Undergraduate Courses

5 Neuroanatomy. (Cross-listed as Occupational Therapy 103.) See Occupational Therapy for course description.
Whitney, Pessina

6 Big Bang to Humankind. (Cross-listed as Chemistry 0006 & Astronomy 0006). Course will explore the origins of the Universe, the formation of Earth and its structure, the chemistry of life, the development of complex organisms, and the development of modern humans. Students will learn the evidence for the various ideas presented, the scientific method used by scientists, and how the community of scientists evaluates the evidence. This course does not fulfill pre-medical requirements for a lab-based chemistry course. Open to all students, freshman through seniors. Spring.
Campbell.

7 Environmental Biology. (Cross listed as Environmental Studies 007)
An examination of major natural and created ecosystems and human influences on them. Biological bases for species distributions, human population size, and conservation. Ecological bases for sound land use and pollution abatement.
Orians, Reed

14 Organisms and Population. Forms a logical sequel to Biology 13. Selected topics in animal and plant physiology, development, genetics, and population biology, with emphasis on evolutionary mechanisms. Two lectures and one laboratory each week. Prerequisite: Biology 13 recommended. Spring.
Warchola, Gouvea, Grossi

41 General Genetics. Basic concepts of classical and molecular genetics, including Mendelian genetics, genetic mapping, recombination, the genetic code, gene transcription and translation, regulation in prokaryotes and eukaryotes, genetic engineering, and human chromosomal abnormalities. Prerequisite: Biology 13 or equivalent. Fall/Summer.
K. Mirkin

44 Primate Social Behavior. (Cross-listed as Anthropology 0044): Introduction to social lives of primates. Uses experimental and observational studies to teach students how to understand and engage with scientific literature and method. Covers ecological, physiological, and developmental bases of primate social behavior, with attention to evolution of social interactions among individuals of different age, sex, relatedness, and status. Topics include competition and cooperation, dominance and territoriality, sex and mating, parenting, cognition and conservation. Includes a weekly lab where students will learn primatological methods. (Group C) No pre-requisites. Spring.
Saipe

46 Cell Biology. Basic concepts of cellular organization, function, regulation. Emphasis on molecular/biochemical approach to fundamentals of bioenergetics; plasma membrane functions such as transport, secretion, and signal transduction; organelle function and biogenesis; cell growth and division. Prerequisite: Biology 13 or equivalent. (Group A.) Spring.
Koegel

50 Experiments in Molecular Biology. Similar to Biology 49, but investigating a series of laboratory problems using modern techniques of biotechnology. Gene cloning, recombinant protein expression, protein biochemistry, and immunochemistry are emphasized for teaching state-of-the-art laboratory skills and for reinforcing basic concepts of modern molecular biology. One laboratory session per week plus one discussion period. Prerequisites: sophomore standing and Biology 13 or equivalent. Open only to majors in biology, biochemistry, or biotechnology. Spring.
52 Experiments in Cell Biology. The field of Cell Biology focuses on examining cells and the behaviors they perform. This course will introduce students to the investigation of several laboratory problems using standard techniques of cell biology examining diverse organisms, ranging from single cells to intact animals. One laboratory session per week plus one discussion period. Requires completion of BIO 0013 or equivalent. Spring.

McLaughlin, Fuchs, Levin

61 Biology of Aging. An introduction to the biology of aging. Focus on molecular, cellular, and physiological changes that occur during the aging process in humans and other organisms. Major topics include theories of aging, genetic regulation of longevity in model systems, and therapeutic modulation of the aging process. Prerequisites: Bio13 and Bio14 or their equivalent, or consent.

McVey

62 Molecular Biotechnology. (Cross-listed as BME 62 and CHBE 62.) Overview of key aspects of molecular biology and engineering aspects of biotechnology. Lecture topics include molecular biology, recombinant DNA techniques, immunology, cell biology, protein purification, fermentation, cell culture, combinatorial methods, and bioinformatics. (Group A.) (May be taken at the 100-level with consent; see below.) Recommendations: CHEM 1, BIO 13, or permission of instructor.

Kaplan, Lennon

94 Introduction to Research. At least ten hours per week of guided laboratory research, generally including one hour of consultation or seminar with research supervisor and a paper. Details of individual project to be worked out with the supervisor. Gives students an opportunity to participate in biological research on the Tufts Medford/Somerville and Boston campuses. Does not satisfy laboratory or course requirement for the major in biology. May be counted as credit toward degree only. Students typically initiate independent research in their sophomore or junior years. Prerequisites: Permission of research mentor and subsequently course coordinator. Pass-fail grading.

Koegel

Undergraduate and Graduate Courses

106 Microbiology. A survey to provide a general understanding of bacteria and viruses. Bacterial structure, growth, ecology, pathogenic mechanisms, and viral life cycles. The laboratory will familiarize students with microbiological methods and various groups of microorganisms. Three lectures, one laboratory per week. Prerequisites: Requires completion of Bio 013, Bio 014, and Bio 041 or graduate student. Spring.

Wolfe

108 Plant Development. (Cross-listed as ENV 108.) Structural and physiological aspects of plant development. Genetic and environmental influences on development as these pertain to germination, root and shoot growth, and plant sexuality and flowering. Information on corn, bean, and tobacco systems will be extended to diverse groups such as cacti, ferns, bromelaids, water plants, parasitic and carnivorous plants. Recommendations: BIO 13 and 14, or equivalent.

Ellmore

116 General Physiology II. Elements of homeostasis and of endocrine, nervous, and digestive systems are discussed at various levels, from the molecular to the organ system. Material will include lessons from and comparisons across vertebrates and invertebrates. Prerequisites: Bio 13 and 14, or equivalent.

Spinazolla
117 Physiology of Movement. Introduction to the physiological basis of human and animal movement. Topics include biomechanics, kinesiology, muscle and bone physiology, biological materials, and locomotion. (Group B or Q). Prerequisites: Bio 13 & 14 or equivalent required. Physics 1 and Math 32 will be helpful, but not required.
Tytell

119 Biophysics. (Cross-listed as PHY 25) Presentation at an introductory level of selected topics in physics relevant to modern medicine and biology. Development of topics to the point of application to biomedical problems. Topics drawn from acoustics, physics of fluids, diffusion, laser physics, and other subjects varying from year to year. Prerequisites: PHY 1, 2, or 11, 12 or permission of instructor. Corequisite: MATH 42 (formerly MATH 13). Spring.
Cebe

130 Animal Behavior. An examination of ethological theory: the development of behavior, orientation, migration, communication, and social behavior. Particular emphasis will be placed on the functioning of animal societies. Prerequisites: Biology 13 and 14, or equivalent. (Group C.) Spring.
Starks

131 Principles of Medical Imaging. (Cross-listed as Electrical Engineering 131). This interdisciplinary course presents the principles of medical imaging techniques such as diagnostic ultrasound, radiography, X-ray, computed tomography (CT), and magnetic resonance imaging (MRI). For each imaging modality, topics include the physical principles, key aspects of instrumentation design, mathematical methods, and the anatomical/physiological information content of the images. Representative medical images will be discussed and interpreted. This course cannot be taken for basic science requirement for engineering students. Prerequisites: Mathematics 11, Physics 2 or 12, or consent.
Fantini

133 Ecological Statistics and Data w/Lab. Probability and likelihood, fitting simple models to data, and using models to make predictions. Examples come from problems in ecology, with emphasis on monitoring plant and animal populations and forecasting how these populations will respond to changing environments. Includes an introduction to Bayesian statistics, building mixed and compounded probability distributions, and use of the open-source statistics program, R. Open to students at any level who are interested in using models to interpret biological or environmental data. Students should have an interest in ecology. Calculus recommended, strong working knowledge of high school algebra required. (Group C or Group Q) Spring.
Brown

134 Neurobiology. Biology of nervous systems. From the biophysical basis of neuronal function, through synaptic interactions and signal processing in neural circuits, to behavior, learning, and memory. Examples from both vertebrates and invertebrates. Recommendations: BIO 13 and 14, plus one Group A course in biology or PSY 103.
Trimmer

143 Evolutionary Biology w/Lab. Theory and evidence on mechanisms of evolutionary change in natural populations. Population genetics, speciation, biogeography, biochemical coevolution, life history strategies, sexual selection, and genetics of endangered species. Labs address questions in ecology and evolutionary biology through the application of bioinformatic analytical tools on genomic data sources (gene expression, protein, DNA). Prerequisites: Bio 13 and 14, or equivalent. 1.5 credits (Group A, Group C or Group Q) Spring.
Dopman

152 Biochemistry and Cellular Metabolism. An in-depth examination of the structure and function of biomolecules: chemical and physical properties of proteins, carbohydrates, and lipids; enzyme kinetics and mechanisms; metabolism of carbohydrates, lipids, and amino acids and the metabolic relationships of organ systems. Prerequisites: Biology 13 and Chemistry 51 or 50. (Group A.) Spring.
Fuchs
**164 Marine Biology.** An intermediate-level introduction to the biology of marine organisms. Following a detailed survey of major marine animal and plant groups, the course will consider food web dynamics; physiological and ecological adaptations to key marine habitats, including the deep sea, coral reefs, estuaries, and the intertidal zone; and the impact of global warming, ocean acidification, and overfishing on marine communities and fisheries. Prerequisites: Biology 13 and 14, or equivalent. (Group C.) Spring. Pechenik


**178 Seminar in Immunology.** Advanced topics in immunology. Readings and discussion of the current literature emphasized. Topics include antigen presentation, T-cell activation, cytokine release and effects, self-and non-self recognition, and immunopathology of HIV. Prerequisite: Biology 104 and consent. (Group A) Spring 2015 and alternate years. Bernheim

**185 Food for All: Ecology, Biotechnology and Sustainability.** With the human population expected to exceed 9 billion by 2050, how will we meet the increasing demand for food in an ecologically sustainable way? Historically, rapid increases in yield have been a result of advances in three main technologies: (1) genetic improvement; (2) use of synthetic pesticides and fertilizers; and (3) expanded irrigation. Each of these technological advances, however, has limitations or has led to significant environmental degradation. There is an urgent need for new approaches to food production without destroying the environment. In this interdisciplinary course, we will examine the pros and cons of divergent approaches to meeting this food demand. Using crops grown in developing and industrialized countries as case studies, we will evaluate: (1) how ecological knowledge makes food production more sustainable; (2) what existing and emerging approaches can, in the face of climate change, contribute to a reliable supply of nutritious food; and (3) the political and economic drivers that shape who has access to these technologies. We will also explore stakeholder-specific perspectives (growers, advocacy groups, industry, governmental agencies), as well as develop important communication skills for negotiating these different perspectives. (Group C)

**Section 1 Prerequisites:** Graduate student standing, **Recommended:** Intro level biology or equivalent.

**Section 2 Prerequisites:** ENVS majors, ENVS minors or Biology majors (We'll open it up to others if there are spots available. **Recommended:** Intro level biology or equivalent.

Orians, Gomez

**186 Seminar in Field Endocrinology.** Advanced seminar explores the mechanistic role of endocrine systems in coordinating how animals survive, breed, and adapt to the ever-changing natural environment. Emphasis on wild animals in natural conditions with focus on student-led discussions of primary scientific literature surrounding a core text. Prerequisite: 1 prior Group B course

Romero

**190 DNA: Structure and Function.** DNA is the indispensable molecule of life. Fundamentals of DNA structure and functioning are therefore central to understanding molecular genetics and genomics. In this course, DNA structure and function are examined through lectures and discussions of the original scholarly literature. Originally, DNA was believed to be a uniform right-handed double helix with limited structural flexibility. It has now become clear, however, that its structure is highly versatile, and this versatility is vital for major genetic processes. Topics include DNA secondary and tertiary structures, DNA topology and topoisomerases, mechanisms of protein-DNA recognition and the structure of the chromatin; how the principles of DNA organization are employed in key genetic transactions, including DNA replication, transcription, repair, and recombination. Recommendations: BIO 41 and junior standing or consent. S Mirkin

**194 Independent Research.** At least fifteen hours per week of laboratory or field investigation, which must include independent design of experiments. Students write a summary of research accomplished and give an oral presentation to Susan Koegel
196-01 Selected topics: Biology of Fishes. Please reach out to Jan Pechenik for more details on this course. Please note that this class meets off campus at the New England Aquarium.

196-02 Selected Topics: Adv Genetics and Genome Editing. This course will teach the current state-of-the-art knowledge of DNA repair pathways that the cell uses to maintain a stable genome, including double-strand break repair, gap repair, repair and replication through DNA structures and chromatin, and consequences of inappropriate repair for cell health and cancer initiation. It will also cover current genome editing technologies including CRISPR-Cas9, Adenovirus-mediated gene delivery for gene therapy, and RNAi. The course will have both a lecture component and a presentation/discussion component emphasizing reading of original journal articles in these fields and techniques used to make discoveries. Prerequisites: A prior course in Genetics and/or Molecular Biology is highly recommended. *Dykstra, Polleys, House*

196-03 Selected Topics: Adv Topics Behavioral Research. Please reach out to Philip Starks for more details on this course.

196-04 Selected Topics: Edible Insects. Please reach out to Sara Lewis for more information about this course.

196-05 Selected Topics: Plant and Animal Interactions. Please reach out to Colin Orians or Elizabeth Crone for more details on this course.

196-08 Selected Topics: Research in Developmental Plasticity. Please reach out to Michael Levin for more details on this course.

196-10 Selected Topics: Adv Topics Conservation Biology. Please reach out to Michael Reed for more details on this course.

196-21 Selected Topics: Teaching Bio – Student Centered Ped. Please reach out to Julia Gouvea for more details about this course.

199 Senior Honors Thesis. Intensive laboratory or field investigation, including independent design of experiments, a written thesis, and an oral defense. Application is made during the student's sixth semester. Normally, the applicant should have received at least three grades of A toward satisfying the concentration requirements for the biology major and should have a cumulative average of at least 3.30. Prerequisites: Biology 193 or equivalent, and prior consent of the course coordinator. *K Mirkin*

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Additional Graduate Courses

*Graduate courses include all 100 level courses and above.*

*The following courses are primarily for graduate students; undergraduate registration requires the consent of the instructor.*

200 Lab Meeting. Lab meeting of the Professor in the selected section. This course is only for members of the lab, and should not be chosen without permission of the professor. It is 0 credits.
254 Graduate Student Research Rotation. A research rotation is an opportunity to explore a new area of Biology, to learn new techniques, and to become acquainted with some of the research ongoing in our department as students conduct intensive laboratory or field investigation, including independent design of experiments ending with a final oral report. Students will normally present their findings the Friday before the start of spring semester. Rotation Duration: Oral reports will be given to a group consisting of other students who have just finished a rotation, the sponsoring research mentors, members' of the students' committees, graduate students, and other interested persons. 1 graded credit. Prerequisite: consent.

256 Masters Thesis Research (1st Year). This course provides credit for first year graduate student MS thesis research. The content includes learning experimental design, research presentations, and reading papers in the field of the chosen ThMS research. Chose section -01 and the faculty mentor you are working with.

258 Graduate Research and Experimental Design (2nd Year). This course provides credit for second year graduate student thesis or dissertation research. The content includes learning experimental design, research presentations, and reading papers in the field of the chosen PhD or ThMS research. Chose section -01 and the faculty mentor you are working with.

291 Graduate Seminar in Molecular and Developmental Biology A & B Presentation of individual reports on basic topics to a seminar group for discussion and criticism. Credit as arranged.

294 Special Topics. Guided individual study of an approved topic. Credit as arranged.

296 Master's Thesis. Guided research on a topic that has been approved as a suitable subject for a master's thesis. Credit as arranged.

298 PhD Dissertation Guided research on a topic suitable for a doctoral dissertation. Credit as arranged.

401PT Master's Continuation, Part-time.

402FT Master's Continuation, Full-time.

405 Graduate Teaching Assistant

406 Graduate Research Assistant

501PT Doctoral Continuation, Part-time.

502FT Doctoral Continuation, Full-time.