DEPARTMENT OF BIOLOGY

The Department of Biology (*https://biology.mit.edu*) offers undergraduate, graduate, and postdoctoral training in basic biology and in a variety of biological fields of specialization. The quantitative aspects of biology—including molecular biology, biochemistry, genetics, and cell biology—represent the core of the program. Students in the department are encouraged to acquire a solid background in the physical sciences not only to master the applications of mathematics, physics, and chemistry to biology but also to develop an integrated scientific perspective. The various programs, which emphasize practical experimentation, combine a minimum of formal laboratory exercises with ample opportunities for research work both in project-oriented laboratory subjects and in the department's research laboratories. Students at all levels are encouraged to acquire familiarity with advanced research techniques and to participate in seminar activities.

Undergraduate Study

Bachelor of Science in Biology (Course 7)

The curriculum leading to the Bachelor of Science in Biology (*https://catalog.mit.edu/degree-charts/biology-course-7*) is designed to prepare students for a professional career in the area of the biological sciences. Graduates of this program are well prepared for positions in industrial or research institutes. However, experience has shown that many graduates choose to continue their education at a graduate school in order to obtain a PhD in an area such as biochemistry, microbiology, genetics, biophysics, cell biology, or physiology, followed by research or teaching in one of those areas. The undergraduate curriculum is also excellent preparation for students who wish to continue their education toward an MD, particularly if their career plans include laboratory investigations bearing on human disease. Students are encouraged to use their elective subjects for more advanced subjects in their field and for additional study in basic and advanced subjects offered in various departments.

Bachelor of Science in Chemistry and Biology (Course 5-7)

The Departments of Biology and Chemistry jointly offer a Bachelor of Science in Chemistry and Biology (*https://catalog.mit.edu/degree-charts/chemistry-biology-course-5-7*). A detailed description of the requirements for this degree program (*https://catalog.mit.edu/interdisciplinary/undergraduate-programs/degrees/chemistry-biology*) can be found in the section on Interdisciplinary Programs.

Bachelor of Science in Computer Science and Molecular Biology (Course 6-7)

The Department of Biology jointly offers a Bachelor of Science in Computer Science and Molecular Biology (*https://catalog.mit.edu/degree-charts/computer-science-molecular-biology-course-6-7*) with the Department of Electrical Engineering and Computer Science. Requirements for this degree program (*https://catalog.mit.edu/interdisciplinary/undergraduate-programs/degrees/computer-science-molecular-biology*) can be found in the section on Interdisciplinary Programs.

Minor in Biology

The department offers a Minor in Biology; the requirements are as follows:

5.12	Organic Chemistry I	12
7.03	Genetics	12
7.05	General Biochemistry	12
or 5.07[J]	Introduction to Biological Chemistry	
Select two of the following:		24-30
7.002 & 7.003[J]	Fundamentals of Experimental Molecular Biology and Applied Molecular Biology Laboratory	
7.06	Cell Biology	
7.08[J]	Fundamentals of Chemical Biology	
7.093 & 7.094	Modern Biostatistics and Modern Computational Biology	
7.20[J]	Human Physiology	
7.21	Microbial Physiology	
7.23[J]	Immunology	
7.26	Molecular Basis of Infectious Disease	
7.27	Principles of Human Disease and Aging	
7.28	Molecular Biology	
7.29[J]	Cellular and Molecular Neurobiology	
7.30[J]	Fundamentals of Ecology	
7.31	Current Topics in Mammalian Biology: Medical Implications	
7.32	Systems Biology	
7.33[J]	Evolutionary Biology: Concepts, Models and Computation	
7.37[J]	Molecular and Engineering Aspects of Biotechnology	
or 7.371	Biological and Engineering Principles Underlying Novel Biotherapeutics	
7.45	The Hallmarks of Cancer	
7.46	Building with Cells	
7.49[J]	Developmental Neurobiology	
Total Units		**60-66**

For a general description of the minor program (*https://catalog.mit.edu/mit/undergraduate-education/academic-programs/minors*), see Undergraduate Education.

Inquiries
Additional information regarding undergraduate academic programs and research opportunities may be obtained from the Biology Education Office (*undergradbio@mit.edu*), Room 68-120, 617-253-4718.

Graduate Study

The Department of Biology offers graduate work leading to the Doctor of Philosophy. Students may choose from among the following fields of specialization.

Biochemistry, Biophysics, and Structural Biology focus on improving our understanding of molecular processes central to life. Using *in vitro* approaches, biochemists and biophysicists analyze the mechanisms of biological information transfer, from maintenance and replication of the genome to protein synthesis, sorting, and processing. Structural biologists elucidate the molecular shapes of biological macromolecules and complexes and determine how structure enables function. Applying principles and tools from chemistry and physics, biochemists and biophysicists elaborate the details of protein and nucleic acid folding and interactions, biomolecular dynamics, catalysis, and macromolecular assembly.

Cancer Biology involves the discovery of genes implicated in cancer, the identification of cell biological processes affected during tumorigenesis, and the development of potential new therapeutic targets. Cancer biologists employ genetic approaches, including classical genetics, to determine the components of growth control pathways in model organisms, cloning of human oncogenes and tumor suppressor genes, and generating mutant mouse strains to study these and other cancer-associated genes. They also perform biochemical and cell biological studies to elucidate the function of cancer genes, the details of proliferation, cell cycle and cell death pathways, the nature of cell-cell and cell-matrix interactions, and the mechanisms of chromosome stability and of DNA repair, replication, and transcription.

Cell Biology is the study of processes carried out by individual cells, such as cell division, organelle inheritance and biogenesis, signal transduction, and motility. These processes are often affected by components in the environment, including nutrients, growth signals, and cell-cell contact. Cell biologists study these processes using single-celled organisms, such as bacteria and yeast; multicellular organisms, such as zebrafish and mice; established mammalian tissue culture lines; and primary cell cultures derived from recombinant animals.

Computational Biology applies quantitative methods to the study of molecular, cellular, and organismal biology. Computational biologists develop and apply models, analyze data, and run simulations to study nucleic acid and protein sequences, biomolecular structures and functions, cellular information processing, tissue morphogenesis, and emergent behaviors.

Genetics is the study of genes, genetic variation, and heredity in living organisms that range in complexity from viruses to single-celled organisms to multicellular organisms, including humans. Geneticists seek to understand the transmission of genes by analyzing DNA replication, DNA repair, chromosome segregation, and cell division. They also use genetic and genomic tools to identify and analyze the genes and gene regulators required for normal biological processes, including development, sex determination, and aging, as well as for the etiology of disease.

Human Disease applies molecular genetics to the problems of human disease. The range of disease areas includes developmental defects, cancer, atherosclerosis and heart disease, neuromuscular diseases, and diseases of other organ systems. Researchers use genetic and genomic strategies to identify, isolate, and characterize genes that cause and contribute to the etiology of human diseases. They explore the mechanisms underlying developmental defects and diseases through the comparison of the genetic pathways in humans and model organisms. They also isolate cells from affected patients to generate novel assay systems to examine gene-function-pathology relationships.

Immunology focuses on the genetic, cellular, and molecular mechanisms by which organisms respond to and eliminate infections by a large number of pathogens. The immune response requires an elaborate collaboration of different cells of the immune system, including macrophages, B lymphocytes, and T lymphocytes. Immunologists study the role of the immune system not just in response to infection but also in a range of human diseases, including cancer.

Microbiology is the study of microscopic organisms, such as bacteria, viruses, archaea, fungi, and protozoa. Exploiting sophisticated genetic, molecular biological, and biochemical systems available for microorganisms, microbiologists obtain high-resolution insights into the fundamental processes necessary for life and explore ways to manipulate microorganisms to achieve particular desired ends. They also determine how aspects of the microbial life cycle and lifestyle enable their survival within particular biological niches and facilitate interactions with their environment.

Neurobiology seeks to understand how the remarkable diversity in neuronal cell types and their connections are established and how changes in them underlie learning and thinking. Neurobiologists identify and characterize the molecules involved in specifying neuronal cell fate in vertebrates and invertebrates, and in guiding axons to their correct targets.

Stem Cell and Developmental Biology explores how a germ line stem cell develops into a multicellular organism, which requires that cells divide, differentiate, and assume their proper positions relative to one another as they produce organ systems and entire

organisms. Stem cells are unusual cells in the body that retain the capacity to both self-renew and differentiate. Stem cell researchers identify the molecular mechanisms underlying stem cell renewal and differentiation, and use stem cells for disease modeling and regenerative medicine.

Admission Requirements for Graduate Study

In the Department of Biology, the Master of Science is not a prerequisite for a program of study leading to the doctorate.

The department modifies the General Institute Requirements for admission to graduate study as follows: 18.01 Calculus, 18.02 Calculus; one year of college physics; 5.12 Organic Chemistry I; and professional subjects including general biochemistry, genetics, and physical chemistry. However, students may make up some deficiencies over the course of their graduate work.

Doctor of Philosophy

The General Degree Requirements for the Doctor of Philosophy (*https://catalog.mit.edu/mit/graduate-education/general-degree-requirements*) are listed under Graduate Education. In the departmental program, each graduate student is expected to acquire solid foundations sufficient for approaching biological questions using the methods of biochemistry, genetics, and quantitative analysis. Most students take subjects in these areas during the first year. All students are required to take three subjects:

7.50	Method and Logic in Molecular Biology	12
7.51	Principles of Biochemical Analysis	12
7.52	Genetics for Graduate Students	12

7.50 is a seminar designed specifically to introduce graduate students to in-depth discussion and analysis of topics in molecular biology.

Students have a choice of several elective subjects, which have been designed for the entering graduate student. One of the elective subjects must focus on computational and quantitative approaches to biology. Typically, students choose one of the following subjects:

7.571 & 7.572	Quantitative Analysis of Biological Data and Quantitative Measurements and Modeling of Biological Systems	12
7.81[J]	Systems Biology	12

In addition to providing a strong formal background in biology, the first-year program serves to familiarize the students with faculty and students in all parts of the department.

Interdisciplinary Programs

Joint Program with the Woods Hole Oceanographic Institution

The Joint Program with the Woods Hole Oceanographic Institution (WHOI) (*http://mit.whoi.edu*) is intended for students whose primary career objective is oceanography or oceanographic engineering. Students divide their academic and research efforts between the campuses of MIT and WHOI. Joint Program students are assigned an MIT faculty member as academic advisor; thesis research may be advised by MIT or WHOI faculty. While in residence at MIT, students follow a program similar to that of other students in their home department. The program is described in more detail (*https://catalog.mit.edu/interdisciplinary/graduate-programs/joint-program-woods-hole-oceanographic-institution*) under Interdisciplinary Graduate Programs.

Master of Engineering in Computer Science and Molecular Biology (Course 6-7P)

The Departments of Biology and Electrical Engineering and Computer Science jointly offer a Master of Engineering in Computer Science and Molecular Biology (6-7P) (*https://catalog.mit.edu/degree-charts/master-computer-science-molecular-biology-course-6-7p*). A detailed description of the program (*https://catalog.mit.edu/interdisciplinary/graduate-programs/computer-science-molecular-biology*) requirements may be found under the section on Interdisciplinary Programs.

Financial Support

Students who are accepted into the graduate program are provided with support from departmental training grants, departmental funds for teaching assistants, and research grants. In addition, some students bring National Science Foundation and other competitive fellowships. Through these sources, full tuition plus a stipend or salary for living expenses are provided.

Students are encouraged to apply for outside fellowships for which they are eligible, such as the NSF Fellowships. Information regarding graduate student fellowships is available at most colleges from the career planning office.

Inquiries

Additional information regarding graduate academic programs, research activities, admissions, financial aid, and assistantships may be obtained from the Biology Education Office (*gradbio@mit.edu*), Room 68-120, 617-253-3717.

Faculty and Teaching Staff

Amy E. Keating, PhD
Jay A. Stein (1968) Professor
Professor of Biology
Professor of Biological Engineering
Head, Department of Biology

Iain Cheeseman, PhD
Professor of Biology
Associate Head, Department of Biology

Professors

Tania Baker, PhD
E.C. Whitehead Professor
Professor of Biology
(On leave, spring)

David Bartel, PhD
Professor of Biology
(On leave)

Facundo Batista, PhD
Phillip and Susan Ragon Professor
Professor of Biology

Stephen P. Bell, PhD
Uncas (1923) and Helen Whitaker Professor
Professor of Biology
(On leave)

Laurie Boyer, PhD
Professor of Biology
Professor of Biological Engineering

Christopher B. Burge, PhD
Uncas (1923) and Helen Whitaker Professor
Professor of Biology
Professor of Biological Engineering

Jianzhu Chen, PhD
Professor of Biology

Sallie W. Chisholm, PhD
Institute Professor
Professor of Civil and Environmental Engineering
Professor of Biology

Catherine L. Drennan, PhD
John and Dorothy Wilson Professor
Professor of Biology
Professor of Chemistry

Mary Gehring, PhD
Professor of Biology

Alan D. Grossman, PhD
Praecis Professor
Professor of Biology

Leonard Pershing Guarente, PhD
Novartis Professor of Biology

Michael Hemann, PhD
Professor of Biology
(On leave, spring)

H. Robert Horvitz, PhD
David H. Koch Professor
Professor of Biology

David E. Housman, PhD
Virginia and Daniel K. Ludwig Professor for Cancer Research
Professor of Biology

Barbara Imperiali, PhD
Class of 1922 Professor
Professor of Biology
Professor of Chemistry

Tyler E. Jacks, PhD
David H. Koch Professor
Daniel K. Ludwig Professor for Cancer Research
Professor of Biology

Rudolf Jaenisch, MD
Professor of Biology

Chris Kaiser, PhD
Amgen Professor
Professor of Biology

Sally Kornbluth, PhD
Ellen Swallow Richards (1873) Professor
President
Professor of Biology

Monty Krieger, PhD
Whitehead Professor
Professor of Biology
(On leave, fall)

Eric S. Lander, PhD
Professor of Biology

Michael T. Laub, PhD
Salvador E. Luria Professor
Professor of Biology

Douglas A. Lauffenburger, PhD
Ford Foundation Professor
Professor of Biological Engineering
Professor of Chemical Engineering
Professor of Biology

Jacqueline Lees, PhD
Virginia and Daniel K. Ludwig Professor for Cancer Research
Professor of Biology
(On leave, fall)

Ruth E. Lehmann, PhD
Professor of Biology

Daniel Lew, PhD
Professor of Biology

J. Troy Littleton, MD, PhD
Menicon Professor in Neuroscience
Professor of Biology
Professor of Brain and Cognitive Sciences

Harvey F. Lodish, PhD
Professor of Biology
Professor of Biological Engineering

Adam C. Martin, PhD
Professor of Biology

Elly Nedivi, PhD
William R. (1964) and Linda R. Young Professorship
Professor of Neuroscience
Professor of Biology

David C. Page, MD
Professor of Biology
Member, Health Sciences and Technology Faculty

Peter Reddien, PhD
Professor of Biology

Robert T. Sauer, PhD
Salvador E. Luria Professor
Professor of Biology

Thomas Schwartz, PhD
Boris Magasanik Professor in Biology

Anthony J. Sinskey, ScD
Professor of Biology
(On leave, spring)

Susumu Tonegawa, PhD
Picower Professor
Professor of Biology
Professor of Neuroscience

Matthew G. Vander Heiden, MD, PhD
Lester Wolfe Professor of Molecular Biology
Professor of Biology

Graham C. Walker, PhD
Professor of Biology

Robert A. Weinberg, PhD
Daniel K. Ludwig Professor for Cancer Research
Professor of Biology

Jonathan Weissman, PhD
Professor of Biology

Matthew A. Wilson, PhD
Sherman Fairchild Professor
Professor of Neuroscience
Professor of Biology

Michael B. Yaffe, MD, PhD
David H. Koch Professor in Science
Professor of Biology
Professor of Biological Engineering

Yukiko Yamashita, PhD
Professor of Biology

Richard A. Young, PhD
Professor of Biology

Associate Professors

Eliezer Calo, PhD
Associate Professor of Biology

Joseph Davis, PhD
Associate Professor of Biology

Rebecca Lamason, PhD
Associate Professor of Biology

Gene-Wei Li, PhD
Associate Professor of Biology

Sebastian Lourido, PhD
Associate Professor of Biology
(On leave, spring)

Stefani Spranger, PhD
Associate Professor of Biology

Omer Yilmaz, PhD
Associate Professor of Biology
(On leave, fall)

Assistant Professors
Lindsay Case, PhD
Irwin and Helen Sizer Career Development Professor
Assistant Professor of Biology

Yiyin Erin Chen, MD, PhD
Robert A. Swanson (1969) Career Development Professor of Life Sciences
Assistant Professor of Biology

Olivia Corradin, PhD
Class of 1922 Career Development Professor
Assistant Professor of Biology

Whitney Henry, PhD
Assistant Professor of Biology

Sinisa Hrvatin, PhD
Thomas D. and Virginia W. Cabot Career Development Professor
Assistant Professor of Biology

Ankur Jain, PhD
Assistant Professor of Biology

Kristin Knouse, PhD
Whitehead Career Development Professor
Assistant Professor of Biology

Pulin Li, PhD
Assistant Professor of Biology

Hernandez Moura Silva, PhD
Assistant Professor of Biology

Sergey Ovchinnikov, PhD
Assistant Professor of Biology

Sara Prescott, PhD
Pfizer Inc. - Gerald D. Laubach Career Development Chair
Assistant Professor of Biology

Alison Ringel, PhD
Assistant Professor of Biology

Francisco J. Sánchez-Rivera, PhD
Eisen and Chang Career Development Professor
Assistant Professor of Biology

Yadira Soto-Feliciano, PhD
Howard S. (1953) and Linda B. Stern Career Development Professor
Assistant Professor of Biology

Seychelle Vos, PhD
Assistant Professor of Biology

Brandon Weissbourd, PhD
Doherty Professorship in Ocean Utilization
Assistant Professor of Biology

Harikesh Wong, PhD
Assistant Professor of Biology

Professors of the Practice
Bruce Walker, MD
Professor of the Practice of Biology

Senior Lecturers
Mandana Sassanfar, PhD
Senior Lecturer in Biology

Lecturers
Vivian Siegel, PhD
Lecturer in Biology

Mary Ellen Wiltrout, PhD
Lecturer in Biology

Instructors
Monika Avello, PhD
Instructor of Biology

Darcy Gordon, PhD
Instructor of Biology

Tyler Smith, PhD
Instructor of Biology

Technical Instructors
Vanessa J. Cheung, PhD
Senior Technical Instructor of Biology

Wai Keung Chu, PhD
Technical Instructor of Biology

Anthony Fuccione, BS
Technical Instructor of Biology

Research Staff

Research Scientists
Mary Anderson, PhD
Research Scientist of Biology

Vincent Butty, MD, PhD
Research Scientist of Biology

Alexandra D'Ordine, PhD
Research Scientist of Biology

Huiming Ding, PhD
Research Scientist of Biology

Brian Grone, PhD
Research Scientist of Biology

Charley Gruber, PhD
Research Scientist of Biology

Stuart S. Levine, PhD
Research Scientist of Biology

Daniel Cham-Chin Lim, PhD
Research Scientist of Biology

Jennifer Podgorski, PhD
Research Scientist of Biology

Janet L. Smith, PhD
Research Scientist of Biology

Sarah Sterling, PhD
Research Scientist of Biology

Alexei Stortchevoi, PhD
Research Scientist of Biology

Yann Vanrobaeys, PhD
Research Scientist of Biology

Mohan Viswanathan, PhD
Research Scientist of Biology

Dandan Yang, PhD
Research Scientist of Biology

Professors Emeriti

David Baltimore, PhD
Professor Emeritus of Biology

Martha Constantine-Paton, PhD
Professor Emerita of Neuroscience
Professor Emerita of Biology

Gerald R. Fink, PhD
Professor Emeritus of Biology

Malcolm L. Gefter, PhD
Professor Emeritus of Biochemistry

Frank Gertler, PhD
Professor Emeritus of Biology

Nancy Haven Hopkins, PhD
Amgen Professor Emerita
Professor Emerita of Biology

Richard O. Hynes, PhD
Daniel K. Ludwig Professor Emeritus for Cancer Research
Professor Emeritus of Biology

Jonathan Alan King, PhD
Professor Emeritus of Molecular Biology

Terry L. Orr-Weaver, PhD
Professor Emerita of Biology

William G. Quinn, PhD
Professor Emeritus of Neurobiology
Professor Emeritus of Biology

Uttam L. RajBhandary, PhD
Lester Wolfe Professor Emeritus of Molecular Biology

Phillips W. Robbins, PhD
Professor Emeritus of Biochemistry

Leona D. Samson, PhD
Uncas (1923) and Helen Whitaker Professor Emerita
Professor Emerita of Biological Engineering
Professor Emerita of Biology

Paul R. Schimmel, PhD
John D. MacArthur Professor Emeritus
Professor Emeritus of Biochemistry and Biophysics

Phillip A. Sharp, PhD
Institute Professor Emeritus
Professor Emeritus of Biology

Ethan R. Signer, PhD
Professor Emeritus of Biology

Hazel L. Sive, PhD
Professor Emerita of Biology

Frank Solomon, PhD
Professor Emeritus of Biology

Lisa A. Steiner, MD
Professor Emerita of Immunology

JoAnne Stubbe, PhD
Novartis Professor Emerita
Professor Emerita of Chemistry
Professor Emerita of Biology

Undergraduate Subjects

Introductory Biology
All five subjects cover the same core material, comprising about 50% of the course, while the remaining material is specialized for each version as described below. Core material includes fundamental principles of biochemistry, genetics, molecular biology, and cell biology. These topics address structure and regulation of genes, structure and synthesis of proteins, how these molecules are integrated into cells and how cells communicate with one another.

7.012 Introductory Biology
Prereq: None
U (Fall)
5-0-7 units. BIOLOGY
Credit cannot also be received for 7.013, 7.014, 7.015, 7.016, ES.7012, ES.7013

Exploration into biochemistry and structural biology, molecular and cell biology, genetics and immunology, and viruses and bacteria. Special topics can include cancer biology, aging, and the human microbiome project. Enrollment limited to seating capacity of classroom. Admittance may be controlled by lottery.
O. Corradin, E. Lander

7.013 Introductory Biology
Prereq: None
Acad Year 2024-2025: Not offered
Acad Year 2025-2026: U (Spring)
5-0-7 units. BIOLOGY
Credit cannot also be received for 7.012, 7.014, 7.015, 7.016, ES.7012, ES.7013

Genomic approaches to human biology, including neuroscience, development, immunology, tissue repair and stem cells, tissue engineering, and infectious and inherited diseases, including cancer. Enrollment limited to seating capacity of classroom. Admittance may be controlled by lottery.
Staff

7.014 Introductory Biology
U (Spring)
5-0-7 units. BIOLOGY
Credit cannot also be received for 7.012, 7.013, 7.015, 7.016, ES.7012, ES.7013

Studies the fundamental principles of biology and their application towards understanding the Earth as a dynamic system shaped by life. Focuses on environmental life science with an emphasis on biogeochemistry, population genetics, population and community ecology, evolution, and the impact of climate change. Enrollment limited to seating capacity of classroom. Admittance may be controlled by lottery.
G. C. Walker, D. Des Marais

7.015 Introductory Biology
Prereq: None
U (Fall)
5-0-7 units. BIOLOGY
Credit cannot also be received for 7.012, 7.013, 7.014, 7.016, ES.7012, ES.7013

Emphasizes the application of fundamental biological principles to modern, trending topics in biology. Specific modules focus on antibiotic resistance, biotechnology (e.g., genetically-modified organisms and CRISPR-based genome editing), personal genetics and genomics, viruses and vaccines, ancient DNA, and the metabolism of drugs. Includes discussion of the social and ethical issues surrounding modern biology. Limited to 60; admittance may be controlled by lottery.
M. Laub, S. Vos

7.016 Introductory Biology
Prereq: None
U (Spring)
5-0-7 units. BIOLOGY
Credit cannot also be received for 7.012, 7.013, 7.014, 7.015, ES.7012, ES.7013

Introduction to fundamental principles of biochemistry, molecular biology and genetics for understanding the functions of living systems. Covers examples of the use of chemical biology, the use of genetics in biological discovery, principles of cellular organization and communication, immunology, cancer, and engineering biological systems. In addition, includes 21st-century molecular genetics in understanding human health and therapeutic intervention. Enrollment limited to seating capacity of classroom. Admittance may be controlled by lottery.
S. Hrvatin, A. Martin

7.00 COVID-19, SARS-CoV-2 and the Pandemic
Prereq: None
Acad Year 2024-2025: Not offered
Acad Year 2025-2026: U (Fall)
1-0-1 units

Lectures by leading experts on the fundamentals of COVID-19 epidemiology, coronavirus and host cell biology, immunity, vaccine development, clinical disease and therapy. Subject can count toward the 6-unit discovery-focused credit limit for first year students.
R. Young, F. Batista

7.002 Fundamentals of Experimental Molecular Biology
Prereq: None
U (Fall, Spring)
1-4-1 units. Partial Lab

Introduces the experimental concepts and methods of molecular biology. Covers basic principles of experimental design and data analysis, with an emphasis on the acquisition of practical laboratory experience. Satisfies 6 units of Institute Laboratory credit. Satisfies biology laboratory credit for pre-health professions. Enrollment limited.
Fall: T. Baker, T. Schwartz. Spring: T. Schwartz

7.003[J] Applied Molecular Biology Laboratory
Same subject as 10.7003[J]
Prereq: 7.002
U (Fall, Spring)
2-7-3 units. Partial Lab

Laboratory-based exploration of modern experimental molecular biology. Specific experimental system studied may vary from term to term, depending on instructor. Emphasizes concepts of experimental design, data analysis and communication in biology and how these concepts are applied in the biotechnology industry. Satisfies 6 units of Institute Laboratory credit. Enrollment limited; admittance may be controlled by lottery.
Fall: E. Calo, K. Knouse. Spring: L. Case, H. Moura Silva

7.03 Genetics
Prereq: Biology (GIR)
U (Fall, Spring)
4-0-8 units. REST

The principles of genetics with application to the study of biological function at the level of molecules, cells, and multicellular organisms, including humans. Structure and function of genes, chromosomes, and genomes. Biological variation resulting from recombination, mutation, and selection. Population genetics. Use of genetic methods to analyze protein function, gene regulation, and inherited disease.
Fall: M. Gehring, P. Reddien. Spring: O. Corradin, F. Sánchez-Rivera

7.05 General Biochemistry
Prereq: (Biology (GIR) and 5.12) or permission of instructor
U (Spring)
5-0-7 units. REST
Credit cannot also be received for 5.07[J], 20.507[J]

Contributions of biochemistry toward an understanding of the structure and functioning of organisms, tissues, and cells. Chemistry and functions of constituents of cells and tissues and the chemical and physical-chemical basis for the structures of nucleic acids, proteins, and carbohydrates. Basic enzymology and biochemical reaction mechanisms involved in macromolecular synthesis and degradation, signaling, transport, and movement. General metabolism of carbohydrates, fats, and nitrogen-containing materials such as amino acids, proteins, and related compounds.
A. Ringel, M. Vander Heiden, M. Yaffe

7.06 Cell Biology
Prereq: 7.03 and 7.05
U (Fall, Spring)
4-0-8 units

Presents the biology of cells of higher organisms. Studies the structure, function, and biosynthesis of cellular membranes and organelles; cell growth and oncogenic transformation; transport, receptors, and cell signaling; the cytoskeleton, the extracellular matrix, and cell movements; cell division and cell cycle; functions of specialized cell types. Emphasizes the current molecular knowledge of cell biological processes as well as the genetic, biochemical, and other experimental approaches that resulted in these discoveries.
Fall: P. Li, S. Lourido. Spring: K. Knouse, R. Lamason

7.08[J] Fundamentals of Chemical Biology
Same subject as 5.08[J]
Subject meets with 7.80
Prereq: (Biology (GIR), 5.13, and (5.07[J] or 7.05)) or permission of instructor
U (Spring)
4-0-8 units

See description under subject 5.08[J].
B. Imperiali, R. Raines

7.093 Modern Biostatistics
Subject meets with 7.573
Prereq: 7.03 and 7.05
U (Spring; first half of term)
2-0-4 units

Provides a practical introduction to probability and statistics used in modern biology. Topics covered include discrete and continuous probability distributions, statistical modeling, hypothesis testing, independence, conditional probability, multiple test corrections, nonparametric methods, clustering, correlation, linear regression, principal components analysis with applications to high-throughput DNA sequencing, and image data analysis. Homework is in the R programming language, but prior programming experience is not required. Students taking the graduate version are expected to explore the subject in greater depth.
A. Jain, H. Wong

7.094 Modern Computational Biology
Subject meets with 7.574
Prereq: 7.03 and 7.05
U (Spring; second half of term)
2-0-4 units

Introduces modern methods in computational biology, focusing on DNA/RNA/protein analysis. Topics include next-generation DNA sequencing and sequencing data analysis, RNA-seq (bulk and single-cell), and protein dynamics. Students taking the graduate version are expected to explore the subject in greater depth.
A. Jain, H. Wong

7.102 Introduction to Molecular Biology Techniques
Prereq: None
U (IAP)
0-5-1 units. Partial Lab

Designed primarily for first-year students with little or no lab experience. Introduces basic methods of experimental molecular biology. Specific experiments vary from year-to-year, but will focus on the identification and characterization of bacteria and bacteriophages from the wild using an array of basic methods in molecular biology and microbiology. Biology GIR or Chemistry GIR recommended. Satisfies 6 units of Institute Laboratory credit. Limited to 16; admittance may be controlled by lottery.
A. Martin

7.11 Biology Teaching
Prereq: None
U (Fall, Spring)
Units arranged
Can be repeated for credit.

For qualified undergraduate students interested in gaining some experience in teaching. Laboratory, tutorial, or classroom teaching under the supervision of a faculty member. Students selected by interview.
Consult Staff

7.19 Communication in Experimental Biology
Prereq: (7.06 and (5.362, 7.003[J], or 20.109)) or permission of instructor
U (Fall, Spring)
4-4-4 units

Students carry out independent literature research. Journal club discussions are used to help students evaluate and write scientific papers. Instruction and practice in written and oral communication is provided.
Fall: F. Batista, D. Housman. Spring: C. Kaiser

7.20[J] Human Physiology
Same subject as HST.540[J]
Prereq: 7.05
Acad Year 2024-2025: Not offered
Acad Year 2025-2026: U (Fall)
5-0-7 units

Comprehensive exploration of human physiology, emphasizing the molecular basis and applied aspects of organ function and regulation in health and disease. Includes a review of cell structure and function, as well as the mechanisms by which the endocrine and nervous systems integrate cellular metabolism. Special emphasis on examining the cardiovascular, pulmonary, gastrointestinal, and renal systems, as well as liver function, drug metabolism, and pharmacogenetics.
M. Krieger, O. Yilmaz

7.21 Microbial Physiology
Subject meets with 7.62
Prereq: 7.03 and 7.05
U (Fall)
4-0-8 units

Biochemical properties of bacteria and other microorganisms that enable them to grow under a variety of conditions. Interaction between bacteria and bacteriophages. Genetic and metabolic regulation of enzyme action and enzyme formation. Structure and function of components of the bacterial cell envelope. Protein secretion with a special emphasis on its various roles in pathogenesis. Additional topics include bioenergetics, symbiosis, quorum sensing, global responses to DNA damage, and biofilms. Students taking the graduate version are expected to explore the subject in greater depth.
G. C. Walker, A. J. Sinskey

7.23[J] Immunology
Same subject as 20.230[J]
Subject meets with 7.63[J], 20.630[J]
Prereq: 7.06
U (Spring)
5-0-7 units

Comprehensive survey of molecular, genetic, and cellular aspects of the immune system. Topics include innate and adaptive immunity; cells and organs of the immune system; hematopoiesis; immunoglobulin, T cell receptor, and major histocompatibility complex (MHC) proteins and genes; development and functions of B and T lymphocytes; immune responses to infections and tumors; hypersensitivity, autoimmunity, and immunodeficiencies. Particular attention to the development and function of the immune system as a whole, as studied by modern methods and techniques. Students taking graduate version explore the subject in greater depth, including study of recent primary literature.
S. Spranger, M. Birnbaum

7.24 Advanced Concepts in Immunology
Subject meets with 7.84
Prereq: 7.23[J]
U (Spring)
3-0-9 units

Provides a comprehensive and intensified understanding of the relevance of the immune system beyond immunity. Focuses on how the immune system intersects with all aspects of body homeostasis/physiology or disease and how the immune system can be manipulated therapeutically. New advances in the intersection of immunology with cancer biology, neurosciences, metabolism, aging, and maternal-fetal immunology or similar explored. Presents new modern methods and techniques applicable beyond immunology. Includes critical analysis and discussion of assigned readings. Students apply principles learned in class to generate a potential research project, presented in a written form. Students taking graduate version complete additional assignments.
H. Moura Silva, S. Spranger

7.26 Molecular Basis of Infectious Disease
Subject meets with 7.66
Prereq: 7.06
U (Spring)
4-0-8 units

Focuses on the principles of host-pathogen interactions with an emphasis on infectious diseases of humans. Presents key concepts of pathogenesis through the study of various human pathogens. Includes critical analysis and discussion of assigned readings. Students taking the graduate version are expected to explore the subject in greater depth.
E. Chen, R. Lamason

7.27 Principles of Human Disease and Aging
Prereq: 7.06
U (Spring)
4-0-8 units

Covers modern approaches to human diseases and aging, emphasizing the molecular and cellular basis of genetic diseases, infectious diseases, aging, and cancer. Topics include the genetics of simple and complex traits; karyotypic analysis and positional cloning; genetic diagnosis; evolutionary determination of aging, genetic and molecular aspects of aging, HIV/AIDs and other infectious diseases; the roles of oncogenes and tumor suppressors; the interaction between genetics and environment; animal models of human disease, cancer, and aging; and treatment strategies for diseases and aging. Includes a paper describing novel treatment options for a specific disease chosen by each student.
D. Housman, Y. Soto-Feliciano

7.28 Molecular Biology
Subject meets with 7.58
Prereq: 7.03; *Coreq: 7.05*
U (Spring)
5-0-7 units

Detailed analysis of the biochemical mechanisms that control the maintenance, expression, and evolution of prokaryotic and eukaryotic genomes. Topics covered in lecture and readings of relevant literature include: gene regulation, DNA replication, genetic recombination, and mRNA translation. Logic of experimental design and data analysis emphasized. Presentations include both lectures and group discussions of representative papers from the literature. Students taking the graduate version are expected to explore the subject in greater depth.
E. Calo, Y. Soto-Feliciano

7.29[J] Cellular and Molecular Neurobiology
Same subject as 9.09[J]
Prereq: 7.05 or 9.01
U (Spring)
4-0-8 units

Introduction to the structure and function of the nervous system. Emphasizes the cellular properties of neurons and other excitable cells. Includes the structure and biophysical properties of excitable cells, synaptic transmission, neurochemistry, neurodevelopment, integration of information in simple systems, and detection and information coding during sensory transduction.
T. Littleton, S. Prescott

7.30[J] Fundamentals of Ecology
Same subject as 1.018[J], 12.031[J]
Prereq: None
U (Fall)
4-0-8 units. REST

See description under subject 1.018[J].
M. Follows, D. Des Marais

7.31 Current Topics in Mammalian Biology: Medical Implications
Prereq: 7.06 or permission of instructor
Acad Year 2024-2025: Not offered
Acad Year 2025-2026: U (Fall)
4-0-8 units

Covers recent advances in mammalian cell and developmental biology with particular emphasis on approaches that utilize mouse genetics. Combines formal lectures on selected topics with readings of original papers which are discussed in class. Major emphasis on the implications of mechanisms of human genetic diseases. Topics include early mammalian development; genomic imprinting; X inactivation; embryonic stem cells; nuclear reprogramming of somatic cells; cell migration; nervous system development; and central nervous system degenerative diseases such as Alzheimer's and Huntington's disease. Limited to 20.
F. Gertler, R. Jaenisch

7.32 Systems Biology
Subject meets with 7.81[J], 8.591[J]
Prereq: (18.03 and 18.05) or permission of instructor
U (Fall)
3-0-9 units

Introduction to cellular and population-level systems biology with an emphasis on synthetic biology, modeling of genetic networks, cell-cell interactions, and evolutionary dynamics. Cellular systems include genetic switches and oscillators, network motifs, genetic network evolution, and cellular decision-making. Population-level systems include models of pattern formation, cell-cell communications, and evolutionary systems biology. Students taking graduate version explore the subject in more depth.
J. Gore

7.33[J] Evolutionary Biology: Concepts, Models and Computation
Same subject as 6.4710[J]
Prereq: (6.100A and 7.03) or permission of instructor
Acad Year 2024-2025: Not offered
Acad Year 2025-2026: U (Spring)
3-0-9 units

Explores and illustrates how evolution explains biology, with an emphasis on computational model building for analyzing evolutionary data. Covers key concepts of biological evolution, including adaptive evolution, neutral evolution, evolution of sex, genomic conflict, speciation, phylogeny and comparative methods, life's history, coevolution, human evolution, and evolution of disease.
R. Berwick, D. Bartel

7.340-7.344 Advanced Undergraduate Seminar
Prereq: 7.06 or 7.28
U (Fall, Spring)
2-0-4 units
Can be repeated for credit.

Seminars covering topics of current interest in biology with a focus on how to understand experimental methods and design and how to critically read the primary research literature. Small class size facilitates discussions and interactions with an active research scientist. Students visit research laboratories to see firsthand how biological research is conducted. Contact Biology Education Office for topics.
H. R. Horvitz

7.345-7.349 Advanced Undergraduate Seminar
Prereq: 7.06 or 7.28
U (Fall, Spring)
2-0-4 units
Can be repeated for credit.

Seminars covering topics of current interest in biology with a focus on how to understand experimental methods and design and how to critically read the primary research literature. Small class size facilitates discussions and interactions with an active research scientist. Students visit research laboratories to see firsthand how biological research is conducted. Contact Biology Education Office for topics.
H. R. Horvitz

7.35 Human Genetics and Genomics
Subject meets with 7.75
Prereq: 7.06, (7.03 and 7.05), or permission of instructor
U (Spring)
3-0-9 units

Upper-level seminar offering in-depth analysis and engaged discussion of primary literature on the dimensions and phenotypic consequences of variation in human genes, chromosomes, and genomes. Topics include the human genome project; pedigree analysis; mutation and selection; linkage and association studies; medical genetics and disease; sex chromosomes and sex differences; the biology of the germ line; epigenetics, imprinting, and transgenerational inheritance; human origins; and evolutionary and population genetics. Students taking graduate version complete additional assignments. Limited to 20 total for versions meeting together.
D. Page

7.36 The CRISPR Revolution: Engineering the Genome for Basic Science and Clinical Medicine (New)
Subject meets with 7.91
Prereq: 7.06 or permission of instructor
U (Fall)
3-0-9 units

Provides a conceptual and technical understanding of genome editing systems and their research and clinical applications. Focuses on fundamental CRISPR biology in bacteria, methodologies for manipulating the genome with CRISPR, and the application of genome engineering in research and medicine. Combines lectures and literature discussions with critical analysis and assigned readings, with the goal of better understanding how key discoveries were made and how these are applied in the real work. Class work includes brief writing assignments as well as a final research proposal and scientific presentation. Students taking the graduate version explore the subject in greater depth, in part through additional assignments.
F. Sánchez-Rivera, J. Weissman

7.37[J] Molecular and Engineering Aspects of Biotechnology
Same subject as 10.441[J], 20.361[J]
Prereq: (7.06 and (2.005, 3.012, 5.60, or 20.110[J])) or permission of instructor
Acad Year 2024-2025: Not offered
Acad Year 2025-2026: U (Spring)
4-0-8 units
Credit cannot also be received for 7.371

Covers biological and bioengineering principles underlying the development and therapeutic use of recombinant proteins and stem cells; glycoengineering of recombinant proteins; normal and pathological signaling by growth factors and their receptors; receptor trafficking; monoclonal antibodies as therapeutics; protein pharmacology and delivery; stem cell-derived tissues as therapeutics; RNA therapeutics; combinatorial protein engineering; and new antitumor drugs.
Staff

7.371 Biological and Engineering Principles Underlying Novel Biotherapeutics
Prereq: 7.06
U (Fall)
4-0-8 units
Credit cannot also be received for 7.37[J], 10.441[J], 20.361[J]

Covers biological and bioengineering principles underlying the development and therapeutic use of recombinant proteins and immune cells. Special attention to monoclonal antibodies and engineered immune system cells as therapeutics; protein- and glyco-engineering to enhance protein function; protein pharmacology and delivery; nucleic acid- based biotherapeutics; generation of functional cells and tissues from embryonic stem cells and iPS cells; and immune cell-cancer cell interactions in cancer immunotherapy.
J. Chen, H. Lodish

7.38 Design Principles of Biological Systems
Subject meets with 7.83
Prereq: 7.06 or permission of instructor
U (Fall)
3-0-9 units

Introduces students to biological control mechanisms governing decision-making and tools to decipher, model, and perturb these mechanisms. Systems presented include signal transduction, cell cycle control, developmental biology, and the immune system. These systems provide examples of feedback and feedforward control, oscillators, kinetic proofreading, spatial and temporal averaging, and pattern formation. Students taking graduate version complete additional assignments.
D. Lew, H. Wong

7.45 The Hallmarks of Cancer
Subject meets with 7.85
Prereq: None. *Coreq: 7.06*
U (Fall)
4-0-8 units

Provides a comprehensive introduction to the fundamentals of cancer biology and cancer treatment. Topics include cancer genetics, genomics, and epigenetics; familial cancer syndromes; signal transduction, cell cycle control, and apoptosis; cancer metabolism; stem cells and cancer; metastasis; cancer immunology and immunotherapy; conventional and molecularly-targeted therapies; and early detection and prevention. Students taking graduate version complete additional assignments.
M. Hemann, T. Jacks

7.46 Building with Cells
Subject meets with 7.86
Prereq: 7.03 and 7.05
U (Fall)
4-0-8 units

Focuses on fundamental principles of developmental biology by which cells build organs and organisms. Analyzes the pivotal role of stem cells in tissue maintenance or repair, and in treatment of disease. Explores how to integrate this knowledge with engineering tools to construct functional tissue structures. Students taking graduate version complete additional assignments
L. Boyer, P. Li

7.458[J] Advances in Biomanufacturing
Same subject as 10.03[J]
Subject meets with 7.548[J], 10.53[J]
Prereq: None
U (Spring; second half of term)
1-0-2 units

Seminar examines how biopharmaceuticals, an increasingly important class of pharmaceuticals, are manufactured. Topics range from fundamental bioprocesses to new technologies to the economics of biomanufacturing. Also covers the impact of globalization on regulation and quality approaches as well as supply chain integrity. Students taking graduate version complete additional assignments.
J. C. Love, A. Sinskey, S. Springs

7.49[J] Developmental Neurobiology
Same subject as 9.18[J]
Subject meets with 7.69[J], 9.181[J]
Prereq: 7.03, 7.05, 9.01, or permission of instructor
U (Spring)
3-0-9 units

Considers molecular control of neural specification, formation of neuronal connections, construction of neural systems, and the contributions of experience to shaping brain structure and function. Topics include: neural induction and pattern formation, cell lineage and fate determination, neuronal migration, axon guidance, synapse formation and stabilization, activity-dependent development and critical periods, development of behavior. Students taking graduate version complete additional readings that will be addressed in their mid-term and final exams.
E. Nedivi

7.390 Practical Internship Experience in Biology
Prereq: None
U (Fall, IAP, Spring, Summer)
0-1-0 units
Can be repeated for credit.

For Course 7, 5-7, and 6-7 students participating in curriculum-related off-campus internship experiences in biology. Before enrolling, students must consult the Biology Education Office for details on procedures and restrictions, and have approval from their faculty advisor. Subject to department approval. Upon completion, the student must submit a write-up of the experience, approved by their faculty advisor.
Staff

7.391 Independent Study in Biology
Prereq: None
Acad Year 2024-2025: U (Fall, Spring, Summer)
Acad Year 2025-2026: Not offered
Units arranged [P/D/F]
Can be repeated for credit.

Program of study or research to be arranged with a department faculty member.
Staff

7.392 Independent Study in Biology
Prereq: None
Acad Year 2024-2025: U (Fall, IAP, Spring)
Acad Year 2025-2026: Not offered
Units arranged
Can be repeated for credit.

Program of study or research to be arranged with a department faculty member.
Staff

7.393 Independent Study in Genetics
Prereq: None
Acad Year 2024-2025: U (Fall, Spring)
Acad Year 2025-2026: Not offered
Units arranged
Can be repeated for credit.

Program of study or research to be arranged with a department faculty member.
Staff

7.394 Independent Study in Biochemistry
Prereq: None
Acad Year 2024-2025: U (Fall, Spring)
Acad Year 2025-2026: Not offered
Units arranged
Can be repeated for credit.

Program of study or research to be arranged with a department faculty member.
Staff

7.395 Independent Study in Cell and Molecular Biology
Prereq: None
Acad Year 2024-2025: U (Fall, Spring)
Acad Year 2025-2026: Not offered
Units arranged
Can be repeated for credit.

Program of study or research to be arranged with a department faculty member.
Staff

7.396 Independent Study in Experimental Biology
Prereq: None
Acad Year 2024-2025: U (Fall, IAP, Spring)
Acad Year 2025-2026: Not offered
Units arranged [P/D/F]
Can be repeated for credit.

Program of study or research to be arranged with a department faculty member.
Staff

7.C01 Machine Learning in Molecular and Cellular Biology
Subject meets with 3.C01[J], 3.C51[J], 7.C51, 10.C01[J], 10.C51[J], 20.C01[J], 20.C51[J]
Prereq: Biology (GIR), 6.100A, and 7.05; *Coreq: 6.C01*
U (Spring)
2-0-4 units
Credit cannot also be received for 1.C01, 1.C51, 2.C01, 2.C51, 3.C01[J], 3.C51[J], 7.C51, 10.C01[J], 10.C51[J], 20.C01[J], 20.C51[J], 22.C01, 22.C51, SCM.C51

Introduces machine learning as a tool to understand natural biological systems, with an evolving emphasis on problems in molecular and cellular biology that are being actively advanced using machine learning. Students design, implement, and interpret machine learning approaches to aid in predicting protein structure, probing protein structure/function relationships, and imaging biological systems at scales ranging from the atomic to cellular. Students taking graduate version complete an additional project-based assignment. Students cannot receive credit without simultaneous completion of 6.C01.
J. Davis

7.S391 Special Subject in Biology
Prereq: Permission of instructor
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit.

Covers material in various fields of biology not offered by the regular subjects of instruction.
Staff

7.S392 Special Subject in Biology
Prereq: Permission of instructor
U (Fall, IAP, Spring)
Not offered regularly; consult department
Units arranged [P/D/F]
Can be repeated for credit.

Covers material in various fields of biology not offered by the regular subjects of instruction.
Staff

7.S399 Special Subject in Biology
Prereq: Permission of instructor
U (Fall, IAP, Spring)
Not offered regularly; consult department
Units arranged
Can be repeated for credit.

Covers material in various fields of biology not offered by the regular subjects of instruction.
Staff

7.UR Undergraduate Research
Prereq: Permission of department
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit.

Undergraduate research opportunities in the Department of Biology.
Staff

7.URG Undergraduate Research
Prereq: Permission of department
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit.

Undergraduate research opportunities in the Department of Biology.
Staff

Graduate Subjects

MIT-WHOI Joint Program in Oceanography

7.410 Applied Statistics
Prereq: Permission of instructor
G (Spring)
3-0-9 units

Provides an introduction to modern applied statistics. Topics include likelihood-based methods for estimation, confidence intervals, and hypothesis-testing; bootstrapping; time series modeling; linear models; nonparametric regression; and model selection. Organized around examples drawn from the recent literature.
WHOI Staff

7.411 Seminars in Biological Oceanography
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit.

Selected topics in biological oceanography.
WHOI Staff

7.421 Problems in Biological Oceanography
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit.

Advanced problems in biological oceanography with assigned reading and consultation.
Information: M. Neubert (WHOI)

7.430 Topics in Quantitative Marine Science
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 units
Can be repeated for credit.

Lectures and discussions on quantitative marine ecology. Topics vary from year to year.
WHOI Staff

7.431 Topics in Marine Ecology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 units
Can be repeated for credit.

Lectures and discussions on ecological principles and processes in marine populations, communities, and ecosystems. Topics vary from year to year.
M. Neubert

7.432 Topics in Marine Physiology and Biochemistry
Prereq: Permission of instructor
G (Spring)
2-0-4 units
Can be repeated for credit.

Lectures and discussions on physiological and biochemical processes in marine organisms. Topics vary from year to year.
WHOI Staff

7.433 Topics in Biological Oceanography
Prereq: Permission of instructor
G (Spring)
2-0-4 units
Can be repeated for credit.

Lectures and discussions on biological oceanography. Topics vary from year to year.
S. Laney, M. Hahn

7.434 Topics in Zooplankton Biology
Prereq: Permission of instructor
Acad Year 2024-2025: Not offered
Acad Year 2025-2026: G (Fall, Spring)
2-0-4 units
Can be repeated for credit.

Lectures and discussions on the biology of marine zooplankton. Topics vary from year to year.
WHOI Staff

7.435 Topics in Benthic Biology
Prereq: Permission of instructor
Acad Year 2024-2025: Not offered
Acad Year 2025-2026: G (Fall, Spring)
2-0-4 units
Can be repeated for credit.

Lectures and discussions on the biology of marine benthos. Topics vary from year to year.
WHOI Staff

7.436 Topics in Phytoplankton Biology
Prereq: Permission of instructor
Acad Year 2024-2025: Not offered
Acad Year 2025-2026: G (Fall, Spring)
2-0-4 units
Can be repeated for credit.

Lectures and discussion on the biology of marine phytoplankton. Topics vary from year to year.
WHOI Staff

7.437 Topics in Molecular Biological Oceanography
Prereq: Permission of instructor
Acad Year 2024-2025: Not offered
Acad Year 2025-2026: G (Fall, Spring)
2-0-4 units
Can be repeated for credit.

Lectures and discussion on molecular biological oceanography. Topics vary from year to year.
WHOI Staff

7.438 Topics in the Behavior of Marine Animals
Prereq: Permission of instructor
Acad Year 2024-2025: Not offered
Acad Year 2025-2026: G (Fall, Spring)
2-0-4 units
Can be repeated for credit.

Lectures and discussion on the behavioral biology of marine animals. Topics vary from year to year.
WHOI Staff

7.439 Topics in Marine Microbiology
Prereq: Permission of instructor
G (Spring)
2-0-4 units
Can be repeated for credit.

Lectures and discussion on the biology of marine prokaryotes. Topics vary from year to year.
WHOI Staff

7.440 An Introduction to Mathematical Ecology
Prereq: Calculus I (GIR), 1.018[J], or permission of instructor
G (Spring)
3-0-9 units

Covers the basic models of population growth, demography, population interaction (competition, predation, mutualism), food webs, harvesting, and infectious disease, and the mathematical tools required for their analysis. Because these tools are also basic to the analysis of models in biochemistry, physiology, and behavior, subject also broadly relevant to students whose interests are not limited to ecological problems.
M. Neubert (WHOI)

7.470 Biological Oceanography
Prereq: Permission of instructor
G (Spring)
3-0-9 units

Intended for students with advanced training in biology. Intensive overview of biological oceanography. Major paradigms discussed, and dependence of biological processes in the ocean on physical and chemical aspects of the environment examined. Surveys the diversity of marine habitats, major groups of taxa inhabiting those habitats, and the general biology of the various taxa: the production and consumption of organic material in the ocean, as well as factors controlling those processes. Species diversity, structure of marine food webs, and the flow of energy within different marine habitats are detailed and contrasted.
WHOI Staff

7.491 Research in Biological Oceanography
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit.

Directed research in biological oceanography not leading to graduate thesis and initiated prior to the qualifying exam.
WHOI Staff

Microbiology (MICRO)

7.492[J] Methods and Problems in Microbiology
Same subject as 1.86[J], 20.445[J]
Prereq: None
G (Fall)
3-0-9 units

Students will read and discuss primary literature covering key areas of microbial research with emphasis on methods and approaches used to understand and manipulate microbes. Preference to first-year Microbiology and Biology students.
M. Laub

7.493[J] Microbial Genetics and Evolution
Same subject as 1.87[J], 12.493[J], 20.446[J]
Prereq: 7.03, 7.05, or permission of instructor
G (Fall)
4-0-8 units

Covers aspects of microbial genetic and genomic analyses, central dogma, horizontal gene transfer, and evolution.
A. D. Grossman, O. Cordero

7.494 Research Problems in Microbiology
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit.

Directed research in the fields of microbial science and engineering.
Staff

7.498 Teaching Experience in Microbiology
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit.

For qualified graduate students in the Microbiology graduate program interested in teaching. Classroom or laboratory teaching under the supervision of a faculty member.
Staff

7.499 Research Rotations in Microbiology
Prereq: None. *Coreq: 7.492[J] or 7.493[J]*; permission of instructor
G (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit.

Introduces students to faculty participating in the interdepartmental Microbiology graduate program through a series of three lab rotations, which provide broad exposure to microbiology research at MIT. Students select a lab for thesis research by the end of their first year. Given the interdisciplinary nature of the program and the many research programs available, students may be able to work jointly with more than one research advisor. Limited to students in the Microbiology graduate program.
Staff

7.MTHG Microbiology Graduate Thesis
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit.

Program of research leading to the writing of a PhD thesis. To be arranged by the student and the appropriate MIT faculty member.
Staff

Biology

7.50 Method and Logic in Molecular Biology
Prereq: None. *Coreq: 7.51 and 7.52*; or permission of instructor
G (Fall)
4-0-8 units

Logic, experimental design and methods in biology, using discussions of the primary literature to discern the principles of biological investigation in making discoveries and testing hypotheses. In collaboration with faculty, students also apply those principles to generate a potential research project, presented in both written and oral form. Limited to Course 7 graduate students.
I. Cheeseman, R. Lehmann, D. Lew, S. Vos, J. Weissman, Y. Yamashita

7.51 Principles of Biochemical Analysis
Prereq: Permission of instructor
G (Fall)
6-0-6 units

Principles of protein biochemistry, emphasizing structure, equilibrium studies, kinetics, and experimental design. Topics include macromolecular binding and specificity, allosteric systems, mechanisms of inhibition, enzyme principles, single-molecule studies, structure-function relationships, molecular evolution, and library methods. Case studies examine mechanisms of transcription factors, kinases, molecular machines, and other proteins.
L. Case, A. Keating

7.52 Genetics for Graduate Students
Prereq: Permission of instructor
G (Fall)
4-0-8 units

Principles and approaches of genetic analysis, including Mendelian inheritance and prokaryotic genetics, yeast genetics, developmental genetics, neurogenetics, and human genetics.
C. Kaiser

7.540[J] Advances in Chemical Biology
Same subject as 5.54[J], 20.554[J]
Prereq: 5.07[J], 5.13, 7.06, and permission of instructor
G (Fall)
3-0-9 units

See description under subject 5.54[J].
L. Kiessling, M. Shoulders

7.546[J] Science and Business of Biotechnology
Same subject as 15.480[J], 20.586[J]
Prereq: None. *Coreq: 15.401*; permission of instructor
G (Spring)
3-0-6 units

Covers the new types of drugs and other therapeutics in current practice and under development, the financing and business structures of early-stage biotechnology companies, and the evaluation of their risk/reward profiles. Includes a series of live case studies with industry leaders of both established and emerging biotechnology companies as guest speakers, focusing on the underlying science and engineering as well as core financing and business issues. Students must possess a basic background in cellular and molecular biology.
J. Chen, A. Koehler, A. Lo, H. Lodish

7.548[J] Advances in Biomanufacturing
Same subject as 10.53[J]
Subject meets with 7.458[J], 10.03[J]
Prereq: None
G (Spring; second half of term)
1-0-2 units

Seminar examines how biopharmaceuticals, an increasingly important class of pharmaceuticals, are manufactured. Topics range from fundamental bioprocesses to new technologies to the economics of biomanufacturing. Also covers the impact of globalization on regulation and quality approaches as well as supply chain integrity. Students taking graduate version complete additional assignments.
J. C. Love, A. Sinskey, S. Springs

7.549[J] Case Studies and Strategies in Drug Discovery and Development
Same subject as 15.137[J], 20.486[J], HST.916[J]
Prereq: None
G (Spring)
Not offered regularly; consult department
2-0-4 units

See description under subject 20.486[J].
A. W. Wood

7.55 Case Studies in Modern Experimental Design
Prereq: Permission of instructor
G (Spring)
2-0-7 units

Focuses on enhancing students' ability to analyze, design and present experiments, emphasizing modern techniques. Class discussions begin with papers that developed or utilized contemporary approaches (e.g., quantitative microscopy, biophysical and molecular genetic methods) to address important problems in biology. Each student prepares one specific aim of a standard research proposal for a project that emphasizes research strategy, experimental design, and writing.
L. Guarente, A. Ringel

7.571 Quantitative Analysis of Biological Data
Prereq: None
G (Spring; first half of term)
2-0-4 units

Application of probability theory and statistical methods to analyze biological data. Topics include: descriptive and inferential statistics, an introduction to Bayesian statistics, design of quantitative experiments, and methods to analyze high-dimensional datasets. A ‹em›conceptual‹/em› understanding of topics is emphasized, and methods are illustrated using the Python programming language. Although a basic understanding of Python is encouraged, no programming experience is required. Students taking the graduate version are expected to explore the subject in greater depth.
J. Davis

7.572 Quantitative Measurements and Modeling of Biological Systems
Prereq: None
G (Spring; second half of term)
2-0-4 units

Quantitative experimental design, data analysis, and modeling for biological systems. Topics include absolute/relative quantification, noise and reproducibility, regression and correlation, and modeling of population growth, gene expression, cellular dynamics, feedback regulation, oscillation. Students taking the graduate version are expected to explore the subject in greater depth.
G. W. Li

7.573 Modern Biostatistics
Subject meets with 7.093
Prereq: 7.03 and 7.05
G (Spring; first half of term)
2-0-4 units

Provides a practical introduction to probability and statistics used in modern biology. Topics covered include discrete and continuous probability distributions, statistical modeling, hypothesis testing, independence, conditional probability, multiple test corrections, nonparametric methods, clustering, correlation, linear regression, principal components analysis with applications to high-throughput DNA sequencing and image data analysis. Homework is in the R programming language, but prior programming experience is not required. Students taking the graduate version are expected to explore the subject in greater depth.
A. Jain, H. Wong

7.574 Modern Computational Biology
Subject meets with 7.094
Prereq: 7.03 and 7.05
G (Spring; second half of term)
2-0-4 units

Introduces modern methods in computational biology, focusing on DNA/RNA/protein analysis. Topics include next-generation DNA sequencing and sequencing data analysis, RNA-seq (bulk and single-cell), and protein dynamics. Students taking the graduate version are expected to explore the subject in greater depth.
A, Jain, H. Wong

7.58 Molecular Biology
Subject meets with 7.28
Prereq: 7.03, 7.05, and permission of instructor
G (Spring)
5-0-7 units

Detailed analysis of the biochemical mechanisms that control the maintenance, expression, and evolution of prokaryotic and eukaryotic genomes. Topics covered in lecture and readings of relevant literature include: gene regulation, DNA replication, genetic recombination, and mRNA translation. Logic of experimental design and data analysis emphasized. Presentations include both lectures and group discussions of representative papers from the literature. Students taking the graduate version are expected to explore the subject in greater depth.
E. Calo, Y. Soto-Feliciano

7.59[J] Teaching College-Level Science and Engineering
Same subject as 1.95[J], 5.95[J], 8.395[J], 18.094[J]
Subject meets with 2.978
Prereq: None
G (Fall)
2-0-2 units

See description under subject 5.95[J].
J. Rankin

7.60 Cell Biology: Structure and Functions of the Nucleus
Prereq: 7.06 or permission of instructor
G (Spring)
3-0-9 units

Eukaryotic genome structure, function, and expression, processing of RNA, and regulation of the cell cycle. Emphasis on the techniques and logic used to address important problems in nuclear cell biology. Lectures on broad topic areas in nuclear cell biology and discussions on representative recent papers.
L. Boyer, R. Young

7.61[J] Eukaryotic Cell Biology: Principles and Practice
Same subject as 20.561[J]
Prereq: Permission of instructor
Acad Year 2024-2025: Not offered
Acad Year 2025-2026: G (Fall)
4-0-8 units

Emphasizes methods and logic used to analyze structure and function of eukaryotic cells in diverse systems (e.g., yeast, fly, worm, mouse, human; development, stem cells, neurons). Combines lectures and in-depth roundtable discussions of literature readings with the active participation of faculty experts. Focuses on membranes (structure, function, traffic), organelles, the cell surface, signal transduction, cytoskeleton, cell motility and extracellular matrix. Ranges from basic studies to applications to human disease, while stressing critical analysis of experimental approaches. Enrollment limited.
M. Krieger, M. Yaffe

7.62 Microbial Physiology
Subject meets with 7.21
Prereq: 7.03, 7.05, and permission of instructor
G (Fall)
4-0-8 units

Biochemical properties of bacteria and other microorganisms that enable them to grow under a variety of conditions. Interaction between bacteria and bacteriophages. Genetic and metabolic regulation of enzyme action and enzyme formation. Structure and function of components of the bacterial cell envelope. Protein secretion with a special emphasis on its various roles in pathogenesis. Additional topics include bioenergetics, symbiosis, quorum sensing, global responses to DNA damage, and biofilms. Students taking the graduate version are expected to explore the subject in greater depth.
G. C. Walker, A. J. Sinskey

7.63[J] Immunology
Same subject as 20.630[J]
Subject meets with 7.23[J], 20.230[J]
Prereq: 7.06 and permission of instructor
G (Spring)
5-0-7 units

Comprehensive survey of molecular, genetic, and cellular aspects of the immune system. Topics include innate and adaptive immunity; cells and organs of the immune system; hematopoiesis; immunoglobulin, T cell receptor, and major histocompatibility complex (MHC) proteins and genes; development and functions of B and T lymphocytes; immune responses to infections and tumors; hypersensitivity, autoimmunity, and immunodeficiencies. Particular attention to the development and function of the immune system as a whole, as studied by modern methods and techniques. Students taking graduate version explore the subject in greater depth, including study of recent primary literature.
S. Spranger, M. Birnbaum

7.64 Molecular Mechanisms, Pathology and Therapy of Human Neuromuscular Disorders
Prereq: Permission of instructor
Acad Year 2024-2025: Not offered
Acad Year 2025-2026: G (Spring)
3-0-9 units

Investigates the molecular and clinical basis of central nervous system and neuromuscular disorders with particular emphasis on strategies for therapeutic intervention. Considers the in-depth analysis of clinical features, pathological mechanisms, and responses to current therapeutic interventions. Covers neurodegenerative diseases, such as Huntington's disease, Parkinson's disease, Alzheimer's disease, Amyotropic Lateral Schlerosis, Frontal Temporal Dementia, and neuromuscular disorders, such as Myotonic Dystrophy, Facio Scapular Humoral Dystrophy, and Duchenne Muscular Dystrophy.
D. Housman

7.65[J] Molecular and Cellular Neuroscience Core I
Same subject as 9.015[J]
Prereq: None
G (Fall)
3-0-9 units

See description under subject 9.015[J].
J. T. Littleton, M. Sheng, B. Weissbourd

7.66 Molecular Basis of Infectious Disease
Subject meets with 7.26
Prereq: 7.06 and permission of instructor
G (Spring)
4-0-8 units

Focuses on the principles of host-pathogen interactions with an emphasis on infectious diseases of humans. Presents key concepts of pathogenesis through the study of various human pathogens. Includes critical analysis and discussion of assigned readings. Students taking the graduate version are expected to explore the subject in greater depth.
E. Chen, R. Lamason

7.68[J] Molecular and Cellular Neuroscience Core II
Same subject as 9.013[J]
Prereq: Permission of instructor
G (Spring)
Not offered regularly; consult department
3-0-9 units

See description under subject 9.013[J].
G. Feng, L.-H. Tsai

7.69[J] Developmental Neurobiology
Same subject as 9.181[J]
Subject meets with 7.49[J], 9.18[J]
Prereq: 9.011 or permission of instructor
G (Spring)
3-0-9 units

See description under subject 9.181[J].
E. Nedivi, M. Heiman

7.70 Regulation of Gene Expression
Prereq: Permission of instructor
Acad Year 2024-2025: Not offered
Acad Year 2025-2026: G (Spring)
4-0-8 units

Seminar examines basic principles of biological regulation of gene expression. Focuses on examples that underpin these principles, as well as those that challenge certain long-held views. Topics covered may include the role of transcription factors, enhancers, DNA modifications, non-coding RNAs, and chromatin structure in the regulation of gene expression and mechanisms for epigenetic inheritance of transcriptional states. Limited to 40.
Staff

7.71 Biophysical Technique
Subject meets with 5.78
Prereq: 5.13, 5.60, (5.07[J] or 7.05), and permission of instructor
G (Spring)
5-0-7 units

Introduces students to modern biophysical methods to study biological systems from atomic, to molecular and cellular scales. Includes an in-depth discussion on the techniques that cover the full resolution range, including X-ray crystallography, electron-, and light microscopy. Discusses other common biophysical techniques for macromolecular characterizations. Lectures cover theoretical principles behind the techniques, and students are given practical laboratory exercises using instrumentation available at MIT. Meets with 5.78 when offered concurrently.
C. Drennan, T. Schwartz

7.72 Stem Cells, Regeneration, and Development
Prereq: Permission of instructor
G (Spring)
4-0-8 units

Topics include diverse stem cells, such as muscle, intestine, skin, hair and hematopoietic stem cells, as well as pluripotent stem cells. Topics address cell polarity and cell fate; positional information and patterning of development and regeneration; limb, heart and whole body regeneration; stem cell renewal; progenitor cells in development; responses to wounding; and applications of stem cells in development of therapies. Discussions of papers supplement lectures.
R. Jaenisch, P. Reddien

7.73 Principles of Chemical Biology
Prereq: 7.05 and permission of instructor
Acad Year 2024-2025: Not offered
Acad Year 2025-2026: G (Spring)
3-0-9 units

Spanning the fields of biology, chemistry and engineering, class addresses the principles of chemical biology and its application of chemical and physical methods and reagents to the study and manipulation of biological systems. Topics include bioorthogonal reactions and activity-based protein profiling, small molecule inhibitors and chemical genetics, fluorescent probes for biological studies, and unnatural amino acid mutagenesis. Also covers chemical biology approaches for studying dynamic post-translational modification reactions, natural product biosynthesis and mutasynthesis, and high-throughput drug screening. Students taking the graduate version are expected to explore the subject in greater depth.
B. Imperiali, J. K. Weng

7.74[J] Topics in Biophysics and Physical Biology
Same subject as 8.590[J], 20.416[J]
Prereq: None
Acad Year 2024-2025: Not offered
Acad Year 2025-2026: G (Fall)
2-0-4 units

Provides broad exposure to research in biophysics and physical biology, with emphasis on the critical evaluation of scientific literature. Weekly meetings include in-depth discussion of scientific literature led by distinct faculty on active research topics. Each session also includes brief discussion of non-research topics including effective presentation skills, writing papers and fellowship proposals, choosing scientific and technical research topics, time management, and scientific ethics.
J. Gore, N. Fakhri

7.75 Human Genetics and Genomics
Subject meets with 7.35
Prereq: 7.52 or permission of instructor
G (Spring)
3-0-9 units

Upper level seminar offering in-depth analysis and engaged discussion of primary literature on the dimensions and phenotypic consequences of variation in human genes, chromosomes, and genomes. Topics include the human genome project; pedigree analysis; mutation and selection; linkage and association studies; medical genetics and disease; sex chromosomes and sex differences; the biology of the germ line; epigenetics, imprinting, and transgenerational inheritance; human origins; and evolutionary and population genetics. Students taking graduate version complete additional assignments. Limited to 20 total for versions meeting together.
D. Page

7.76 Topics in Macromolecular Structure and Function
Prereq: Permission of instructor
Acad Year 2024-2025: Not offered
Acad Year 2025-2026: G (Spring)
3-0-6 units

In-depth analysis and discussion of classic and current literature, with an emphasis on the structure, function, and mechanisms of proteins and other biological macromolecules.
Staff

7.77 Nucleic Acids, Structure, Function, Evolution, and Their Interactions with Proteins
Prereq: 7.05, 7.51, or permission of instructor
G (Spring)
3-0-9 units

Surveys primary literature, focusing on biochemical, biophysical, genetic, and combinatorial approaches for understanding nucleic acids. Topics include the general properties, functions, and structural motifs of DNA and RNA; RNAs as catalysts and as regulators of gene expression; RNA editing and surveillance, and the interaction of nucleic acids with proteins, such as zinc-finger proteins, modification enzymes, aminoacyl-tRNA synthetases and other proteins of the translational machinery. Includes some lectures but is mostly analysis and discussion of current literature in the context of student presentations.
D. Bartel, A. Jain

7.80 Fundamentals of Chemical Biology
Subject meets with 5.08[J], 7.08[J]
Prereq: 5.13 and (5.07[J] or 7.05)
G (Spring)
4-0-8 units

Spanning the fields of biology, chemistry, and engineering, this class introduces students to the principles of chemical biology and the application of chemical and physical methods and reagents to the study and manipulation of biological systems. Topics include nucleic acid structure, recognition, and manipulation; protein folding and stability, and proteostasis; bioorthogonal reactions and activity-based protein profiling; chemical genetics and small-molecule inhibitor screening; fluorescent probes for biological analysis and imaging; and unnatural amino acid mutagenesis. The class will also discuss the logic of dynamic post-translational modification reactions with an emphasis on chemical biology approaches for studying complex processes including glycosylation, phosphorylation, and lipidation. Students taking the graduate version are expected to explore the subject in greater depth.
B. Imperiali, R. Raines

7.81[J] Systems Biology
Same subject as 8.591[J]
Subject meets with 7.32
Prereq: (18.03 and 18.05) or permission of instructor
G (Fall)
3-0-9 units

See description under subject 8.591[J].
J. Gore

7.82 Development, Disease and Therapeutics
Prereq: Permission of instructor
G (Spring)
3-0-9 units

Seminar covering the key concepts and technological approaches that are used to study and treat human disease. Topics include human genome variation, germline editing, gene therapy, stem cell derived organoids, human-animal chimeras and the application of these approaches to the study and treatment of major diseases.
R. Jaenisch, R. Young

7.83 Design Principles of Biological Systems
Subject meets with 7.38
Prereq: Permission of instructor
G (Fall)
3-0-9 units

Introduces students to biological control mechanisms governing decision-making and tools to decipher, model, and perturb these mechanisms. Systems presented include signal transduction, cell cycle control, developmental biology, and the immune system. These systems provide examples of feedback and feedforward control, oscillators, kinetic proofreading, spatial and temporal averaging, and pattern formation. Students taking graduate version complete additional assignments.
D. Lew, H. Wong

7.84 Advanced Concepts in Immunology
Subject meets with 7.24
Prereq: None. *Coreq: 7.63[J]*; or permission of instructor
G (Spring)
3-0-9 units

Provides a comprehensive and intensified understanding of the relevance of the immune system beyond immunity. Focuses on how the immune system intersects with all aspects of body homeostasis/physiology or disease and how the immune system can be manipulated therapeutically. New advances in the intersection of immunology with cancer biology, neurosciences, metabolism, aging, and maternal-fetal immunology or similar explored. Presents new modern methods and techniques applicable beyond immunology. Includes critical analysis and discussion of assigned readings. Students apply principles learned in class to generate a potential research project, presented in a written form. Students taking graduate version complete additional assignments.
H. Moura Silva, S. Spranger

7.85 The Hallmarks of Cancer
Subject meets with 7.45
Prereq: None. *Coreq: 7.06*; permission of instructor
G (Fall)
4-0-8 units

Provides a comprehensive introduction to the fundamentals of cancer biology and cancer treatment. Topics include cancer genetics, genomics, and epigenetics; familial cancer syndromes; signal transduction, cell cycle control, and apoptosis; cancer metabolism; stem cells and cancer; metastasis; cancer immunology and immunotherapy; conventional and molecularly-targeted therapies; and early detection and prevention. Students taking graduate version complete additional assignments.
M. Hemann, T. Jacks

7.86 Building with Cells
Subject meets with 7.46
Prereq: 7.03 and 7.05
G (Fall)
4-0-8 units

Focuses on fundamental principles of developmental biology by which cells build organs and organisms. Analyzes the pivotal role of stem cells in tissue maintenance or repair, and in treatment of disease. Explores how to integrate this knowledge with engineering tools to construct functional tissue structures. Students taking graduate version complete additional assignments.
L. Boyer, P. Li

7.88[J] Protein Folding in Health and Disease
Same subject as 5.48[J]
Prereq: (5.07[J] or 7.05) and permission of instructor
Acad Year 2024-2025: Not offered
Acad Year 2025-2026: G (Spring; first half of term)
3-0-3 units

See description under subject 5.48[J].
M. Shoulders

7.89[J] Topics in Computational and Systems Biology
Same subject as CSB.100[J]
Prereq: Permission of instructor
G (Fall)
2-0-10 units

See description under subject CSB.100[J]. Preference to first-year CSB PhD students.
C. Burge

7.91 The CRISPR Revolution: Engineering the Genome for Basic Science and Clinical Medicine
Subject meets with 7.36
Prereq: Permission of instructor
G (Fall)
3-0-9 units

Provides a conceptual and technical understanding of genome editing systems and their research and clinical applications. Focuses on fundamental CRISPR biology in bacteria, methodologies for manipulating the genome with CRISPR, and the application of genome engineering in research and medicine. Combines lectures and literature discussions with critical analysis and assigned readings, with the goal of better understanding how key discoveries were made and how these are applied in the real work. Class work includes brief writing assignments as well as a final research proposal and scientific presentation. Students taking the graduate version explore the subject in greater depth, in part through additional assignments.
F. Sánchez-Rivera, J. Weissman

7.930[J] Research Experience in Biopharma
Same subject as 20.930[J], CSB.930[J]
Prereq: None
G (Fall)
2-10-0 units

See description under subject 20.930[J].
C. Burge

7.931 Independent Study in Biology
Prereq: Permission of instructor
Acad Year 2024-2025: G (Fall, Spring)
Acad Year 2025-2026: Not offered
Units arranged [P/D/F]
Can be repeated for credit.

Program of study or research to be arranged with a department faculty member.
Staff

7.932 Independent Study in Biology
Prereq: Permission of instructor
Acad Year 2024-2025: G (Fall, Spring)
Acad Year 2025-2026: Not offered
Units arranged
Can be repeated for credit.

Program of study or research to be arranged with a department faculty member.
Staff

7.933 Research Rotations in Biology
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit.

Introduces students to faculty participating in the Biology graduate program through a series of lab rotations, which provide broad exposure to biology research at MIT. Students select a lab for thesis research by the end of their first year. Limited to students in the Biology graduate program.
Staff

7.934 Teaching Experience in Biology
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged [P/D/F]
Can be repeated for credit.

For qualified graduate students in the Biology graduate program interested in teaching. Classroom or laboratory teaching under the supervision of a faculty member.
Staff

7.935 Responsible Conduct in Biology
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]

Sessions focus on the responsible conduct of science. Considers recordkeeping and reporting; roles of mentor and mentee; authorship, review, and confidentiality; resolving conflicts; misfeasance and malfeasance; collaborations, competing interests, and intellectual property; and proper practices in the use of animal and human subjects. Limited to second-year graduate students in Biology.
S. Hrvatin, Y. Yamashita

7.936 Professional Development in Biology
Prereq: None
G (Fall, IAP, Spring, Summer)
0-2-0 units
Can be repeated for credit.

Required for course 7 doctoral students to gain professional perspective in career development activities such as internships, scientific meetings, and career and networking events. Written report required upon completion of activities.
Staff

7.941 Research Problems
Prereq: Permission of instructor
G (Fall, Summer)
Units arranged [P/D/F]
Can be repeated for credit.

Directed research in a field of biological science, but not contributory to graduate thesis.
Consult Biology Education Office

7.942 Research Problems
Prereq: Permission of instructor
G (Spring)
Units arranged [P/D/F]
Can be repeated for credit.

Directed research in a field of biological science, but not contributory to graduate thesis.
Consult Biology Education Office

7.95 Cancer Biology
Prereq: 7.85 and permission of instructor
G (Spring)
3-0-9 units

Advanced seminar involving intensive analysis of historical and current developments in cancer biology. Topics address principles of apoptosis, principles of cancer biology, cancer genetics, cancer cell metabolism, tumor immunology, and therapy. Detailed analysis of research literature, including important reports published in recent years. Enrollment limited.
R. Weinberg, O. Yilmaz

7.98[J] Neural Plasticity in Learning and Memory
Same subject as 9.301[J]
Prereq: Permission of instructor
G (Spring)
3-0-6 units

See description under subject 9.301[J]. Juniors and seniors require instructor's permission.
S. Tonegawa

7.C51 Machine Learning in Molecular and Cellular Biology
Subject meets with 3.C01[J], 3.C51[J], 7.C01, 10.C01[J], 10.C51[J], 20.C01[J], 20.C51[J]
Prereq: Biology (GIR), 6.100A, and 7.05; *Coreq: 6.C51*
G (Spring)
2-0-4 units
Credit cannot also be received for 1.C01, 1.C51, 2.C01, 2.C51, 3.C01[J], 3.C51[J], 7.C01, 10.C01[J], 10.C51[J], 20.C01[J], 20.C51[J], 22.C01, 22.C51, SCM.C51

Introduces machine learning as a tool to understand natural biological systems, with an evolving emphasis on problems in molecular and cellular biology that are being actively advanced using machine learning. Students design, implement, and interpret machine learning approaches to aid in predicting protein structure, probing protein structure/function relationships, and imaging biological systems at scales ranging from the atomic to cellular. Students taking graduate version complete an additional project-based assignment. Students cannot receive credit without simultaneous completion of 6.C01.
J. Davis

7.S930 Special Subject in Biology
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit.

Covers material in various fields of biology not offered by the regular subjects of instruction.
Staff

7.S931 Special Subject in Biology
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit.

Covers material in various fields of biology not offered by the regular subjects of instruction.
Staff

7.S932 Special Subject in Biology
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Not offered regularly; consult department
Units arranged [P/D/F]
Can be repeated for credit.

Covers material in various fields of biology not offered by the regular subjects of instruction.
Staff

7.S939 Special Subject in Biology
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged
Can be repeated for credit.

Covers material in various fields of biology not offered by the regular subjects of instruction.
Staff

7.THG Graduate Biology Thesis
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit.

Program of research leading to the writing of a Ph.D. thesis; to be arranged by the student and an appropriate MIT faculty member.
Staff