7.015 Introductory Biology
Prereq: Advanced high school course covering cellular and molecular biology, or permission of instructor
Acad Year 2014–2015: Not offered
Acad Year 2015–2016: U (Fall)
5-0-7 BIOLOGY
Credit cannot also be received for 7.012, 7.014, 7.015, 7.016, ES.7012, ES.7013
Emphasizes the application of the fundamental principles to trending topics in microbiology- and immunology-related issues, and allows students to understand how biological principles are used in a direct, human health context. Introduces evolutionary principles, demonstrating their relevance to current topics in infectious diseases. Includes written assignments, discussions, and group presentations. Enrollment limited to 60. Admittance may be controlled by lottery.
M. Laub, H. Ploegh

7.02J Introduction to Experimental Biology and Communication
(Same subject as 10.702J)
Prereq: None
U (Fall, Spring)
4-8-6 Institute LAB
Introduction to the experimental concepts and methods of molecular biology, biochemistry, and genetic analysis. Emphasis on experimental design, critical data analysis, and the development of written communications skills. 12 units may be applied to the General Institute Laboratory Requirement. Concurrent registration with 7.03 strongly recommended. Enrollment limited.
Fall: L. Boyer, P. Gupta, K. D. Wittrup
Spring: M. Gehring, T. Schwartz, K. D. Wittrup

7.03 Genetics
Prereq: Biology (GIR)
U (Fall, Spring)
4-0-8 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: G. Fink, C. Kaiser, P. Reddien
Spring: M. Hemann, A. Regev

7.05 General Biochemistry
Prereq: 5.12, Biology (GIR), or permission of instructor
U (Fall, Spring)
5-0-7 REST
Credit cannot also be received for 5.07, 20.507
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. General metabolism of carbohydrates, fats, and nitrogen-containing materials such as amino acids, proteins, and related compounds.
M. Vander Heiden, M. Yaffe

7.06 Cell Biology
Prereq: 7.03, 7.05
U (Fall, Spring)
4-0-8
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: A. Martin, F. Solomon
Spring: I. Cheeseman, T. Orr-Weaver

7.08j Biological Chemistry II
(Same subject as 5.08j)
(Subject meets with 7.80)
Prereq: 5.12; 5.07 or 7.05
U (Spring)
4-0-8

See description under subject 5.08j.
J. Stubbe, E. Nolan

7.10j Physical Chemistry of Biomolecular Systems
(Same subject as 20.111j)
Prereq: Calculus II (GIR), Chemistry (GIR), Physics I (GIR); Coreq: Physics II (GIR)
U (Spring)
5-0-7
Credit cannot also be received for 2.772, 20.110
See description under subject 20.111j.
E. Alm, A. Jasanoff, C. Voigt

7.11 Biology Teaching
Prereq: None
U (Fall, IAP, 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 Biology Education Office

7.15 Experimental Molecular Genetics
Prereq: 7.02, 7.03
U (Spring)
4-16-10

In this project-based laboratory subject, students carry out independent experiments that develop skills in the planning, execution, and analysis of original experimental biological research. Specific research topic, which is determined by teaching staff, involves the application of modern methods of molecular genetics. Reading and writing assignments focus on the critical evaluation and discussion of relevant scientific literature. Emphasis placed on instruction in laboratory methods and the testing of hypotheses, as well as the critical analysis of experimental results.
J. Weng

7.16 Experimental Molecular Biology
Prereq: 7.02, 7.03, 7.05
U (Fall)
4-16-10
Applies high-throughput genetic approaches to study the response of mammalian cells to cytotoxic or infectious stimuli. RNA interference (RNAi) screening and microarray expression analysis will be used to examine the genetics of cellular pro-survival and pro-death pathways. Teams of two or three students design and carry out experiments to address questions regarding the mechanisms that govern the regulation and execution of cellular responses. Some projects involve the use of DNA damaging agents or other cytotoxic drugs to help understand the pathways that control a cell’s response to chemotherapies. Other projects examine the genes that underlie the cellular response to conserved pathogen molecules. Instruction and practice in written and oral communication provided.

J. Saeij

7.17 Topics in Experimental Biology
(Subject meets with 7.19)
Prereq: 7.02, 7.03, 7.05
U (Fall, Spring)
4-16-10

Independent experimental study under the direction of a member of the Biology Department faculty. Allows students with a strong interest in independent research to fulfill the project laboratory requirement for the Biology Department Program in the context of a research laboratory at MIT. The research must be conducted on the MIT campus and be a continuation of a previous 12-unit UROP project or full-time work over the summer. Written and oral presentation of the research results is required. Journal club discussions are used to help students evaluate and write scientific papers. Instruction and practice in written and oral communication is provided. Permission of the faculty research supervisor and the Biology Education Office must be obtained in advance.
Fall: D. Kim, M. L. Pardue
Spring: U. Rajbhandary

7.19 Communication in Experimental Biology
(Subject meets with 7.18)
Prereq: 7.02, 7.03, 7.05
U (Fall, Spring)
4-4-4

Students carry out independent literature research. Meets with the seminar and writing tutorial portions of 7.18. Journal club discussions are used to help students evaluate and write scientific papers. Instruction and practice in written and oral communication is provided. Permission of the instructor and the Biology Education Office must be obtained in advance.
Fall: D. Kim, M. L. Pardue
Spring: U. Rajbhandary

7.20j Human Physiology
(Same subject as HST.540J)
Prereq: 7.05
U (Fall)
5-0-7

Comprehensive subject in 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.
M. Krieger, D. Sabatini

7.21 Microbial Physiology
(Subject meets with 7.62)
Prereq: 7.03, 7.05
Acad Year 2014–2015: Not offered
Acad Year 2015–2016: U (Fall)
4-0-8

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. Simskey

7.22 Development and Evolution
Prereq: 7.06
Acad Year 2014–2015: Not offered
Acad Year 2015–2016: U (Fall)
5-0-7

Topics include development of animal body plans, tissue patterning, cell type determination, organogenesis, morphogenesis, stem cells, and the evolution of developmental diversity and processes. Covers experimental approaches to problems of development and evolution, such as the study of vertebrate (mouse, chick, frog, fish) and invertebrate (fly, worm) models.
R. O. Hynes, P. Reddien
7.23 Immunology
(Subject meets with 7.63)
Prereq: 7.06, or permission of instructor
U (fall)
4-0-8
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; 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 the graduate version are expected to explore the subject in greater depth.
H. Ploegh

7.24 Immunology in Medicine (New)
(Subject meets with 7.84)
Prereq: 7.06 or permission of instructor
U (Spring)
5-0-7
Studies the development and function of the immune system at molecular, cellular and systems levels with emphasis on the role of immune system in disease pathogenesis and interventions. Discusses in depth the application of immunological principles in development of antibody therapeutics, cancer immunotherapies, vaccines, and other medical interventions. Lectures supplemented with discussions of original papers and team projects. Students taking graduate version complete additional assignments. J. Chen

7.26 Molecular Basis of Infectious Disease
(Subject meets with 7.66)
Prereq: 7.06
Acad Year 2014–2015: Not offered
Acad Year 2015–2016: U (Spring)
4-0-8
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.
D. Kim, J. Saeij

7.27 Principles of Human Disease
Prereq: 7.06
U (Spring)
4-0-8
Covers current understanding of and modern approaches to human disease, emphasizing the molecular and cellular basis of both genetic disease and cancer. Topics include the genetics of simple and complex traits; karyotypic analysis and positional cloning; genetic diagnosis; the roles of oncogenes and tumor suppressors in tumor initiation, progression, and treatment; the interaction between genetics and environment; animal models of human disease; cancer; aging and disease; and conventional and gene therapy treatment strategies.
D. Housman, L. Guarente

7.28 Molecular Biology
(Subject meets with 7.58)
Prereq: 7.03; Coreq: 7.05
U (Spring)
5-0-7
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.
T. Baker, S. Bell, W. Gilbert

7.29 Cellular and Molecular Neurobiology
(Same subject as 9.09J)
Prereq: 7.05 or 9.01
U (Spring)
4-0-8
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.
W. G. Quinn, T. Littleton

7.30A Fundamentals of Ecology I (New)
(Same subject as 1.018A, 12.031A)
Prereq: None
U (Fall; first half of term)
2-0-4
See description under subject 1.018A.
S. Chisholm, M. Follows

7.30B Fundamentals of Ecology II (New)
(Same subject as 1.018B, 12.031B)
Prereq: 1.018A
U (Fall; second half of term)
2-0-4
See description under subject 1.018B.
S. Chisholm, M. Follows

7.31 Current Topics in Mammalian Biology: Medical Implications
Prereq: 7.06 or permission of instructor
U (Fall)
4-0-8
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 7.81J, 8.591J)
Prereq: 18.03, 18.05; or permission of instructor
U (Fall)
3-0-9
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

D. Housman, L. Guarente

T. Baker, S. Bell, W. Gilbert

W. G. Quinn, T. Littleton

F. Gertler, R. Jaenisch

J. Gore
7.33J Evolutionary Biology: Concepts, Models and Computation
(Same subject as 6.049J)
Prereq: 7.03; 6.0002, 6.01, or permission of instructor
U (Spring)
3-0-9
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 [P/D/F]
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 [P/D/F]
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

7.36J Foundations of Computational and Systems Biology
(Same subject as 6.802J, 20.390J)
Prereq: Biology (GIR), 6.0002 or 6.01; or 7.05; or permission of instructor
U (Spring)
3-0-9
Provides an introduction to computational and systems biology. Includes units on the analysis of protein and nucleic acid sequences, protein structures, and biological networks. Presents principles and methods used for sequence alignment, motif finding, expression array analysis, structural modeling, structure design and prediction, and network analysis and modeling. Techniques include dynamic programming, Markov and hidden Markov models, Bayesian networks, clustering methods, and energy minimization approaches. Exposes students to emerging research areas. Designed for students with strong backgrounds in either molecular biology or computer science. Some foundational material covering basic programming skills, probability and statistics is provided for students with less quantitative backgrounds. Students taking graduate version complete additional assignments.
I. Cheesman, A. Martin

7.37J Molecular and Engineering Aspects of Biotechnology
(Same subject as 10.441J, 20.361J)
Prereq: 2.005, 3.012, 5.60, 20.110, or 20.111; 7.06; or permission of instructor
U (Spring)
4-0-8
Covers biological and bioengineering principles underlying the development and therapeutic use of recombinant proteins and stem cells; glycengineering 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.
H. Lodish, L. Griffith

7.38 Forces in Cell Biology and Development
(Same subject with 7.83)
Prereq: 7.03, 7.05, 7.06
U (Spring)
3-0-9
Covers the current understanding of how physical forces are generated in cells and how these forces organize and shape cells and tissues. Topics include methods to measure and detect forces for single molecules or in cells, mechanisms of force generation, sensing of force in signal transduction, and the roles of force in key cell biological and developmental processes and human disease. Includes lectures on concepts and experimental approaches related to forces in biology and discussions of representative recent papers. Students taking the graduate version are expected to explore the subject in greater depth.
I. Cheeseman, A. Martin

7.49J Developmental Neurobiology
(Same subject as 9.18J)
(Subject meets with 7.69J, 9.181J)
Prereq: 9.01, 7.03, 7.05, or permission of instructor
U (Spring)
3-0-9
See description under subject 9.18J.
E. Nedivi, M. Heiman

7.391 Independent Study in Biology
Prereq: None
U (Fall, IAP, Spring)
Units arranged [P/D/F]
Can be repeated for credit
Program of study or research to be arranged with a department faculty member.
Staff

7.393 Independent Study in Genetics
Prereq: None
U (Fall, IAP, Spring)
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
U (Fall, IAP, Spring)
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
U (Fall, IAP, Spring)
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
U (Fall, IAP, Spring)
Units arranged [P/D/F]
Can be repeated for credit
Program of study or research to be arranged with a department faculty member.
Staff

7.399 Special Subject in Biology (New)
Prereq: Permission of instructor
U (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

7.410 Applied Statistics
Prereq: Permission of instructor
G (Spring)
3-0-9 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
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.
A. Solow

7.412 Problems in Biological Oceanography
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Advanced problems in biological oceanography with assigned reading and consultation.
Information: M. Neubert (WHOI)

7.413 Topics in Marine Ecology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
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.
WHOI Staff

7.414 Topics in Marine Biology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussion on molecular biological oceanography. Topics vary from year to year.
WHOI Staff

7.415 Topics in Phytoplankton Biology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on the biology of marine phytoplankton. Topics vary from year to year.
WHOI Staff

7.416 Topics in Zooplankton Biology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on the biology of marine zooplankton. Topics vary from year to year.
WHOI Staff

7.417 Topics in Benthic Biology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on the biology of marine benthos. Topics vary from year to year.
WHOI Staff

7.418 Topics in Biochemistry
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on biochemistry. Topics vary from year to year.
WHOI Staff

7.419 Topics in Cell and Molecular Biology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on cell and molecular biology. Topics vary from year to year.
WHOI Staff

7.420 Topics in Marine Physiology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on marine physiology. Topics vary from year to year.
WHOI Staff

7.421 Topics in Marine Physiology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on marine physiology. Topics vary from year to year.
WHOI Staff

7.422 Topics in Marine Physiology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on marine physiology. Topics vary from year to year.
WHOI Staff

7.423 Topics in Marine Physiology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on marine physiology. Topics vary from year to year.
WHOI Staff

7.424 Topics in Marine Physiology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on marine physiology. Topics vary from year to year.
WHOI Staff

7.425 Topics in Marine Physiology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on marine physiology. Topics vary from year to year.
WHOI Staff

7.426 Topics in Marine Physiology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on marine physiology. Topics vary from year to year.
WHOI Staff

7.427 Topics in Marine Physiology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on marine physiology. Topics vary from year to year.
WHOI Staff

7.428 Topics in Marine Physiology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on marine physiology. Topics vary from year to year.
WHOI Staff

7.429 Topics in Marine Physiology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on marine physiology. Topics vary from year to year.
WHOI Staff

7.430 Topics in Marine Physiology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on marine physiology. Topics vary from year to year.
WHOI Staff

7.431 Topics in Marine Physiology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on marine physiology. Topics vary from year to year.
WHOI Staff

7.432 Topics in Marine Physiology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on marine physiology. Topics vary from year to year.
WHOI Staff

7.433 Topics in Marine Physiology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on marine physiology. Topics vary from year to year.
WHOI Staff

7.434 Topics in Marine Physiology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on marine physiology. Topics vary from year to year.
WHOI Staff

7.435 Topics in Marine Physiology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on marine physiology. Topics vary from year to year.
WHOI Staff

7.436 Topics in Marine Physiology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on marine physiology. Topics vary from year to year.
WHOI Staff

7.437 Topics in Marine Physiology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on marine physiology. Topics vary from year to year.
WHOI Staff
7.438 Topics in the Behavior of Marine Animals
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
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 (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
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), 7.30B, or permission of instructor
Acad Year 2014–2015: G (Spring)
Acad Year 2015–2016: Not offered
3-0-9 H-LEVEL Grad Credit
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, H. Caswell (WHOI)

7.47 Biological Oceanography
Prereq: Advanced training in biology
G (Spring)
3-0-9 H-LEVEL Grad Credit
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)
Units arranged [P/D/F] H-LEVEL Grad Credit
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)

7.492J Methods and Problems in Microbiology
(Same subject as 1.86J, 20.446J)
Prereq: Permission of instructor or Coreq: 7.493 G (Fall)
3-0-9 H-LEVEL Grad Credit
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. Limited to students in the microbiology program.
M. Polz

7.493J Microbial Genetics and Evolution
(Same subject as 1.87J, 20.446J)
Prereq: 7.03, 7.05, 7.28 or permission of instructor
G (Fall)
4-0-8 H-LEVEL Grad Credit
Covers aspects of microbial genetic and genomic analyses, central dogma, horizontal gene transfer, and evolution.
A. D. Grossman, E. Alm

7.494 Research Problems in Microbiology
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged [P/D/F] H-LEVEL Grad Credit
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, IAP, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
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: Permission of instructor; Coreq: 7.492, or 7.493
G (Fall, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
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 supervisor. Limited to students in the Microbiology graduate program. Limited to students in the microbiology program.
Staff

7.MTHG Microbiology Graduate Thesis
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged H-LEVEL Grad Credit
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: Permission of instructor or Coreq: 7.51, 7.52
G (Fall)
4-0-8 H-LEVEL Grad Credit
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.
Staff

7.51 Principles of Biochemical Analysis
Prereq: Permission of instructor
G (Fall)
6-0-6 H-LEVEL Grad Credit
Fundamental principles of biochemistry. Analysis of the structure and mechanism of catalytic and regulatory macromolecules.
A. Keating, R. T. Sauer
7.52 Genetics for Graduate Students
Prereq: Permission of instructor
G (Fall)
4-0-8 H-LEVEL Grad Credit
Principles and approaches of genetic analysis, including Mendelian inheritance and prokaryotic genetics, yeast genetics, developmental genetics, neurogenetics, and human genetics.
A. Amon, D. Housman, H. R. Horvitz

7.540| Frontiers in Chemical Biology
(Same subject as 5.54), 20.554])
Prereq: 5.13, 5.07, 7.06, permission of instructor
G (Fall)
4-0-8 H-LEVEL Grad Credit
See description under subject 5.54.
B. Pentelute, M. Shoulders

7.547| Principles and Practice of Drug Development
(Same subject as 10.547), 15.136, ESD.691, HST.920)
Prereq: Permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit
See description under subject 15.136.

7.549| Case Studies and Strategies in Drug Discovery and Development
(Same subject as 15.137), 20.486, HST.916)
Prereq: Permission of instructor
G (Spring)
2-0-4
See description under subject 20.486.
S. R. Tannenbaum, A. J. Sinskey, A. Wood

7.55 Case Studies in Modern Experimental Design
Prereq: Permission of instructor
G (Spring)
2-0-7 H-LEVEL Grad Credit
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.
P. Chang, F. Solomon

7.57 Quantitative Biology for Graduate Students
Prereq: Permission of instructor
G (Spring)
4-0-8 H-LEVEL Grad Credit
Introduces the fundamental concepts and tools of quantitative approaches to molecular and cellular biology. Covers a wide range of mathematical, computational, and statistical methods, although no previous expertise in these areas is required. Focuses on understanding quantitative approaches through the analysis of particular problems and examples drawn from classical genetics, molecular biology, cell biology, genomics, and systems biology.
P. Gupta, A. Regev

7.58 Molecular Biology
(Subject meets with 7.28)
Prereq: 7.03; 7.05
G (Spring)
5-0-7 H-LEVEL Grad Credit
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.
T. Baker, S. Bell, W. Gilbert

7.59 Teaching College-Level Science and Engineering
(Same subject as 1.95, 5.95, 6.982, 8.395, 18.094)
(Subject meets with 2.978)
Prereq: None
G (Fall)
2-0-2 [P/D/F]
See description under subject 5.95.
J. Rankin

7.60 Cell Biology: Structure and Functions of the Nucleus
Prereq: 7.06
G (Spring)
4-0-8 H-LEVEL Grad Credit
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.
P. Sharp, R. Young

7.61 Eukaryotic Cell Biology: Principles and Practice
Prereq: Permission of instructor
G (Fall)
4-0-8 H-LEVEL Grad Credit
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, neuronal). 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, cytoskeleton and extracellular matrix. Ranges from basic studies to applications to human disease, while stressing critical analysis of experimental approaches. Enrollment limited.
R. O. Hynes, M. Krieger

7.62 Microbial Physiology
(Subject meets with 7.21)
Prereq: 7.03, 7.05
Acad Year 2014–2015: Not offered
Acad Year 2015–2016: G (Fall)
4-0-8 H-LEVEL Grad Credit
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 Immunology
(Subject meets with 7.23)
Prereq: Permission of instructor
G (Fall)
5-0-7 H-LEVEL Grad Credit
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; 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 sys-
tem as a whole, as studied by modern methods
and techniques. Students taking the graduate
version are expected to explore the subject in
greater depth.
H. Ploegh

7.64 Molecular Mechanisms, Pathology and
Therapy of Human Neuromuscular Disorders
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
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 therapeu-
tic interventions. Covers neurodegenerative
diseases, such as Huntington’s disease, Parkin-
sen’s disease, Alzheimer’s disease, Amyotrophic
Lateral Sclerosis, Frontal Temporal Dementia,
and neuromuscular disorders, such as Myotonic
Dystrophy, Facio Scapular Humoral Dystrophy,
and Duchenne Muscular Dystrophy.
D. Housman

7.65J Molecular and Cellular Neuroscience Core I
(Same subject as 9.015J)
Prereq: None
G (Fall)
3-0-9
See description under subject 9.015J.
J. T. Littleton, H. Sive, F. Gertler

7.66 Molecular Basis of Infectious Disease
(Subject meets with 7.26)
Prereq: 7.06
Acad Year 2014–2015: Not offered
Acad Year 2015–2016: G (Spring)
4-0-8 H-LEVEL Grad Credit
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 tak-
ing the graduate version are expected to explore
the subject in greater depth.
D. Kim, J. Saeij

7.67J Genetic Methods in Neurobiology
(Same subject as 9.322J)
Prereq: Permission of instructor
G (Spring)
3-0-6 H-LEVEL Grad Credit
See description under subject 9.322J.
W. G. Quinn

7.68J Molecular and Cellular Neuroscience Core II
(Same subject as 9.013J)
Prereq: Permission of instructor
G (Spring)
3-0-9
See description under subject 9.013J.
G. Feng, L.-H. Tsai, Y. Lin

7.69J Developmental Neurobiology
(Same subject as 9.181J)
Prereq: 9.011 or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 9.181J.
E. Nedivi, M. Heiman

7.70 Regulation of Gene Expression
Prereq: Permission of instructor
Acad Year 2014–2015: Not offered
Acad Year 2015–2016: G (Spring)
4-0-8 H-LEVEL Grad Credit
Seminar examines basic principles of biologi-
cal 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 transcrip-
tion 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.
L. Boyer, M. Gehring

7.71 Biophysical Chemistry Techniques
Prereq: 5.13, 5.60; 5.07 or 7.05
Acad Year 2014–2015: Not offered
Acad Year 2015–2016: G (Spring)
5-0-7 H-LEVEL Grad Credit
Credit cannot also be received for 5.78
For students who want to understand the
benefits and caveats of biophysical techniques
used to ascertain the structure of macromol-
elcules, especially on the 3-D level. The first half
of the course focuses on X-ray crystallography,
the single most important technique used in
determining the 3-D structure of macromol-
elcules. Discussion of crystallographic theory is
complemented with exercises such as crystal-
lization, data processing, and model building.
In the second half of the course, biophysical
techniques are covered that supplement the 3-D
characterization of biological macromolecules.
Topics include CD spectroscopy, isothermal calo-
rimetry, analytical ultracentrifugation, dynamic
light scattering, and surface plasmon resonance
(BIAcore). Theoretical principles behind the tech-
niques are covered, applications are discussed,
and students are performing practical exercises
using instrumentation available at MIT. Meets
with 5.78 when offered concurrently.
C. Drennan, T. Schwartz

7.72 Principles and Frontiers of Developmental
Biology
Prereq: Permission of instructor
G (Fall)
4-0-8 H-LEVEL Grad Credit
Covers fundamental principles and frontiers
of animal development. Focuses on molecular
mechanisms, experimental approaches, evolu-
tionary context, human disorders, and topics
of societal importance. Compares vertebrate
(mouse, chick, frog, fish) and invertebrate (fly,
worm) models. Modules include patterning and
asymmetry of the body plan, cell type determina-
tion and diversity, organogenesis, morphogen-
esis, maternal control, organismal growth, stem
cells, and issues in human development.
H. Sive, T. Orr-Weaver

7.74J Topics in Biophysics and Physical Biology
(Same subject as 8.590J, 20.416J)
Prereq: None
G (Fall)
2-0-4 [P/D/F]
See description under subject 20.416J.
M. Bathe, J. Gore

7.76J Topics in Protein Biochemistry
Prereq: Permission of instructor
Acad Year 2014–2015: Not offered
Acad Year 2015–2016: G (Spring)
2-0-7 H-LEVEL Grad Credit
In-depth analysis and discussion of classic and
current literature, with an emphasis on protein
structure and function. Topics include binding
specificity; cooperativity and allostery; protein
folding and misfolding; macromolecular as-
sembly; sequence homology and prediction of
structure; and protein engineering and design.
Undergraduates should have taken 7.71 or 5.64.
A. Keating, R. T. Sauer
7.77 Nucleic Acids, Structure, Function, Evolution and Their Interactions with Proteins
Prereq: 7.05 or 7.51
G (Spring)
3-0-9 H-LEVEL Grad Credit

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 presentation of current literature in the context of student presentations.
D. Bartel, U. RajBhandary

7.78 Methods and Topics in Protein Biochemistry and Biophysics (New)
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

Students read and discuss papers dealing with protein structure and function and biophysical techniques used to characterize biological macromolecules. Topics include cooperativity and allosterity, protein folding and misfolding, pathways of macromolecular assembly, molecular motors, and protein design. Methods include CD spectroscopy, isothermal calorimetry, analytical ultracentrifugation, light scattering, and real-time kinetic measurements. Covers theoretical principles behind the techniques. Students complete practical exercises using instrumentation available at MIT.
R. T. Sauer, T. Schwartz

7.80 Biological Chemistry II
(Subject meets with 5.08J, 7.08J)
Prereq: 5.12; 5.07 or 7.05
G (Spring)
4-0-8 H-LEVEL Grad Credit

More advanced treatment of biochemical mechanisms that underlie biological processes. Topics include macromolecular machines such as the ribosome, the proteosome, fatty acid synthases as a paradigm for polyketide synthases and non-ribosomal polypeptide synthases, and polymerases. Emphasis is on experimental methods used to unravel these processes and how these processes fit into the cellular context and coordinate regulation. Students taking the graduate version are expected to explore the subject in greater depth.
J. Stubbe, E. Nolan

7.81J Systems Biology
(Same subject as 8.591J)
(Subject meets with 7.32)
Prereq: 18.03, 18.05; or permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

See description under subject 8.591J.
J. Chen

7.82 Topics of Mammalian Development and Genetics
Prereq: Permission of instructor
G (Spring)
3-0-9 [P/D/F] H-LEVEL Grad Credit

Seminar covering embryologic, molecular, and genetic approaches to development in mice and humans. Topics include preimplantation development; gastrulation; embryonic stem cells, gene targeting and nuclear reprogramming of somatic cells; genomic imprinting; X-inactivation; sex determination; and germ cells.
R. Jaenisch, R. Young

7.83 Forces in Cell Biology and Development
(Subject meets with 7.38)
Prereq: 7.06
G (Spring)
3-0-9 H-LEVEL Grad Credit

Covers the current understanding of how physical forces are generated in cells and how these forces organize and shape cells and tissues. Topics include methods to measure and detect forces for single molecules or in cells, mechanisms of force generation, sensing of force in signal transduction, and the roles of force in key cell biological and developmental processes and human disease. Includes lectures on concepts and experimental approaches related to forces in biology and discussions of representative recent papers. Students taking the graduate version are expected to explore the subject in greater depth.
I. Cheeseman, A. Martin

7.84 Immunology in Medicine (New)
(Subject meets with 7.24)
Prereq: Permission of Instructor
G (Spring)
5-0-7 H-LEVEL Grad Credit

Studies the development and function of the immune system at molecular, cellular and systems levels with emphasis on the role of immune system in disease pathogenesis and interventions. Discusses in depth the application of immunological principles in development of antibody therapeutics, cancer immunotherapies, vaccines, and other medical interventions. Lectures supplemented with discussions of original papers and team projects. Students taking graduate version complete additional assignments.
J. Chen

7.88J Protein Folding and Human Disease
(Same subject as 5.48J, 10.543J)
Prereq: 7.51 or permission of instructor
G (Spring)
3-0-6 H-LEVEL Grad Credit

Addresses the multifaceted biochemical problem of protein folding and the surprising ways it affects biological systems. Considers underlying chemistry and cellular biology, folding intermediates and off-pathway reactions, and the roles of chaperones and other folding assistants. Covers the amyloid fold, beneficial amyloid functions, major protein folding diseases (such as Alzheimer’s and Prion diseases) and the effects of protein folding on the evolution of novel functions.
J. A. King

7.89J Topics in Computational and Systems Biology
(Subject meets with CSB.100J)
Prereq: Permission of instructor
G (Fall)
2-0-10 H-LEVEL Grad Credit

Sees description under subject CSB.100J.
C. Burge

7.91J Foundations of Computational and Systems Biology
(Same subject as 20.490J)
(Subject meets with 6.802J, 6.874J, 7.36J, 20.390J, HST.506J)
Prereq: Biology (GIR), 6.0002 or 6.01; or 7.05; or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

Provides an introduction to computational and systems biology. Includes units on the analysis of protein and nucleic acid sequences, protein structures, and biological networks. Presents principles and methods used for sequence alignment, motif finding, expression array analysis, structural modeling, structure design and prediction, and network analysis and modeling. Techniques include dynamic programming, Markov and hidden Markov models, Bayesian networks, clustering methods, and energy minimization approaches. Exposes students to emerging research areas. Designed for students with strong backgrounds in either molecular biology or computer science. Some foundational material covering basic programming skills, probability and statistics is provided for students with less quantitative backgrounds.
Students taking graduate version complete additional assignments.

C. Burge, E. Fraenkel, D. Gifford

7.931 Independent Study in Biology
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

7.932 Independent Study in Biology
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
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] H-LEVEL Grad Credit
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] H-LEVEL Grad 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 (New)
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged H-LEVEL Grad Credit

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.

Staff

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

7.942 Research Problems
Prereq: Permission of instructor
G (Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
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: 7.06
G (Spring)
3-0-9 H-LEVEL Grad Credit

Intensive analysis of historical and current developments in cancer biology. Topics include principles of transformation, viral and cellular oncogenes, tumor suppressor genes, tumor-cell growth, apoptosis, principles of cancer biology, and cancer genetics. Detailed analyses of the current research literature including important research reports published in recent years. Enrollment limited.

M. Vander Heiden, R. Weinberg

7.98J Neural Plasticity in Learning and Memory
(Same subject as 9.301J)
Prereq: Permission of instructor
G (Spring)
3-0-6 H-LEVEL Grad Credit

See description under subject 9.301J.

S. Tonegawa, W. Quinn

7.5930, 7.5931 Special Subject in Biology
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

7.5932 Special Subject in Biology
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Not offered regularly; consult department
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

7.5939 Special Subject in Biology (New)
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Not offered regularly; consult department
Units arranged H-LEVEL Grad Credit
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, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

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

Staff
Bachelor of Science in Biology/Course 7

**General Institute Requirements (GIRs)**

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science Requirement [two subjects can be satisfied by 5.111, 5.112, or 3.091, and 7.012, 7.013, 7.014, 7.015, or 7.016 in the Departmental Program]</td>
<td>6</td>
</tr>
<tr>
<td>Humanities, Arts, and Social Sciences Requirement</td>
<td>8</td>
</tr>
<tr>
<td>Restricted Electives in Science and Technology (REST) Requirement [can be satisfied from among 5.12, 5.60(1) and 7.03 or 7.05 in the Departmental Program]</td>
<td>2</td>
</tr>
<tr>
<td>Laboratory Requirement [can be satisfied by 7.02 in the Departmental Program]</td>
<td>1</td>
</tr>
</tbody>
</table>

**Total GIR Subjects Required for SB Degree**

17

**Communication Requirement**

The program includes a Communication Requirement of 4 subjects:

- 2 subjects designated as Communication Intensive in Humanities, Arts, and Social Sciences (CI-H); and
- 2 subjects designated as Communication Intensive in the Major (CI-M).

**PLUS Departmental Program**

Subject names below are followed by credit units, and by prerequisites, if any (corequisites in italics).

### Required Subjects

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.111 or 5.112 Principles of Chemical Science, 12, Chemistry (GIR) or 3.091 Introduction to Solid-State Chemistry, 12, Chemistry (GIR)</td>
<td>99–102</td>
</tr>
<tr>
<td>5.12 Organic Chemistry I, 12, REST; Chemistry (GIR)</td>
<td></td>
</tr>
<tr>
<td>20.110J Thermodynamics of Biomolecular Systems,12, REST; Calculus II (GIR), Chemistry (GIR)</td>
<td></td>
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<tr>
<td>or 7.10J Physical Chemistry of Biomolecular Systems,12; Calculus II (GIR), Chemistry (GIR), Physics I (GIR), Physics II (GIR)</td>
<td></td>
</tr>
<tr>
<td>or 5.60 Thermodynamics and Kinetics,12, REST; Calculus II (GIR), Chemistry (GIR)</td>
<td></td>
</tr>
<tr>
<td>7.012, 7.023, 7.014, 7.015, or 7.016 Introductory Biology, 12</td>
<td></td>
</tr>
<tr>
<td>7.021 Introduction to Experimental Biology and Communication, 18, LAB, CI-M; Biology (GIR)</td>
<td></td>
</tr>
<tr>
<td>or 20.109 Laboratory Fundamentals in Biological Engineering, 15, LAB, CI-M; Biology (GIR), Chemistry (GIR), 6.0002, 18.03, 20.110J*</td>
<td></td>
</tr>
<tr>
<td>7.03 Genetics, 12, REST; Biology (GIR)</td>
<td></td>
</tr>
<tr>
<td>7.05 General Biochemistry, 12, REST; Biology (GIR)*</td>
<td></td>
</tr>
<tr>
<td>or 5.07 Biological Chemistry I, 12; 5.12</td>
<td></td>
</tr>
<tr>
<td>7.06 Cell Biology, 12; 7.03, 7.05</td>
<td></td>
</tr>
</tbody>
</table>

### Restricted Electives

Three undergraduate-level 12-unit subjects offered by the Department of Biology for which 7.03 and/or 7.05 are prerequisites. Exceptions: 7.30AJ and 7.30BJ(2) are eligible as a restricted elective: 7.19 cannot be used as a restricted elective. Graduate-level subjects may not be used as restricted electives. Subjects that count as restricted electives are the following: 7.08(1), 7.20(1), 7.21, 7.22, 7.23, 7.25, 7.26, 7.27, 7.28, 7.29(1), 7.30H and 7.30H(2), 7.31, 7.32, 7.33, 7.35, 7.36, 7.37, 7.38, 7.41, and 7.49.

One of the 30-unit project laboratory subjects in the department curriculum. Those currently offered are:

- 7.13 Experimental Microbial Genetics, 30, CI-M; 7.023, 7.03, 7.05
- 7.25 Experimental Molecular Genetics, 30, CI-M; 7.023, 7.03
- 7.16 Experimental Molecular Biology, 30, CI-M; 7.023, 7.03, 7.05
- 7.18 Topics in Experimental Biology, 30, CI-M; 7.023, 7.03, 7.05

### Departmental Program Units That Also Satisfy the GIRs

(60)

### Unrestricted Electives

72–75

**Total Units Beyond the GIRs Required for SB Degree**

180

No subject can be counted both as part of the 17-subject GIRs and as part of the 180 units required beyond the GIRs. Every subject in the student’s departmental program will count toward one or the other, but not both.

**Notes**

*Alternate prerequisites are listed in the subject description.

1The department recommends 20.110J, 7.10, or 5.60 to fulfill the biology requirements, but will also accept 2.005, 3.012, 8.044, or 10.213 as a substitution.

2The combination of 7.30AJ and 7.30BJ counts as one Biology restricted elective.

For an explanation of credit units, or hours, please refer to the online help of the MIT Subject Listing & Schedule, http://student.mit.edu/catalog/index.cgi.
Bachelor of Science in Biology/Course 7-A

General Institute Requirements (GIRs)

Science Requirement [two subjects can be satisfied by 5.111, 5.112, or 3.091, and 7.012, 7.013, 7.014, 7.015, or 7.016 in the Departmental Program]

6

Humanities, Arts, and Social Sciences Requirement

8

Restricted Electives in Science and Technology (REST) Requirement [can be satisfied from among 5.12, 5.60 and 7.03 or 7.05 in the Departmental Program]

2

Laboratory Requirement [can be satisfied by 7.02J in the Departmental Program]

1

Total GIR Subjects Required for SB Degree

17

Communication Requirement

The program includes a Communication Requirement of 4 subjects:

2 subjects designated as Communication Intensive in Humanities, Arts, and Social Sciences (CI-H); and

2 subjects designated as Communication Intensive in the Major (CI-M).

PLUS Departmental Program

Subjects names below are followed by credit units, and by prerequisites, if any (corequisites in italics).

Required Subjects

Principles of Chemical Science, 12, Chemistry (GIR)
or

Introduction to Solid-State Chemistry, 12, Chemistry (GIR)

Organic Chemistry I, 12, REST; Chemistry (GIR)

Thermodynamics of Biomolecular Systems, 12, REST; Calculus II (GIR), Chemistry (GIR)
or

Physical Chemistry of Biomolecular Systems, 12; Calculus II (GIR), Chemistry (GIR), Physics I (GIR), Physics II (GIR)
or

Thermodynamics and Kinetics, 12, REST; Calculus II (GIR), Chemistry (GIR)

Introductory Biology, 12, Biology (GIR)
or

Laboratory Fundamentals in Biological Engineering, 15, LAB, CI-M; Biology (GIR)
or

Genetics, 12, REST; Biology (GIR)

General Biochemistry, 12, REST; Biology (GIR)*
or

Biological Chemistry I, 12; 5.12

Cell Biology, 12; 7.03, 7.05

Restricted Electives

Three undergraduate-level 12-unit subjects offered by the Department of Biology for which 7.03 and/or 7.05 are prerequisites. Graduate-level subjects may not be used as restricted electives. Subjects that count as restricted electives are the following: 7.08J, 7.20J, 7.21, 7.22, 7.23, 7.24, 7.25, 7.26, 7.27, 7.28, 7.29J, 7.30A, 7.30B, 7.31, 7.32J, 7.33, 7.35, 7.36, 7.37J, 7.38, and 7.49J.

One of the following CI-M subjects: 3.014, 5.36, 5.38, 7.19, 8.13, 9.12, 10.26, 10.27, 10.28, 10.29, 20.380, or 6.021J.

Departmental Program Units That Also Satisfy the GIRs

(60)

Unrestricted Electives

90–93

Total Units Beyond the GIRs Required for SB Degree

180

No subject can be counted both as part of the 17-subject GIRs and as part of the 180 units required beyond the GIRs. Every subject in the student’s departmental program will count toward one or the other, but not both.

Notes

*Alternate prerequisites are listed in the subject description.

(1) The department recommends 20.110J, 7.10J, or 5.60 to fulfill the biology requirements, but will also accept 2.005, 3.012, 8.044, or 10.213 as a substitution.

(2) The combination of 7.30A and 7.30B counts as one Biology restricted elective.

For an explanation of credit units, or hours, please refer to the online help of the MIT Subject Listing & Schedule, http://student.mit.edu/catalog/index.cgi.
# Bachelor of Science in Computer Science and Molecular Biology/Course 6-7

## General Institute Requirements (GIRs)

<table>
<thead>
<tr>
<th>Subject</th>
<th>Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science Requirement</td>
<td>6</td>
</tr>
<tr>
<td>Humanities, Arts, and Social Sciences Requirement (REST) Requirement</td>
<td>8</td>
</tr>
<tr>
<td>[can be satisfied by 6.042, 18.03, or 18.06 in the Departmental Program]</td>
<td>2</td>
</tr>
<tr>
<td>Laboratory Requirement [can be satisfied by 7.02 or 20.109 in the Departmental Program]</td>
<td>1</td>
</tr>
<tr>
<td>Total GIR Subjects Required for SB Degree</td>
<td>17</td>
</tr>
</tbody>
</table>

## Communication Requirement

The program includes a Communication Requirement of 4 subjects: 2 subjects designated as Communication Intensive in Humanities, Arts, and Social Sciences (CI-H), and 2 subjects designated as Communication Intensive in the Major (CI-M).

## PLUS Departmental Program

Subject names below are followed by credit units, and by prerequisites, if any (corequisites in italics).

### Required Subjects

**1. Mathematics and Introductory**

- **18.03** Differential Equations, 12, REST; Calculus II (GIR)
- **18.06** Linear Algebra, 12, REST; Calculus II (GIR)
- **6.01** Introduction to EECS I, 12, 1/2 LAB; Physics II (GIR)
- **6.042** Mathematics for Computer Science, 12, REST; Calculus I (GIR)

**2. Chemistry**

- **5.12** Organic Chemistry I, 12, REST; Chemistry (GIR)
- **5.60** Thermodynamics and Kinetics, 12, REST; Calculus II (GIR), Chemistry (GIR)
- **7.10** Physical Chemistry of Biomolecular Systems, 12; Calculus II (GIR), Chemistry (GIR), Physics I (GIR), Physics II (GIR)
- **20.110** Thermodynamics of Biomolecular Systems, 12, REST; Calculus II (GIR), Chemistry (GIR)

**3. Introductory Laboratory**

- **7.02** Introduction to Experimental Biology and Communication, 18, CI-M, LAB; Biology (GIR)
- **20.109** Laboratory Fundamentals in Biological Engineering, 15, LAB, CI-M; Biology (GIR), Chemistry (GIR), 6.0002, 18.03, 20.110* 

**4. Foundational Subjects**

**Three Computer Science subjects:**

- **6.005** Elements of Software Construction, 12; REST; 6.01, 6.042/
- **6.006** Introduction to Algorithms, 12; 6.01, 6.042/
- **6.046** Design and Analysis of Algorithms, 12; 6.006*

**Three Biological Science subjects:**

- **7.03** Genetics, 12, REST; Biology (GIR)
- **7.06** Cell Biology, 12; 7.03, 7.05
- **7.05** General Biochemistry, 12, REST; 5.12*
- **5.07** Biological Chemistry I, 12, REST; 5.12

**5. Restricted Electives**

24

One subject in Computational Biology:

- **6.047** Computational Biology: Genomes, Networks, Evolution, 12; 6.006, 6.041, Biology (GIR)*
- **6.503** Foundations of Algorithms and Computational Techniques in Systems Biology, 12; 6.046*
- **7.36** Foundations of Computational and Systems Biology, 12; 7.05*

One subject in Biology:

- **7.20** Human Physiology, 12; 7.05
- **7.23** Immunology, 12; 7.05*
- **7.27** Principles of Human Disease, 12; 7.03, 7.05, 7.06
- **7.28** Molecular Biology, 12; 7.03, 7.05
- **7.33** Evolutionary Biology: Concepts, Models, and Computation, 12; 7.03, 6.0002*

**6. Advanced Undergraduate Project**

12

**6.UAT** Oral Communication, 6

Plus one of the following:

- **6.UAP** Undergraduate Advanced Project, 6, CI-M; 6.UAT
- **6.UAR** Seminar in Undergraduate Advanced Research, 12, CI-M; 6.UR
### Departmental Program Units That Also Satisfy the GIRs

<table>
<thead>
<tr>
<th>Departmental Program Units That Also Satisfy the GIRs</th>
<th>(36)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unrestricted Electives</td>
<td>48</td>
</tr>
</tbody>
</table>

### Total Units Beyond the GIRs Required for SB Degree

| Total Units Beyond the GIRs Required for SB Degree | 195–198 |

*No subject can be counted both as part of the 17-subject GIRs and as part of the 198 units required beyond the GIRs. Every subject in the student’s departmental program will count toward one or the other, but not both.*

### Notes

*Alternate prerequisites and corequisites are listed in the subject description.

(1) See the description of required communication-intensive subjects for information about acceptable substitutions for the 6.UAT/6.UAP or 6.UAT/6.UAR sequence.

For an explanation of credit units, or hours, please refer to the online help in the MIT Subject Listing & Schedule, [http://student.mit.edu/catalog/index.cgi](http://student.mit.edu/catalog/index.cgi).
# Master of Engineering in Computer Science and Molecular Biology/Course 6-7P

## General Institute Requirements (GIRs)

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science Requirement</td>
<td>6</td>
</tr>
<tr>
<td>Humanities, Arts, and Social Sciences Requirement</td>
<td>8</td>
</tr>
<tr>
<td>Restricted Electives in Science and Technology (REST) Requirement [can be satisfied by 6.042, 18.03, or 18.06 in the Departmental Program]</td>
<td>2</td>
</tr>
<tr>
<td>Laboratory Requirement [can be satisfied by 7.02 in the Departmental Program]</td>
<td>1</td>
</tr>
</tbody>
</table>

**Total GIR Subjects Required for SB Degree**: 17

## Communication Requirement

The program includes a Communication Requirement of 4 subjects:
- 2 subjects designated as Communication Intensive in Humanities, Arts, and Social Sciences (CI-H); and
- 2 subjects designated as Communication Intensive in the Major (CI-M).

## PLUS Departmental Program

Subject names below are followed by credit units, and by prerequisites, if any (corequisites in italics).

### Required Subjects

**Units**: 213–216

1. **Mathematics and Introductory**
   - 18.03 Differential Equations, 12, REST; Calculus II (GIR)
   - or
   - 18.06 Linear Algebra, 12, REST, Calculus II (GIR)
   - 6.01 Introduction to EECS I, 12, 1/2 LAB; Physics II (GIR)
   - 6.042 Mathematics for Computer Science, 12, REST; Calculus I (GIR)

2. **Chemistry**
   - 5.12 Organic Chemistry I, 12, REST; Chemistry (GIR)
   - 5.60 Thermodynamics and Kinetics, 12, REST; Calculus II (GIR), Chemistry (GIR)
   - or
   - 7.10j Physical Chemistry of Biomolecular Systems, 12; Calculus II (GIR), Chemistry (GIR), Physics I (GIR), Physics II (GIR)
   - or
   - 20.110j Thermodynamics of Biomolecular Systems, 12, REST; Calculus II (GIR), Chemistry (GIR)

3. **Introductory Laboratory**
   - 7.02 Introduction to Experimental Biology and Communication, 18, CI-M, LAB; Biology (GIR)
   - or
   - 20.109 Laboratory Fundamentals in Biological Engineering, 15, LAB, CI-M; Biology (GIR), Chemistry (GIR), 6.0002, 18.03, 20.110j*

4. **Foundational Subjects**
   - Three Computer Science subjects:
     - 6.005 Elements of Software Construction, 12; REST; 6.01, 6.042j*
     - 6.006 Introduction to Algorithms, 12; 6.01, 6.042j*
     - 6.046 Design and Analysis of Algorithms, 12; 6.006*
   - Three Biological Science subjects:
     - 7.03 Genetics, 12, REST; Biology (GIR)
     - 7.06 Cell Biology, 12; 7.03, 7.05
     - 7.05 General Biochemistry, 12, REST; 5.12*
     - or
     - 5.07j Biological Chemistry I, 12, REST; 5.12

5. **Restricted Electives**
   - 24
   - One subject in Computational Biology:
     - 6.047 Computational Biology: Genomes, Networks, Evolution, 12; 6.006, 6.041, Biology (GIR)*
   - 6.048 Foundations of Algorithms and Computational Techniques in Systems Biology, 12; 6.046*
   - 7.05 Foundations of Computational and Systems Biology, 12; 7.05*
   - One subject in Biology:
     - 7.20 Human Physiology, 12; 7.05
     - 7.23 Immunology, 12; 7.03*
     - 7.27 Principles of Human Disease, 12; 7.03, 7.05, 7.06
     - 7.28 Molecular Biology, 12; 7.03, 7.05
   - 7.22 Evolutionary Biology: Concepts, Models, and Computation, 12; 7.03, 6.0002*

6. **Advanced Undergraduate Project**
   - 12
   - 6.UAT Oral Communication, 6
   - Plus one of the following:
     - 6.UAP Undergraduate Advanced Project, 6, CI-M; 6.UAT
     - or
     - 6.UR Seminar in Undergraduate Advanced Research, 12, CI-M; 6.UR

7. Four graduate subjects totaling at least 42 units, which includes two concentration subjects (approved by the department) plus a third graduate subject in electrical engineering and computer science and/or biology.

8. Two subjects from a restricted departmental list of math electives.
### Departmental Program Units That Also Satisfy the GIRs

<table>
<thead>
<tr>
<th>Category</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unrestricted Electives</td>
<td>48</td>
</tr>
<tr>
<td>Total Units Beyond the GIRs Required for SB Degree</td>
<td>285–288</td>
</tr>
</tbody>
</table>

No subject can be counted both as part of the 17-subject GIRs and as part of the 270–282 units required beyond the GIRs. Every subject in the student's departmental program will count toward one or the other, **but not both**.

### Notes

* Alternate prerequisites and corequisites are listed in the subject description.

(1) To complete the required Communication-Intensive subjects in the major, students must take 7.02J or 20.109 or 6.UAT/6.UAP by the end of the third year. The second CI-M should be chosen to complete the requirements in categories 3 and 6 above.

(2) See the description of required communication-intensive subjects for information about acceptable substitutions for the 6.UAT/6.UAP or 6.UAT/6.UAR sequence.

### Notes on Master of Engineering and Bachelor’s Degree Programs

The Master of Engineering program builds on the bachelor’s degree program (6-7), with restricted elective categories 7 and 8 and the MEng thesis.

The Master of Engineering in Computer Science and Molecular Biology is only awarded to students who have received, or are simultaneously receiving, the 6-7 bachelor’s degree. Students who receive the Master of Engineering degree after having obtained the 6-7 bachelor’s degrees must fulfill the requirements for Course 6-7P as described above.

For an explanation of credit units, or hours, please refer to the online help of the MIT Subject Listing & Schedule, [http://student.mit.edu/catalog/index.cgi](http://student.mit.edu/catalog/index.cgi).