Biology Department

Fall 2019 Course Descriptions

Undergraduate Courses

Biology 001 Environment Preservation & Improvement. (Cross listed as ENV 0091)
Seminar based on current readings from environmental journals that provide insight into environmental science for use by scientists, science media, business leaders, and political decision makers. Topic areas include biodiversity and wildlife, alternative energy, ocean protection, climate shift, urban ecology, sustainable agriculture, GIS and remote imagery. Students must attend the first day of class. This course does not count towards the biology major. Prerequisites: Sophomore standing and Bio 2 or Bio 7 or Bio 10 or Bio 13 or Bio 14.

Dr. Ellmore

Biology 004 Gross Anatomy. (Cross listed as Occupational Therapy 102)
A systemic approach to human anatomy, including the skeletal, muscular, respiratory, digestive, genital, urinary, and nervous systems. Detailed study of the upper and lower extremities, emphasizing normal function. Laboratory sessions weekly. Prerequisite: Any college biology course.

Call Boston School of Occupational Therapy (617-627-5720) for information about this course.

Biology 010 Plants and Humanity.
Principles of botany accenting economic aspects and multicultural implications of plants, their medicinal products, crop potential, and biodiversity. Emphasis placed on global aspects of this dynamic science, with selected topics on acid rain, deforestation, biotechnology, and other applications. Also covered are medicinal, poisonous, and psychoactive species, as well as nutritional sources from seaweeds and mushrooms to mangos and durians.

Dr. Ellmore

Biology 011 Kinesiology. (Cross listed as Occupational Therapy 104)
Introduction to normal human movement. The basic anatomical, physiological, and biomechanical principles that underpin normal movement and function. Includes the assessment of muscle and joint function through manual muscle testing and goniometry. Emphasis on the biomechanics of everyday activities.

Dr. Harney. Call Boston School of Occupational Therapy (627-5720) for information about this course.

Biology 012 Evolution in Our World.
This course, designed for non-biology majors, explores the diversity of life on our planet, how that diversity came about, and how human actions are causing changes for the future. Students will learn the evidence for evolutionary change; the mechanisms through which such changes occur; and the ways in which pollution, ocean acidification, and climate change are subjecting all organisms to a new range of selective pressures. They will also learn about human evolution and about applications of evolutionary thinking to biomedical research. The course provides a sound introduction to the characteristics of scientific thinking

Dr. Dopman and Dr. Pechenik
**Biology 13 Cells and Organisms with Lab.**
An introductory course primarily for prospective biology majors. General biological principles and widely used methods related to current advances in cell and molecular biology, genetics, immunology, plant and biomedical sciences. This course must be taken with the lab — enroll in one of the laboratories in Biology 13L A-N below. Two lectures and one laboratory each week. Four exams + final. Credit cannot be received for both BIO 13 and ES 11. Recommendations: Advanced high-school chemistry and biology recommended.

*Staff, Dr. K Mirkin*

**Biology 41 General Genetics.**
Concepts of classical and molecular genetics. A knowledge of basic genetics and cell structure as covered in Bio 13 is essential for Bio 41 students. Grading is based on two tests and an exam (the exam will be at the assigned final exam time), on-line quizzes, and participation in the mandatory recitation. **Prerequisites:** Bio 13.

*Dr. K Mirkin. Mandatory Recitation you must sign up for one*

**Biology 49 A&B Experiments in Physiology.**
Experimental investigations of several problems in physiology using a wide variety of modern techniques. Classes will concentrate on several biological concepts and emphasize appropriate experimental design, data collection, data analysis and presentation. One laboratory session per week plus one discussion period. **Prerequisite** is Biology 14 & sophomore standing or equivalent.

*Dr. Tytell, Dr. M Kao, Dr. Trimmer*

**Biology 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 immunochromatography 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 BIO 013 or equivalent. Open only to majors in biology, biochemistry, or biotechnology.

*Dr. Fuhrman*

**Biology 51 A&B Experiments in Ecology.** *(Cross-listed as ENV 51).*
An introduction to field research in different habitats. Emphasis on acquiring skills in taxonomic identification, sampling techniques, hypothesis testing and experimental design, data analysis and interpretation, as well as oral and written communication. Opportunity for student-designed group research projects on ecological questions. One laboratory session per week plus one discussion period. **Prerequisites:** Biology 14 or equivalent & sophomore standing.

*Dr. Pechenik, Dr. Ellmore, Dr. Starks*

**Biology 55 Microbiome Research Lab.**
This laboratory course will teach undergraduate students concepts and techniques in microbiome science through independent research projects. Using model microbiomes (fermented foods, plant leaf surfaces, and planarian worms), students will design and conduct experiments to characterize microbiome diversity, identify processes that control microbiome composition, and quantify functional roles of microbiomes. Students will learn principles of experimental design, microbial genomics and metagenomics, microbiome data management and analysis, in vitro microbiome reconstruction, experimental evolution, microbial trait analysis, and microbial genetic screens. No prior lab experience is required. **Prerequisites:** Requires completion of BIO 013. Open only to majors in biology.

*Dr. Wolfe*
**Biology 93 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. Pass/fail grading. Recommendations: Permission of research mentor and subsequently course coordinator.

*Dr. Warchola*

**Graduate and undergraduate courses**

**Biology 103 Developmental Biology.**
Concepts of animal developmental biology, with emphasis on the molecular events underlying the morphological changes that occur going from egg to adult. Examples drawn from several of phyla will illustrate developmental mechanisms, patterns of gene expression and gene regulatory networks involved in gametogenesis, fertilization, cell differentiation, cell signaling, cell-cell interactions and organ formation. Topics include issues of human cloning, birth defects, stem cell research, gene therapy, assisted reproduction technologies and developmental evolution. **Prerequisites:** BIO 041 or 046 or consent.

*Dr. McLaughlin*

**Biology 105 Molecular Biology.**
Gene structure and function in prokaryotes and eukaryotes, fundamentals of recombinant DNA technology. Mechanisms of DNA replication, recombination, transcription, and protein synthesis are emphasized. Advanced topics including gene expression during cell differentiation, retroviral infection, and regulation of cell proliferation are based on current literature. **Prerequisites:** BIO 041.

*Dr. McVey*

**Biology 110 Endocrinology.**
A comprehensive introduction to the chemical and physiological principles of hormonal integration in vertebrates. Topics include: endocrine regulation of metabolism, growth and development, reproduction, neural functions, mineral and water balance, behavior and nutrition. **Prerequisites:** Biology 13 and 14 or equivalent. (Group B)

*Dr. Romero*

**Biology 115 General Physiology I.**
Elements of homeostasis, circulation, respiration, and excretion are discussed at various levels, from the molecular to the organ system. **Recommendations:** BIO 013 and 014, or equivalent

*Staff*

**Biology 121 Mathematical Neuroscience. (Cross-listed as Math 121)**
Mathematical and computational study of systems of differential equations modeling nerve cells (equilibria, limit cycles, bifurcations), neuronal networks (intrinsic rhythmic synchronization, entrainment by external inputs), and learning (synaptic plasticity), and of the potential function of rhythmic synchrony for signaling among neuronal networks and for plasticity. **Prerequisites:** Math 51 or instructor’s consent. course above Bio 14.

*Dr. Börgers*

**Biology 132 Biostatistics.**
Learning how to describe and interpret experimental results and observations is a critical skill in many disciplines. In this course, students will learn statistical methods for summarizing and analyzing experimental data. Topics include descriptive statistics, experimental design, probability, parameter estimation, inference, correlation, regression, analysis of variance, and nonparametric methods. Note:
This course is aimed at providing data analysis tools for any students conducting or planning independent research projects in Biology. **Prerequisites:** Biology 13 and 14 and one additional Biology course above Bio 14.

**Dr. Lewis**

**Biology 144 Conservation Biology.**
Learning and application of principles from population ecology, population genetics, and community ecology to the conservation of species and ecosystems. Focus will be on rare and endangered species, as well as threatened ecosystems. Also includes applications from animal behavior, captive breeding, and wildlife management. **Prerequisites:** BIO 14, or equivalent

**Dr. Reed**

**Biology 172 Biochemistry II.** *(Cross-listed as CHEM 172.)*
Continuation of Biology 171. One course. Recommendations: BIO 171.

**Dr. Pamuk Turner**

**Biology 181 Tropical Ecology Conservation** *(Cross-listed as ENV 181)*
This seminar and field trip is designed to provide students with an in depth understanding of tropical ecology and first-hand experience in tropical Central America. Topics to be covered include 1) community ecology, 2) ecosystem ecology, 3) physiological ecology, 4) plant-animal interactions, and 5) conservation biology. In addition to weekly readings, discussions, and writing assignments, students will write a grant proposal and present it to the class. Over winter break we will travel to Costa Rica for an intensive two-week field experience. We will gain hands-on research experience in contrasting habitats and learn about conservation efforts in Costa Rica. A typical 2-day schedule will be a morning orientation hike followed by meetings to design experiments, data collection in the afternoon, an evening lecture or discussion, data collection the next day, and data analysis in the evening. Although the conditions will often be uncomfortable (hot and humid), this is an excellent opportunity to gain first hand research experience in the tropics. The cost of the trip varies each year as it depends on outside grant funding (see application for an updated status of funding). This is a HIGH DEMAND course. **Prerequisites:** Bio 14 or equivalent and permission of instructor. A completed application and supporting materials must be submitted, please contact Monica Morin (monica.morin@tufts.edu)

**Dr. Orians**

**Biology 182 Chimpanzee Behavioral Ecology.** *(Cross-listed as ANTH 177.)*
An advanced seminar on current topics in behavioral research of chimpanzees and bonobos. Topics will include: foraging, dominance, cooperation, adolescence, reproduction, culture, ranging, cognition, molecular ecology, and social relationships. We will discuss behavioral flexibility of chimpanzees between different communities across Africa and learn how to collect and analyze behavioral data. We will compare the behavior of chimpanzees and bonobos with that of humans and examine how these species might serve as models for human evolution. This will be an open discussion seminar where we will be reading primary literature. As a final evaluation, students will be writing research papers using long-term data from wild chimpanzees. This course counts toward the Anthropology upper-level seminar requirement and the Natural Sciences distribution requirement. **Prerequisites:** ANTH/BIO 044 or permission of instructor.

**Dr. Machanda**

**Biology 183 Seminar in Darwinian Medicine.**
The mechanistic vs. evolutionary causes of diseases and modern medical practice. Focus on the evolutionary causes of disease as a means of sharpening research skills and the understanding and application of Darwinian thought. Evolutionary hypothesis creation and testing in both oral and manuscript form. **Recommendations:** BIO 130 or permission of instructor.

**Dr. Starks**
**Biology 193 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 members of the department. **Recommendations:** Sophomore standing or higher, and BIO 93 or BIO 94 or equivalent, and prior permission of research mentor and course coordinator.  
*Dr. Warchola*

**BIO-0196-01 Selected Topics: Teaching Bio: Pedagogy & Practice**
Exploration of special topics in biology through seminars or guided individual study. Prerequisite: consent. Credit as arranged (usually one-half or one course).  
*Dr. McLaughlin, Dr. McVey*

**BIO-0196-08 Selected Topics: Research in Devel. Plasticity**
Exploration of special topics in biology through seminars or guided individual study. Prerequisite: consent. Credit as arranged (usually one-half or one course).  
*Dr. Levin*

**Biology 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 GPA of at least 3.30.  
*Dr. McLaughlin*

**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.*

**Biology 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.

**Biology 243 Topics in Molecular and Cell Biology**
Topics will include protein structure and folding, regulation of gene transcription and structure of transcription factors, structure and function of cell surface receptors and mechanisms of signal transduction, adhesion molecules that mediate cell-cell interactions, and mechanisms of genetic recombination. Students will read and present papers from the current literature. Novel experimental techniques used to answer central questions will be emphasized. **Recommendations:** BIO 105 or equivalent and permission of instructor.  
*Dr. Fuchs*

**Biology 253 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. **Prerequisite:** consent  
*Dr. Tytell*

**Biology 257 Graduate Research & 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.**
Biology 260-01 Teaching Biology: Pedagogy and Practice.
This course aims to enhance the professional development of graduate students by preparing them to teach biological sciences in academic venues that range from community colleges to Research I universities. Graduate student participants will be introduced to issues related to teaching in both lab and lecture settings and will apply effective teaching techniques in their own classrooms. Program participants will learn about pedagogy, gain practical teaching experience, and receive mentoring and formal evaluation of their teaching. The course requirements are designed to be flexible enough to be pursued alongside full-time disciplinary studies, yet ensure that participants are rigorously trained in biology-specific pedagogy. 1 graded credit. Prerequisite: consent/BIO13L Teaching Assistants. Must also register for Bio 260-02
Drs. McLaughlin & McVey

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

Biology 293-01 Special Topics
Guided individual study of an approved topic. Credit as arranged. Please see departmental website for specific details.
Various

Biology 293-02 Special Topics: Field Ornithology
Guided individual study of an approved topic. Credit as arranged. Please see departmental website for specific details.
Dr. Reed

Biology 295 Master’s Thesis

Biology 297 PhD Dissertation

Biology 401 Master’s Degree Cont (Part Time)

Biology 402 Master’s Degree Cont (Full Time)

Biology 405 Grad Teaching Assistant

Biology 406 Grad Research Assistant

Biology 501 Doctoral Degree Cont (Part Time)

Biology 502 Doctoral Degree Cont (Full Time)