BIOLOGY

BIO 100 Human Origins: Disentangling the Myths and Facts that Surround the Evolution of the Human Species (4 Credits)
This course focuses on the origin and diversification of the human species (Homo sapiens), with a focus on African origins and genetic diversity among extant populations. Using principles from evolution, discussions include: 1) the relationship of humans to other primates; 2) the timing and location of the origin of modern humans; 3) the geographic history of humans and the structure of contemporary human diversity; and 4) implications of human genetics/genomics for healthcare/medicine. {N}
Fall, Alternate Years

BIO 102 Science in the Real World: An Introduction to Public Health (4 Credits)
An explicitly multidisciplinary introduction to the challenges, data , tools, and frameworks surrounding global health in the 21st century. Open to students of all majors, this course examines the biological, environmental, social, and political factors that dictate healthspans and lifespans at local, national, regional, and global scales. Students also explore the ways in which notions of health and disease are constructed, and the extent to which these definitions vary over time and culture. Most of the work in this course is done by small interdisciplinary groups. Enrollment limited to 40. Instructor permission required. (E) {N}{S}
Fall

BIO 120 Horticulture: Plants in the Landscape (3 Credits)
Course focuses on the intersection of plants and people. Topics include introduction to landscape plants and their usage, plants as food, plants as urban green infrastructure, garden design history and current issues such as the colonial history of botanic gardens, native vs. disruptive species, and community gardening. Course includes lectures, guest lecturers and in-class discussions. Corequisite: BIO 121. Enrollment limited to 32. {N}
Fall

BIO 121 Horticulture: Plants in the Landscape Laboratory (1 Credit)
Identification, morphology and use of landscape plants including annuals, perennials, trees and shrubs, groundcovers and evergreens. Use of the Botanic Garden outdoor collection as well as field trips are important components of the course. Course requirements include landscape design activities and creation of a Field Guide to plant materials covered in the course. Corequisite: BIO 120. Enrollment limited to 16. {N}
Fall

BIO 122 Horticulture: Botany for Gardeners (3 Credits)
Survey course in the fundamentals of botany and horticulture. Plant structure and function, nomenclature, nutrition, seed biology, propagation, growing practices, soils, compost, and an introduction to biotechnology. Discussions include growing fruits, vegetables, and herbs. Course requirements include a field notebook, in-class discussions, independent engagement with written and multimedia resources, and a book review. Corequisite: BIO 123. Enrollment limited to 32. {N}
Spring

BIO 123 Horticulture: Botany for Gardeners Laboratory (1 Credit)
Practical lab experiences in plant propagation, morphology, development and physiology, soils, seeds, floral design, and an herbal apothecary. Use of the Lyman Conservatory, and winter and spring observation of outdoor plants are important components of the course. Course requirements include a lab journal and an extended field observation phenology project. Corequisite: BIO 122. Enrollment limited to 16. {N}
Spring

BIO 130 Biodiversity, Ecology and Conservation (4 Credits)
Students in this course investigate the origin, nature, and importance of the diversity of life on Earth, key ecological processes, and interactions that create and maintain communities and ecosystems, principal threats to biodiversity, and emerging conservation strategies to protect the elements and processes upon which humans depend. Throughout the semester, the course emphasizes the relevance of diversity and ecological studies in conservation. Concurrent registration in BIO 131 is recommended but not required. Enrollment limited to 69. {N}
Fall, Spring

BIO 131 Research in Biodiversity, Ecology, and Conservation (1 Credit)
Students pull on their boots and explore local habitats that may include the Mill River, MacLeish Field Station, Smith campus Botanic Gardens and local hemlock forests. Students gain experience with a diversity of organisms by conducting research projects that can enhance their understanding of ecology and conservation. Students practice the scientific process and document their work in a lab notebook. Research skills developed include hypothesis development, data collection, statistical analysis and presentation of results. Because research projects vary seasonally, please see the Department of Biological Sciences website for more information. Concurrent registration in BIO 130 recommended.Enrollment limited to 16. {N}
Fall, Spring

BIO 132 Molecules, Cells, and Systems (4 Credits)
Students in this course investigate the structure, function and physiology of cells; the properties of biological molecules; information transfer from the level of DNA to cell-cell communication; and cellular energy generation and transfer. The development of multicellular organisms and the physiology of selected organ systems is also explored. In addition to attending lectures, each student participates in discussion sections that focus on data analysis and interpretation while integrating mechanisms across scales. Concurrent registration in BIO 133 recommended but not required. Enrollment limited to 78. {N}
Fall, Spring

BIO 133 Research in Molecules, Cells, and Systems (1 Credit)
This laboratory course introduces students to biological discovery and the biological research process. Students gain hands-on experience with the use of modern biological research methods by participating in ongoing research with a variety of organisms. This includes scientific discovery, hypothesis development, data collection and analysis, as well as presentation of discoveries and results. Research projects vary with each Instructor. Concurrent registration in BIO 132 recommended but not required. Enrollment limited to 16. {N}
Fall, Spring

BIO 200 Animal Physiology (4 Credits)
In this course students learn how animal bodies function from the molecular to the organismal level and how the physiology of animals, including humans, has been shaped by evolution to enable survival in a wide range of environments. Course content is organized by body system (cardiovascular, respiratory, reproductive, etc.). Assignments provide opportunities for students to practice applying their knowledge of physiology to real-life situations, predicting the outcomes of experiments, and interpreting and writing about the primary literature. Concurrent registration in BIO 201 is recommended but not required. Prerequisites: BIO 132/ BIO 133 and CHM 111 or CHM 118. Enrollment limited to 30. {N}
Fall, Variable

BIO 201 Animal Physiology Laboratory (1 Credit)
This course provides students with the opportunity to design and conduct experiments in human and animal physiology. Emphasis is on developing hypotheses, designing experiments, graphing data, interpreting results, and communicating in the scientific style. Prerequisite: BIO 200, may be taken concurrently. Enrollment limited to 18. {N}
Fall, Variable

BIO 202 Cell Biology (4 Credits)
The structure and function of eukaryotic cells. This course examines contemporary topics in cellular biology: cellular structures, organelle function, membrane and endomembrane systems, cellular regulation, signaling mechanisms, motility, bioelectricity, communication and cellular energetics. This course is a prerequisite for BCH 252. Prerequisites: BIO 132/BIO 133 and CHM 222. BIO 203 is recommended but not required. Discussion sections limited to 18. {N}
Fall

BIO 203 Cell Biology Laboratory (1 Credit)
Inquiry-based laboratory using techniques such as spectrophotometry, enzyme kinetics, bright field and fluorescence light microscopy, and scanning electron microscopy. The emphasis is on student-designed projects. This course is a prerequisite for BCH 253. Corequisite: BIO 202. Enrollment limited to 16. {N}
Fall

BIO 204 Microbiology (3 Credits)
This course examines bacterial morphology, growth, biochemistry, genetics and methods of controlling bacterial activities. Emphasis is on bacterial physiology and the role of the prokaryotes in their natural habitats. The course also covers viral life cycles and diseases caused by viruses. Prerequisites: BIO 132 and CHM 111 or equivalent advanced placement courses. Corequisite: BIO 205. {N}
Spring

BIO 205 Microbiology Laboratory (2 Credits)
Experiments in this course explore the morphology, physiology, biochemistry and genetics of bacteria using a variety of bacterial genera. Methods of aseptic technique, isolation, identification and growth of bacteria are learned. An individual project is completed at the end of the term. Corequisite: BIO 204. Enrollment limited to 16. {N}
Spring

BIO 206 Plant Physiology (4 Credits)
How do plants work? This course explores key processes in plant physiology and how these processes interact with the (changing) environment. Key concepts include photosynthesis/carbon sequestration, water and nutrient uptake and transport, growth and carbon allocation, and plant-soil interactions. The course encourages students to think about these processes in an environmental justice context e.g. food justice, urban tree resilience and natural climate solutions. Corequisite: BIO 207. Prerequisites: A course in ecology, organismal biology or environmental science. Enrollment limited to 24. {N}
Spring, Variable

BIO 207 Plant Physiology Lab (1 Credit)
This laboratory is both a survey of plant physiological techniques and a course-based research experience in plant physiological research. Field trips are taken to MacLeish Field Station and experiments are conducted in Lyman Plant House. Students gain hands-on experience with sophisticated instrumentation and techniques used to measure micro-climate, plant-water relations and gas exchange (photosynthetic rate and respiration). Corequisite: BIO 206. Enrollment limited to 12. {N}
Spring, Variable

BIO 230 Genomes and Genetic Analysis (4 Credits)
An exploration of genes and genomes that highlights the connections between molecular biology, genetics, cell biology and evolution. Students analyze the principal experimental findings that serve as the basis for the current understanding of topics in genetics including DNA, RNA, and protein structure and function, gene organization and networks, gene expression and regulation, the origins and evolution of molecular mechanisms, and the relationship between genotypes and phenotypes of interest. Students also examine the computational tools and rapidly expanding databases that have become central to contemporary biology. Concurrent registration in BIO 231 recommended. Prerequisites: BIO 130 or BIO 132 or equivalent. {N}
Spring

BIO 231 Genomes and Genetic Analysis Laboratory (1 Credit)
A laboratory designed to give students an introduction to genomics and the molecular biology of genetics. Students gain experience with a variety of classical and modern techniques used in human genetic analysis and several experiments using students' DNA are performed throughout the semester. Laboratory and computer-based projects include PCR, restriction analysis and DNA sequencing as well as contemporary bioinformatics and genome database analyses. Prerequisite: BIO 230 or BIO 232, normally taken concurrently. Enrollment limited to 16. {N}
Fall, Spring

BIO 232 Genetics and Evolution (4 Credits)
Evolution frames much of biology by providing insights into how and why things change over time. For example, the study of evolution is essential to: understanding transitions in biodiversity across time and space, elucidating patterns of genetic variation within and between populations, and developing both vaccines and treatments for human diseases. Topics in this course include population genetics, molecular evolution, speciation, phylogenetics and macroevolution. Concurrent registration in BIO 231 recommended. Prerequisite: BIO 130 or BIO 132 or equivalent. {N}
Fall

BIO 260 Invertebrate Diversity (3 Credits)
Invertebrate animals account for the vast majority of species on earth. Although sometimes inconspicuous, invertebrates are vital members of ecological communities. They provide protein, important ecosystem services, biomedical and biotechnological products, and aesthetic value to humans. Today, many invertebrate populations are threatened by human activities. This course surveys the extraordinary diversity and importance of invertebrates, emphasizing their form and function in ecological and evolutionary contexts. Corequisite: BIO 261. Enrollment limited to 20. {N}
Spring, Variable

BIO 261 Invertebrate Diversity Laboratory (2 Credits)
This laboratory examines relationships between invertebrate form and function and compares diversity within and among major body plans using live and preserved material. Students observe and document invertebrate structure, life cycles, locomotion, feeding and other behaviors. Corequisite: BIO 260. Enrollment limited to 20. {N}
Spring, Variable

BIO 264 Plant Diversity and Evolution (4 Credits)
This course explores the diversity of plant life and investigates its evolutionary origins and history through a mixture of lecture, lab, and discussion activities. A key focus of the course is the ecological and environmental context of major evolutionary developments in the Land Plants, including their adaptations to various abiotic challenges, as well as antagonistic and mutualistic interactions with other organisms. The survey of plant diversity is guided by recent phylogenetic studies, and students make use of the outstanding living collections in the Lyman Plant House. Corequisite: BIO 265. Enrollment limited to 20. {N}
Spring, Alternate Years

BIO 265 Plant Diversity and Evolution Laboratory (1 Credit)
This lab introduces students to plant morphology and identification through hands-on work with plant material. In addition, the class focuses on local native plants and the outstanding botanical collections in the Lyman Plant House. Includes field trips to other sites of botanical interest in the region. Corequisite: BIO 264. Enrollment limited to 20. {N}
Spring, Alternate Years

BIO 266 Ecology: Principles and Applications (4 Credits)
This general ecology course provides a conceptual foundation for understanding ecological processes from population dynamics to ecosystem function. Fundamental ecological concepts are covered within the context of current environmental challenges arising from global change. This framing illuminates how population dynamics, community composition and trophic interactions affect ecosystem function and ecosystem services. Corequisite: BIO 267. Prerequisite: BIO 130 or an equivalent course in ecology or environmental science. Enrollment limited to 18. {N}
Fall, Variable

BIO 267 Ecology: Principles and Applications Laboratory (1 Credit)
This general ecology laboratory course provides hands-on experience in the execution of ecological experiments in the field. Students participate in study design, data curation, analysis and interpretation. All statistical analyses are conducted in R. Corequisite: BIO 266. Enrollment limited to 18. {N}
Fall, Variable

BIO 268 Marine Ecology (3 Credits)
The oceans cover over 75 percent of the Earth and are home to enormous biodiversity. Marine Ecology explores a variety of coastal and oceanic systems, focusing on natural and human-induced factors that affect biodiversity and the ecological balance in marine habitats. Using case studies, the class studies some successful conservation and management strategies, including Marine Protected Areas. This course uses a variety of readings, group activities and short writing assignments to develop vital skills such as effective oral, graphical and written communication; critical thinking; and problem solving. Enrollment limited to 24. Corequisite: BIO 269. {N}
Fall

BIO 269 Marine Ecology Laboratory (2 Credits)
The laboratory applies concepts discussed in lecture and uses several small-group projects in the field and laboratory to develop relevant skills for conducting marine-related research. Students learn to design and analyze experiments and to write in the scientific style. Field trips to Rhode Island and Cape Cod, MA provide hands-on experience with marine organisms in their natural habitats. Corequisite: BIO 268. Enrollment limited to 12. {N}
Fall

BIO 272 Vertebrate Biology (4 Credits)
A review of the evolutionary origins, adaptations and trends in the biology of vertebrates. BIO 273 is recommended but not required. No Prerequisites. Enrollment limited to 25. {N}
Spring, Variable

BIO 273 Vertebrate Biology Laboratory (1 Credit)
A largely anatomical exploration of the evolutionary origins, adaptations and trends in the biology of vertebrates. Corequisite: BIO 272. Enrollment limited to 20. {N}
Spring, Variable

BIO 300 Neurophysiology (4 Credits)
Fundamental concepts of nervous system function at the cellular level (electrical signals, membrane potentials, propagation, synapses) and also the systems level (motor control, generating behavior, perception of visual form, color and movement). This course provides a strong foundation for BIO 310 and NSC 318. See website (tinyurl.com/bio300) for full syllabus. Prerequisites: BIO 200 or 202 or NSC 210. {N}
Fall, Spring, Variable

BIO 302 Developmental Biology (4 Credits)
How does a single cell give rise to the complexity and diversity of cells and forms that make up humans? Developmental biology answers this question by spanning disciplines from cell biology and genetics to ecology and evolution. The remarkable phenomena that occur during embryonic development is presented in concert with the experiments underlying the current knowledge. This is an interactive class experience using “flipped classroom” approaches as well as web conferencing with the prominent developmental biologists whose research the class covers. Prerequisites: BIO 132 and (BIO 202 or BIO 230). BIO 130 recommended.
Fall, Spring, Variable

BIO 303 Research in Developmental Biology (3 Credits)
Students design and carry out their own experiments focused on neural and muscle development using zebrafish as a model system. Techniques covered include embryology, indirect immunocytochemistry, in situ hybridization, microinjection of RNA for gain or loss of function studies, pharmacological analysis, GFP-transgenics, an array of microscopy techniques. This laboratory is designed as a true research experience and thus requires time outside of the normally scheduled lab period. Enrollment limited to 18. Instructor permission required. {N}
Fall, Spring, Variable

BIO 306 Immunology (4 Credits)
An introduction to the immune system covering the molecular, cellular and genetic bases of immunity to infectious agents. Discussions include immunodeficiencies, transplantation, allergies, immunopathology and immunotherapies. Concurrent registration in BIO 307 recommended. Prerequisite: BIO 202, BIO 204 or BIO 230. {N}
Spring

BIO 307 Immunology Laboratory (1 Credit)
The use of immunological techniques in clinical diagnosis and as research tools. Experimental exercises include immune cell population analysis, immunofluorescence, Western blotting, ELISA and agglutination reactions. An independent project is completed at the end of the term. Corequisite: BIO 306. Enrollment limited to 16. {N}
Spring

BIO 308/ NSC 308 Cellular and Molecular Neuroscience (4 Credits)
Offered as BIO 308 and NSC 308. Formerly BIO 310. Molecular level structure-function relationships in the nervous system. Topics include development of neurons and glia, neuron-specific gene expression, molecular biology of neurological disorders and the mechanisms of nervous system plasticity and repair. Prerequisites: BIO 200 and NSC 210 or equivalent. Enrollment limited to 20. {N}
Fall, Spring, Variable

BIO 314 Advanced Microscopy Techniques for Research (1 Credit)
Instrument specific course highly recommended for students interested in using state-of-the-art microscopy techniques in research (special studies, honors, SURF, etc.). Participants get exposure to basic and advanced light and electron microscopy techniques available at Smith. Mechanical and optical components are reviewed. Operational parameters for improving image quality and data collection using digital imaging and image analysis techniques are discussed. Emphasis is on the use of these exciting technologies performing quality and up-to-date research in many disciplines ranging from the live science and geology to art and engineering. Evaluation is through engagement in assigned activities. 400-level work cannot overlap with this course work. S/U only. Restrictions: BIO 314 may not be repeated. Enrollment limited to 12.
Fall, Spring

BIO 321id Seminar: Topics in Microbiology-Emerging Infectious Diseases: Going Viral (3 Credits)
While not considered living organisms, the recent COVID and recurrent and threatening influenza pandemics show the havoc viruses can wreak; these unique acellular microbes are the emphasis in this seminar. This course examines the impact of infectious diseases on society. New pathogens are constantly being identified while existing pathogens have warranted increased investigation for multiple reasons, including as causative agents of pandemics, chronic disease or cancer; as increased threats due to multidrug resistance or immune evasion of current immunotherapies; as disease agents that disproportionately impact certain populations; and as agents of bioterrorism. Specific emphasis on the molecular basis of virulence in a variety of organisms is addressed along with the diseases they cause and the public health measures taken to address these pathogens. Prerequisites: BIO 202, BIO 204, BIO 230 or BIO 232, or equivalent. Restrictions: Juniors and seniors only. Enrollment limited to 12. Instructor permission required. {N}
Fall, Variable

BIO 322sb Seminar: Topics in Cell Biology- Synthetic Biology and Bionanotechnology (3 Credits)
An investigation of the emerging fields of synthetic biology and bionanotechnology drawn from semi-popular and primary research literature. In this seminar, we focus on the central question of what can be achieved by approaching biology from an engineering mindset. Specifically, what can be learned by treating biological components (proteins and nucleic acids) and systems (signaling and metabolic networks) as interchangeable machine-like parts? We study examples of this intellectual and experimental approach and how its application has enhanced our understanding of cell biology. Harnessing biological systems for the production of pharmaceuticals and hydrocarbon fuel sources is also considered. Finally, we explore the prospect of affecting and interacting with cells using engineered nanoscale devices made from biological building blocks and the potential application of these techniques in the diagnosis and treatment of disease. Prerequisite: BIO 202 or 230. Restrictions: Juniors and seniors only. Enrollment limited to 12. Instructor permission required. {N}
Fall, Spring, Variable

BIO 323so Seminar: Topics in Developmental Biology- From Cell to Organ to Embryo - The Synthetic Organism (4 Credits)
Restrictions: Juniors and seniors only. Enrollment limited to 12. Instructor permission required. {N}
Fall, Spring, Variable

BIO 330 Research in Cellular Neurophysiology (2 Credits)
A laboratory course on electrophysiological methods in neuroscience. Part I, Basic techniques (electronics, microelectrodes, suction electrodes, pin electrodes) for recording resting, action and receptor potentials. Part II: Investigating a central pattern generator that produces repetitive movements. Part II employs computer-based data acquisition and pharmacological treatments, and involves a self-designed research project. The course includes a discussion of articles and reviews each week. For the syllabus and videos of procedures, see the open website: tinyurl.com/SmithBio330. Prerequisite: NSC 210 or BIO 300 or BIO 310. Enrollment limited to 12. {N}
Spring

BIO 332 Molecular Biology of Eukaryotes and Their Pathogens (4 Credits)
Advanced molecular biology of eukaryotes and their viruses (including coronavirus, Ebola and HIV). Discussions include genomics, bioinformatics, eukaryotic gene organization, regulation of gene expression, RNA processing, retroviruses, transposable elements, gene rearrangement, methods for studying human genes and genetic diseases, CRISPR, molecular biology of infectious diseases, genome projects and whole genome analysis. Reading assignments are from the primary literature. Each student presents an in-class presentation and writes a paper on a topic selected in consultation with the instructor. Concurrent registration in BIO 333 recommended. Prerequisite: BIO 230 or BIO 232. Enrollment limited to 20. {N}
Spring, Variable

BIO 333 Molecular Biology of Eukaryotes and Their Pathogens Laboratory (1 Credit)
A laboratory course designed to complement the lecture material in BIO 332. Advanced techniques used to study the molecular biology of eukaryotes are learned in the context of a semester-long project. These methods include techniques for studying genomics and gene expression including: CRISPR, RNA interference, DNA sequence analysis, RT-PCR, genomics, bioinformatics and others. Corequisite: BIO 332. Prerequisite: BIO 231. Enrollment limited to 16. {N}
Spring, Variable

BIO 334 Bioinformatics and Comparative Molecular Biology (3 Credits)
This course focuses on methods and approaches in the emerging fields of bioinformatics and molecular evolution. Discussions include the quantitative examination of genetic variation, selective and stochastic forces shaping proteins and catalytic RNA, comparative analysis of whole genome data sets, comparative genomics and bioinformatics, and hypothesis testing in computational biology. The course explores the role of bioinformatics and comparative methods in the fields of molecular medicine, drug design and in systematic, conservation and population biology. Concurrent registration in BIO 335 strongly recommended but not required. Prerequisite: BIO 230, BIO 232, or equivalent. Enrollment limited to 20. {N}
Spring, Variable

BIO 335 Bioinformatics and Comparative Molecular Biology Laboratory (2 Credits)
This lab introduces the computational and quantitative tools underlying contemporary bioinformatics. Students explore the various approaches to phylogenetic reconstruction using molecular data, methods of data mining in genome databases, comparative genomics, structure-function modeling and the use of molecular data to reconstruct population and evolutionary history. Students are encouraged to explore datasets of particular interest to them. Corequisite: BIO 334 or equivalent. Enrollment limited to 20. {N}
Spring, Variable

BIO 336 Genomics (3 Credits)
Ongoing developments in high-throughput sequencing technologies have made genomic analysis a central feature of many scientific disciplines, including ecology and evolution. This course reviews the scope and applications of genome sequencing projects. After completing the course, students are prepared to design a high-throughput sequencing project and interpret the results of genomic analysis. Corequisite: BIO 337. Prerequisite: BIO 230 or BIO 232. Enrollment limited to 15. {N}
Fall

BIO 337 Genomics Lab (2 Credits)
This lab covers genomic analysis pipelines from nucleic acid isolation to sequence analysis in Linux and R environments and introduces students to high performance computing. Students work collaboratively to design and execute a comparative genomics project and detect signatures of molecular evolution in the non-model genomes. Corequisite: BIO 336. Prerequisite: BIO 230, BIO 232 or equivalent. Enrollment limited to 15. {N}
Fall

BIO 340rm Colloquium: Topics in Public Health: Resistance--Mechanisms, Causes and Consequences (4 Credits)
This colloquium explores a class of phenomena broadly categorized as "resistance." Specifically, the course asks whether the heterogeneous settings in which that term arises suggest a single underlying mechanism leading to resistance, or conversely, whether disparate phenomena have been inappropriately grouped together under a single rubric. Resistance is a concept that has been evoked at all levels of biological (and non-biological) organization, from the viral to the political. The class selects a subset of the settings in which resistance is seen as an important phenomenon and dissects the mechanisms responsible for the origin and spread of resistance. Students explore the phenomena from mechanistic, ecological, and evolutionary perspectives in hopes of detecting both important similarities and telling differences. Enrollment limited to 24. Instructor permission required. {N}
Fall, Alternate Years

BIO 350id Seminar: Topics in Molecular Biology-Infectious Disease (3 Credits)
This seminar focuses on neglected tropical diseases (NTDs), parasitic and viral diseases other rare diseases that are a public health concern, including Ebola, Chikungunya, Dengue Fever, West Nile, SARS, avian influenza, malaria, river blindness, anthrax and smallpox. We look at pandemics of the past (the influenza of 1918, the Black Death of the Middle Ages, the typhus epidemic of 1914–21) and modern biotechnology. The challenges are great, but new tools of molecular biology (genomics, proteomics, RNA interference, next-generation sequencing, etc.) provide an unprecedented opportunity to understand and develop new strategies for their elimination. Prerequisite: BIO 230. Restrictions: Juniors and seniors only. Enrollment limited to 12. Instructor permission required. {N}
Spring, Variable

BIO 350qg Seminar: Topics in Molecular Biology-Quantitative Genetics (3 Credits)
Unlike Mendel's round or wrinkled peas, many biological traits exhibit more than two distinct forms. Quantitative genetics allows the study of continuously varying traits through statistical models that incorporate interactions between multiple genetic loci and the environment. Ongoing improvements in high-throughput DNA sequencing are revealing genetic mechanisms underlying human traits, such as predisposition to disease. In-class reviews of classic and contemporary literature in quantitative genetics serve as a foundation for a final project wherein students conduct a thorough analysis for a quantitative trait of interest. Restrictions: Juniors and Seniors only. Enrollment limited to 15. Instructor permission required. {N}
Fall, Spring, Variable

BIO 351ep Seminar: Topics in Evolutionary Biology-Epigenetics (3 Credits)
There is increasing evidence of epigenetic phenomena influencing the development of organisms and the transmission of information between generations. These epigenetic phenomena include the inheritance of acquired morphological traits in some lineages and the apparent transmission of RNA caches between generations in plants, animals and microbes. This seminar explores emerging data on epigenetics and discusses the impact of these phenomena on evolution. Participants write an independent research paper on a topic of their choice. Prerequisite: BIO 230, BIO 232 or equivalent. Restrictions: Juniors and seniors only. Enrollment limited to 15. Instructor permission required. {N}
Fall, Variable

BIO 360sr Seminar: Topics in Integrative Biology-Sex and Sexual Reproduction (4 Credits)
"Sex" is often used to describe a suite of traits – such as gamete type, morphology, physiology and behavior – that are related to reproduction. These traits are not binary, and there is extensive diversity in sex and sexual reproduction among animals including humans. This seminar explores our current understanding of variation in sex, gonadal determination, reproductive physiology and sexual behavior in the natural world. The course creates a broader conceptualization of sex by integrating the evidence in primary research articles, reviews, books and essays by feminist and queer authors. Students complete an independent research project on a topic of their choice. Prerequisites: BIO 200, BIO 230 or BIO 232, or equivalent. Restrictions: Juniors and seniors only. Enrollment limited to 15. Instructor permission required. {N}
Fall, Spring, Variable

BIO 363 Research in Animal Behavior (3 Credits)
Diverse fields from ecology to neuroscience rely on measures of animal behavior to reveal new insights into how individuals interact with their physical and social environments. Scientists integrate both high-tech (remote imaging, AI) and low-tech (human observation) solutions to record, track, and analyze patterns of behavior in the wild and in the lab. This course gives students experience with several methods of quantifying and analyzing animal behavior in both field-based and lab-based investigations. Students develop and conduct an independent research project and practice interpreting their own data. Prerequisites: SDS 201, SDS 210, or SDS 220. Enrollment limited to 15. {N}
Fall, Variable

BIO 364 Plant Ecology (3 Credits)
This course surveys the environmental factors, historical processes and ecological interactions that influence the distribution and abundance of plant species in the landscape and informs conservation of rare and threatened plant species. The class examines how plant communities are assembled and what processes influence their structure and diversity, including past and present human activities, climate change and exotic species. The class focuses in particular on plants and plant communities of the Northeast U.S., using examples from the local landscape to illustrate key ecological concepts and approaches to plant conservation. Corequisite: BIO 365. Prerequisite: a course in plant biology, ecology or environmental science; statistics is recommended (e.g., SDS 220). Enrollment limited to 20. {N}
Fall, Variable

BIO 365 Plant Ecology Laboratory (2 Credits)
This lab course involves field and laboratory investigations of plant ecology and conservation, with an emphasis on Northeastern plant species and plant communities. The labs explore interactions between plants and insects, visit wetland and upland habitats and investigate plant population dynamics at sites around western Massachusetts. Students gain hands-on experience with descriptive and experimental research approaches used to investigate ecological processes in plant communities and inform conservation of plant biodiversity. Corequisite: BIO 364. Enrollment limited to 20. {N}
Fall, Variable

BIO 366 Biogeography (4 Credits)
A study of major patterns of distribution of life and of the environmental and geological factors underlying these patterns. The role of phenomena such as sea-level fluctuations, plate tectonics, oceanic currents, biological invasions and climate change in determining past, present and future global patterns of biodiversity are considered. Fundamental differences between terrestrial and marine biogeography are highlighted. Prerequisite: a course in ecology, evolution, or organismal biology or equivalent. Enrollment limited to 20. {N}
Spring, Alternate Years

BIO 368 Seminar: Understanding Climate Change through Plant Biology and the Arts (3 Credits)
Understanding human induced climate change is one of the greatest challenges of this time. This course approaches the topic from two different ways of knowing: plant biology and the arts. These paired approaches ground this course in the scientific underpinnings of climate change and its impact on biological life, creating a space to engage with what climate change means—for students, for the greater human community and for the earth. At the same time, students explore how complex scientific content and deep existential challenges can be effectively communicated to the broader public. They learn how plants physiologically interact with and respond to environmental change; read and discuss primary literature and relevant art works; and create and workshop art, popular science articles and data visualizations centered on climate change and its consequences. Prerequisites: BIO 130 and BIO 132. Restrictions: Juniors and seniors only. Enrollment limited to 15. Instructor permission required. {N}
Fall, Variable

BIO 369 Laboratory: Understanding Climate Change through Plant Biology and the Arts (2 Credits)
Through this lab students (1) become familiar with using tools to measure physiological processes (e.g. Li-Cor 600 to measure stomatal behavior, Osmometer to measure leaf water stress, PMS Pressure Chamber to measure plant water stress), (2) in groups, design an experiment investigating plant biological responses to climate change (e.g. drought, increased CO2 or temperature) to implement in growth chambers or a greenhouse, (3) execute the project and present the findings to the class and public through presentations of scientific findings and artistic interpretations of the findings through art or communication projects. Corequisite: BIO 368. Prerequisites: BIO 130 and BIO 132. Enrollment limited to 15. Instructor permission required. {N}
Fall, Variable

BIO 370 Microbial Diversity (3 Credits)
This course focuses on the origin and diversification of microorganisms, with emphasis on eukaryotic lineages. The first weeks of lecture cover the origin of life on Earth and the diversification of bacteria and archaea. From there, students focus on the diversification of eukaryotes, examining the many innovations that mark some of the major clades of eukaryotes. Evaluation is based on a combination of class participation, short writings and an independent research paper. Concurrent registration in BIO 371 is strongly recommended but not required. Prerequisite: BIO 230 or BIO 232, or equivalent. {N}
Spring

BIO 371 Microbial Diversity Laboratory (2 Credits)
This research-based lab allows students to explore the eukaryotic microbiomes associated with various environments on campus, including the greenhouse and marine aquaria. Students in the course master the basics of light microscopy, PCR and analyses of high-throughput sequencing data. Students also use the scanning electron microscope to survey their communities. The work in the course culminates in a poster presentation on the discoveries of the semester. Corequisite: BIO 370. Enrollment limited to 18. {N}
Spring

BIO 372 Colloquium: Quantitative Ecology (4 Credits)
An advanced course covering ecological modeling and data analysis. Students explore the principles of mathematical modeling to describe population dynamics and species interactions. Students also learn modern analytical approaches in the study of ecological communities and ecological experiments. In addition to theoretical quantitative foundations, students acquire the analytical skills to implement mathematical and statistical models using the R computing language. Corequisite: BIO 373. Prerequisites: BIO 130/BIO 131, BIO 266/BIO 267, BIO 268/BIO 269 or BIO 364/BIO 365 and SDS 201 or SDS 220, or equivalent. Enrollment limited to 20. {N}
Spring, Variable

BIO 373 Quantitative Ecology Lab (1 Credit)
An advanced, applied course on ecological population modeling and data analysis. Students implement mathematical models describing population dynamics and species interactions as well as modern analytical approaches commonly applied to ecological data using the R computing language. Throughout this course students acquire skills in data analysis, data visualization, data management, code, reproducibility and modeling. Corequisite: BIO 372. Enrollment limited to 20. {N}
Spring, Variable

BIO 390cb Seminar: Topics in Environmental Biology-Investigations in Conservation Biology (3 Credits)
Conservation biology combines ecological and evolutionary principles with resource management, the social sciences and ethics to understand, manage and maintain biodiversity. This seminar is designed to familiarize students with the questions conservation biologists ask and the methods they use to conserve life on Earth. Students engage in problem-solving exercises that examine conservation-related questions at the genetic, population, community, landscape or ecosystem levels and employ suitable analytical techniques or strategies to address the questions. Students discuss a related article from the primary literature to illustrate the use of each technique. Restrictions: Juniors and seniors only. Enrollment limited to 12. Instructor permission required. {N}
Fall, Spring, Variable

BIO 390cr Seminar: Topics in Environmental Biology-Coral Reef Ecology and Conservation (3 Credits)
Coral reefs occupy a small portion of Earth's surface, but their importance to the marine ecosystem is great. This course considers the geologic importance and ecological interactions of coral reefs. It focuses on the status of coral reefs worldwide, considering effects of environmental and anthropogenic disturbances (e.g., major storms, eutrophication, acidification, overfishing). Methods for reef conservation are examined. Restrictions: Juniors and seniors only. Enrollment limited to 12. Instructor permission required. {N}
Spring, Variable

BIO 400 Special Studies (1-4 Credits)
Instructor permission required.
Fall, Spring

BIO 430D Honors Project (4 Credits)
Department permission required.
Fall, Spring

BIO 432D Honors Project (6 Credits)
Department permission required.
Fall, Spring

BIO 507 Seminar: Navigating a Master's Degree in Biological Sciences (2 Credits)
This seminar provides the opportunity to meet and collaborate with the other students in the BIO MS program, gain experience describing and sharing planned thesis research with others, and develop professional skills related to crafting research proposals, reading and critiquing scientific literature, and public presentation. This course is required for graduate students and must be taken both years. Restrictions: BIO graduate students only. Instructor permission required.
Fall

BIO 510 Advanced Studies in Molecular Biology (3-4 Credits)
Instructor permission required.
Fall, Spring

BIO 520 Advanced Studies in Botany (3-4 Credits)
Instructor permission required.
Fall, Spring, Variable

BIO 530 Advanced Studies in Microbiology (3-4 Credits)
Instructor permission required.
Fall, Spring

BIO 540 Advanced Studies in Zoology (3-4 Credits)
Instructor permission required.
Fall, Spring

BIO 550 Advanced Studies in Environmental Biology (3-4 Credits)
Instructor permission required.
Fall, Spring