pieces and short speeches.

PH.260.730. Civility, Inclusion, and Professionalism in the Workplace. 1 Credit.

Discusses how to create an inclusive and welcoming workplace atmosphere. Emphasizes culturally sensitive and respectful communication. Familiarizes participants with workplace expectations, acceptable behaviors, and general professional deportment.

PH.260.800. MPH Capstone Molecular Microbiology and Immunology. 2 Credits.

The MPH Capstone is an opportunity for students to work on public health practice projects that are of particular interest to them. The goal is for students to apply the skills and competencies they have acquired to a public health problem that simulates a professional practice experience.

PH.260.801. Topics in Immunology I. 1 Credit.**PH.260.802. Topics in Immunology II. 1 Credit.****PH.260.810. Field Placement Molecular Microbiology and Immunology. 1 - 22 Credits.****PH.260.811. Field Studies in Ecology and Behavior. 3 - 6 Credits.**

PH.260.812. The Performance of Leadership: Foundations. 2 Credits.
Explores leader and leadership as one's natural self-expression through the ontological/phenomenological model in which ontology is the study or science of the nature and function of being (as in "being a leader"), and phenomenology is the method of direct access used to study and research the nature and function of being (as in being's impact on "exercising leadership effectively"). Introduces a new conversational domain and transformative learning paradigm for leadership. Encourages discovery through discussion, exercises, and assignments. Prepares students to develop the skills necessary to create positive, effective, and sustainable change.

PH.260.815. The Business of Academic Biomedical Research. 1 Credit.
Addresses topics related to business aspects of academic biomedical research, and focuses specifically on organizational, managerial, political, strategic and economical characteristics of academic biomedical research. Prepares students for a career in academic biomedical research by discussing essential features for success, other than the actual science.

PH.260.820. Thesis Research Molecular Microbiology and Immunology. 1 - 22 Credits.**PH.260.821. Research Forum in Molecular Microbiology and Immunology. 1 Credit.**

Prepares students for their future careers by creating a forum in which they can practice the essential skills of scientific communication. Focuses on the oral presentation of research findings resulting from laboratory investigations or literature review to faculty and fellow students. Examines the students' ability to condense and communicate background, hypotheses, experimental design, result presentation, and data analysis in a timed presentation.

PH.260.822. Seminars in Research in Molecular Microbiology and Immunology. 1 Credit.

Integrates academic training with current research in microbiology, immunology, and infectious diseases. Presents results of state of the art investigations of microbial diseases of public health significance, emphasizing experimental design and methodology for analysis and discussion by researchers from JHU and other biomedical research institutions.

PH.260.828. Teaching in Molecular Microbiology and Immunology. 1 - 22 Credits.

Teaching Assistant (TA) for PhD students in Molecular Microbiology and Immunology

PH.260.829. Summer Thesis Research. 12 Credits.**PH.260.830. Postdoc Research MMI. 1 - 22 Credits.****PH.260.840. SS/R: Mol Microbiology & Imm. 1 - 22 Credits.****PH.260.844. Causation. 3 Credits.**

Acquaints students with the central concept of causation across the biomedical and public health disciplines. Discusses how cause and effect relationships govern today's research and evidence-based decision-making based on the social, physical, political, and economic determinants of health. Compares how fields and sub-disciplines in biomedicine and public health approach causation using research case examples that illustrate major morbidity and mortality-related health problems. Examines strategies to mitigate the limitations of causal inference.

PH.260.848. Community-Based Practice Through Civic Engagement. 2 Credits.

Examines a participatory, online service-learning approach to enable students regardless of geographical location to engage in real-world, community-based, educational projects. Acquaint students to work with Baltimore-based community organizations through critical reflection on issues of equity and professional practice. Emphasizes the application of professional skills to real-world issues. Discusses the limitations and ethical aspects inherent to civic engagement work. Prepares students to develop evaluation plans and materials for the organizations' identified programs. Emphasizes translation of experiences with Baltimore Community-based organizations into local contexts. Focuses on building reciprocal partnerships that reach beyond "consultancy."

PH.260.851. Laboratory Rotations. 4 - 8 Credits.

All departmental Sc.M. and doctoral students spend one and three terms, respectively, participating in the research activities of departmental faculty's laboratories. Students select appropriate rotations in consultation with their academic advisors and the departmental Graduate Program Committee.

PH.260.855. Pandemics of the 20Th Century. 1 Credit.

Focuses on major pandemics in the human population that have occurred in the 20th century: the 1918 influenza pandemic; the emergence of HIV; the severe acute respiratory distress syndrome (SARS) outbreak of 2002-03; and viral hepatitis (hepatitis B and C viruses). For each pandemic, discussion groups cover a clinical-, public health- and pathogen-oriented reading topic in order to give students a broad understanding of the overall importance of each, as well as to compare and contrast the key aspects of each disease. Focuses on acute and chronic diseases, as well as diseases with different routes of transmission and incubation times between infection and disease. Provides a comprehensive overview of how each pandemic emerged, what key factors dictated spread in the population, and how each pathogen induced disease.

PH.260.895. MPH Practicum: MMI. 1 - 4 Credits.**PH.260.935. Lab for MMI 260.635. 3 Credits.**

Laboratory sessions examine living and preserved parasites, gross pathology, histopathology, and vectors. Journal discussions based on research papers and topics of fundamental importance to parasitology will involve student participation in a seminar format.