

JOINT PROGRAM WITH WOODS HOLE OCEANOGRAPHIC INSTITUTION

MIT and the Woods Hole Oceanographic Institution (WHOI) (<http://mit.who.edu>) on Cape Cod offer several joint degrees, including doctoral degrees in oceanography and doctoral, professional, and master's degrees in oceanographic engineering. The degree is awarded by the student's home department at MIT, jointly with Woods Hole Oceanographic Institution, acknowledging fulfillment of the Joint Program requirements in the selected program discipline. The joint degrees awarded are single documents issued by both institutions. Each Joint Program student is associated with one primary discipline and is a member of one MIT Department and one WHOI Department.

The graduate programs administered by joint MIT-WHOI committees draw from the faculty and staff of both institutions. Students accepted to the Joint Program have access to the extensive intellectual and physical resources available for advanced study at both Woods Hole and MIT. Upon admission, students register in the appropriate MIT department and at WHOI simultaneously, and are assigned academic advisors at each institution.

Graduate study in oceanography encompasses virtually all of the basic sciences as they apply to the marine environment: physics, chemistry, geology, geophysics, and biology. Applied ocean science and engineering allows for concentration in the major engineering fields of aeronautics and astronautics, civil and environmental, mechanical, and electrical engineering and computer science.

The Joint Program involves several departments at MIT—Biology, and Earth, Atmospheric, and Planetary Sciences in the School of Science; and Aeronautics and Astronautics, Civil and Environmental Engineering, Electrical Engineering and Computer Science, and Mechanical Engineering in the School of Engineering.

Research at WHOI is devoted to using the basic sciences and engineering to gain a better understanding of the marine environment. Some 200 scientists and engineers and a support staff of about 600 work in laboratories located in the village of Woods Hole and on the nearby Quisset Campus. Another 75 people operate three research vessels (ranging from 177 to 279 feet in length), the deep-diving submersible ALVIN, and smaller coastal vessels. WHOI also has remotely-operated research vehicles and autonomous underwater vehicles. Computer services provided within WHOI include links to other institutions and to national networks.

A videoconferencing system between MIT and Woods Hole provides interactive transmission for classes, meetings, and other joint events. Specialized research facilities include the National Ocean Sciences Accelerator Mass Spectrometry Facility and the North-East Regional Ion Microprobe Facility. The library facilities shared with the Marine Biological Laboratory are supplemented by collections of the Northeast Fisheries Center of the National Marine Fisheries Service and the US Geological Survey's Office of Marine Resources Branch of

Atlantic Geology, all located in Woods Hole. The village is situated on the southwest corner of Cape Cod, about 80 miles from Boston.

Subjects, seminars, and opportunities for research participation are offered at both MIT and WHOI. Place of residence is determined by the student's selected program of study and research interests, and transportation is provided between institutions. Students have the opportunity to participate in oceanographic cruises during graduate study.

The faculty of MIT, together with the WHOI scientific staff, offer a wide variety of formal and informal subjects in various aspects of oceanography and areas directly applicable to ocean science and engineering; both faculties are equally involved in all levels of instruction. The subjects are supplemented by numerous seminars, directed studies, and cross-registration privileges with Harvard. Complete listings can be found in the subject descriptions of each individual department.

Funding

Funding (<https://mit.who.edu/admissions/funding>), offered as research assistantships or fellowships to all entering graduate students, is sufficient to cover tuition and fees and provide a salary or stipend.

Inquiries

Application for admission (<https://apply.mit.edu/apply>) to the Joint Program in Oceanography and Applied Ocean Science and Engineering with the Woods Hole Oceanographic Institution (WHOI) should be made using Slate, MIT's online graduate application system. Requests for further information may be sent to jp-info@mit.edu. Information on the Joint Program (<http://mit.who.edu>) is available on its website (<https://mit.who.edu>).

Applied Ocean Science and Engineering

Applied ocean science and engineering involves the application of physics and the engineering sciences to the study of oceanic processes and the design of instruments, systems, and structures required to observe, measure, and work in the ocean. The Departments of Aeronautics and Astronautics, Civil and Environmental Engineering, Electrical Engineering and Computer Science, and Mechanical Engineering offer joint programs with WHOI in oceanographic engineering. The programs lead to the Master of Science, Engineer, Doctor of Science, or Doctor of Philosophy degree.

Biological Oceanography

The Joint Program in Oceanography/Applied Ocean Science and Engineering is a five-year program (<https://catalog.mit.edu/degree-charts/phd-biological-oceanography>) that offers a unique

opportunity for training and research in areas that combine observational, experimental, and theoretical approaches to the study of biological systems. Biological oceanography seeks to describe and understand the biological processes that are active in the marine and bordering environments. The research of biological oceanographers is diverse and includes ecology, toxicology, biochemistry, animal behavior and physiology, and molecular biology.

The Departments of Biology; Civil and Environmental Engineering; and Earth, Atmospheric, and Planetary Sciences offer programs with WHOI in biological oceanography. Students applying to the Joint Program must choose biological oceanography as their discipline and additionally choose one of the three associated MIT departments.

All students are required to submit a proposed course of study to the MIT-WHOI Joint Program for approval before the beginning of their first semester. With the assistance of academic advisors from both institutions, each student formulates a program of study involving core courses, more advanced subjects specific to the student's research interest, seminars, and research activities. Students should meet annually with their advisor to review their progress as well as the Academic Program Office's expectations of both students and advisors.

Students are encouraged to enter the program during the summer preceding the first academic year to gain early exposure to the research programs at WHOI. Students should register for a minimum of 36 units for fall and spring semesters, with 24 units for the summer. Core coursework should be completed by the end of the fourth semester in the program.

Incoming students are encouraged to evaluate whether their proposed research.

direction and training needs fit into the areas of biological oceanography, marine physiology, quantitative marine ecology. As detailed in the biological oceanography handbook, these tracks are meant to guide curriculum development rather than being restrictive. Completion of specific track requirements is not strictly required, but students are expected to articulate how proposed deviations better satisfy their training requirements and maintain equal rigor.

At the end of their first year, the student and advisor should find a Joint Program faculty member who will agree to serve as the chair of the student's general exam. The general exam consists of a research report that is completed by the end of third semester, and a thesis proposal defense that is completed by the end of the fourth semester.

To obtain the degree, students must complete mandatory coursework at MIT and WHOI, complete a research report, develop and defend a doctoral thesis proposal, and submit and defend an original theoretical or experimental research thesis. Upon successful completion of the Biological Oceanography discipline and thesis

defense, the student is awarded the Doctor of Philosophy or Doctor of Science in the designated field of Biology, Civil and Environmental Engineering, or Earth, Atmospheric and Planetary Sciences.

Chemical Oceanography

Chemical oceanographers study the chemical composition of the marine environment and the processes that have produced the present composition of sea water and sediments. Principal research areas include water column geochemistry, sedimentary geochemistry, seawater-basalt interactions, and atmospheric chemistry. The Departments of Earth, Atmospheric, and Planetary Sciences and Civil and Environmental Engineering offer programs with WHOI in chemical oceanography and marine geochemistry. These programs lead to the Doctor of Science or Doctor of Philosophy.

Marine Geology and Geophysics

The goal of marine geology and geophysics is to understand the physical and chemical processes that determine the structure and evolution of the ocean basins and their margins. Research is being conducted in a wide range of specialties including micropaleontology, paleoceanography, petrology and volcanic processes, seismology, gravity, magnetics, heat flow, sediment dynamics, and isotope geology. The Department of Earth, Atmospheric, and Planetary Sciences offers programs with WHOI in marine geology and geophysics that lead to the Doctor of Science or Doctor of Philosophy.

Physical Oceanography

MIT and the Woods Hole Oceanographic Institute (WHOI) offer a Doctor of Philosophy (PhD) or Doctor of Science (ScD) in physical oceanography (<https://catalog.mit.edu/degree-charts/phd-physical-oceanography>); these degrees are awarded interchangeably. The Joint Program in Physical Oceanography prepares students to carry out independent and creative research in the field of physical oceanography, which includes the exploration and study of the physics and geography of ocean currents and water properties.

The goal of the Joint Program is to lay the foundation for scholarship and research and to allow the student to follow their individual interests. Students typically complete the doctoral degree in five years. Students are eligible for fellowships, scholarships, and research assistantships for the first five years; extension of research beyond the fifth year requires a petition by the student and principal advisor.

Each student entering the program is assigned two advisors, one from MIT and one from WHOI. One of these is the principal advisor, with whom the student begins their research work; the secondary advisor offers advice from the perspective of the other institution

and is not required to advise in a scientific capacity. The initial assignment of advisors is made by the Joint Program before the student arrives for their first term and is based on the student's indicated scientific interests. In consultation with their advisors, the student must form a four-to-five-person thesis committee at least two months prior to their thesis proposal defense. The principal advisor serves as chair of this committee, which must feature at least one member from MIT and one member from WHOI. The committee must also include one member from the Joint Committee on Physical Oceanography (JCPO), unless the student petitions JCPO and is granted a waiver. Students are expected to meet with their thesis committee at least twice a year.

The general exam and associated foundational coursework should be completed by the end of the student's second year in the program. Students are encouraged to consult with their advisors to determine courses that best suit their research and interests. Students are expected to take 9–12 courses, which typically include four area-specific core courses, one math course, and 4–7 electives. Students may choose elective courses from the offerings of any MIT or WHOI department, with cross-registration available at Harvard. Focus areas include but are not limited to general physical oceanography, physical oceanography and climate, physical-bio-chemical interactions, and coastal/nearshore physical oceanography and engineering. It is expected that the student focus on research during the summer and Independent Activities Period in January of each year.

The general exam qualifies the student for PhD research in the Joint Program and is typically taken after two years in the program. Students who enter the Joint Program with a related master's degree can request to take the exam earlier. The general exam includes formal reports describing two research projects, and an oral exam.

A doctoral thesis is required, including formal defense chaired by a faculty member who is not on thesis committee. This person is selected by the student in consultation with their advisor and must be approved by the Joint Program. In addition, students are expected to give a public seminar covering their thesis research or a substantial section of their thesis research; this seminar takes place about four months before the formal defense at the institution (MIT or WHOI) that is not hosting the formal defense.

After completing all requirements, students are awarded a Doctor of Philosophy or Doctor of Science in Physical Oceanography. Visit the MIT-WHOI Physical Oceanography website (<https://mit.whoi.edu/academics/fields/physical-oceanography>) for additional information on the doctoral program.