Fall 2020 Course Descriptions

Undergraduate Courses

01 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.
Ellmore

04 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.
Prerequisites: Any college biology course, Call Boston School of Occupational Therapy (617-627-5720) for information about this course.
Whitney, Pessina

06 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.
Campbell

08 Microbiology of Food
Systems-based approach to how microbes play critical roles in the production, processing, and consumption of foods. Tools that microbiologists are using to study the microbiology of food systems; basic principles of microbial diversity, ecology, evolution, physiology, and genetics using a farm-to-gut approach. Equal attention to beneficial microbes as well as the historical and contemporary impacts of pathogens. Guest lectures from farmers, chefs, and local food producers and in-class demonstrations and tastings.
Biango-Daniels

10 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.
Ellmore

12 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
Dopman, Pechenik
**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.
*Crowe, K. Mirkin*

**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.
*Kao, Trimmer*

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

**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.
*Ellmore, Starks, Crone*

**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 microorganisms. 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.
*Wolfe*

**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.
*Warchola*
Undergraduate and Graduate Courses

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. (Group A)
Prerequisites: BIO 041 or 046 or consent.
McLaughlin

104 Immunology
Concepts of modern immunology and their importance in biology. Topics include humoral and cellular immune responses, antibody structure and biosynthesis, antigen-antibody interactions, cellular immunology, immunological tolerance, and tumor immunology. (Group A)
Recommendations: Biology 41 or equivalent.
Carr

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. (Group A)
Prerequisites: BIO 041.
McVey

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. (Group B)
Prerequisites: Biology 13 and 14 or equivalent.
Romero

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

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. (Group Q)
Prerequisites: Biology 13 and 14 and one additional Biology course above Bio 14.
Owens

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. (Group C)
Prerequisites: BIO 014, or equivalent.
Reed

172 Biochemistry II (Cross-listed as CHEM 172)
Continuation of Biology 171. One course.
Recommendations: BIO 171.
Pamuk Turner
**179 Seminar Marine Biology**  
Exploration of the primary scientific literature in areas selected by mutual consent. Topics may include symbiotic interactions, migration and dispersal, larval ecology, adult feeding and locomotory biology, responses to pollutants, and physiology of deep-sea animals. Strong focus on developing critical reading skills and effective writing through frequent, short assignments. (Group C)  
**Prerequisite:** Junior standing and BIO 164 or permission of instructor.  
*Pechenik*

**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. (Group C)  
**Recommendations:** BIO 130 or permission of instructor.  
*Starks*

**185: Food For All- Ecology, Technology and Sustainability** (Cross listed as ENV 182)  
An interdisciplinary examination of the pros and cons of two divergent approaches to meeting the increasing global food demand: organic farming and genetic engineering. Contrasting crops grown in developing and industrialized countries serve as case studies to 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. An important focus is developing communication skills for negotiating stakeholder-specific perspectives (growers, advocacy groups, industry, governmental agencies). Please see departmental website for specific details.  
**Recommendations:** Intro Bio or Intro Chemistry or equivalent  
*Orians, Gomez*

**188 Seminar in Molecular Biology & Genetics**  
Current topics in molecular biology, genetics and genomics, studied through readings from the original literature. Focus will be on studies recognized by the Nobel Prize Committee as pivotal to modern molecular biology and genetics. These studies and current research directions that follow from them will be covered using a combination of lectures, class discussion, and presentations. Selected topics of current interest to be covered include genome structure and polymorphisms as related to human disease, RNA functioning in the regulation of gene expression, and cell cycle regulation and cancer.  
**Recommendations:** BIO 41 and junior standing or permission of instructor.  
*S. Mirkin*

**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.  
*Warchola*

**195-08 Independent Study in Biology: Research in Developmental Plasticity**  
Exploration of special topics in biology through seminars or guided individual study.  
**Prerequisite:** consent. Credit as arranged (usually one-half or one course).  
*Levin*

**196-01 Exploratory Topics in Biology: 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).  
*McLaughlin, McVey*

**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.  
*K. Mirkin*
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.

201 Biology Department Seminar
This course, designed for biology graduate students, explores in a seminar format current research in the field of Biology. A satisfactory grade translates into attendance of >80% of seminars.

Tytell

241 Advanced Genetics: DNA Repair 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 original journal articles in these fields and techniques used to make discoveries.

Polleys, Khristich

243 Topics in Molecular and Cell Biology
An examination at the graduate level of current topics in cell and molecular biology. Topics will differ each year and will be chosen from the following general area: maintenance of genome stability including mechanisms of DNA replication and DNA repair; gene transcription; protein structure function and regulation; cell biology of signaling pathways including cell-cell communication and controls of developmental morphology. Students will read and present papers from the current literature. Novel experimental techniques used to answer central questions will be emphasized.

Recommendations: A previous course in cell and molecular biology, such as BIO 105 or equivalent, and permission of instructor.

Freudenreich, K. Mirkin, Levin

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. Dr. McLaughlin. 1 graded credit.

Prerequisite: consent

Tytell, Crone

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.

Various

259 Capstone: Research Proposal and Review
This course consists of writing and successfully defending a Research Proposal by the end of the second PhD year, in accordance with the Biology Graduate Guidelines.

Various
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  
McLaughlin, McVey

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.  
McVey

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

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

295 Master’s Thesis

297 PhD Dissertation

401 Master’s Degree Cont (Part Time)

402 Master’s Degree Cont (Full Time)

405 Grad Teaching Assistant

406 Grad Research Assistant

501 Doctoral Degree Cont (Part Time)

502 Doctoral Degree Cont (Full Time)