These are thrilling times to study biology. Advances in molecular biology, epigenetics, and bioinformatics are leading to extraordinary new insights in every field, from evolution and ecology to development, cell biology, genetics/genomics, and neuroscience. These research areas are providing essential information as we address the urgent challenges of biodiversity conservation, global climate change, epidemiology, and human health and well-being. Biology is also at the heart of new ways of understanding ourselves as human beings in relation to other living things. Connections between biological disciplines are raising key questions in new ways, while biological knowledge has become fundamentally integrated with social and medical ethics, public policy, and journalism.

The Biology Department offers a broad range of courses that emphasize the process of scientific inquiry and current experimental approaches. Our courses also consider real-world implications of biological issues: the ethics of embryonic stem cell research, gender issues and reproductive technologies, the AIDS epidemic, and the impact of human activity on natural communities. Biology courses can be the start of a dedicated career in research, medicine, conservation, public health, bioethics, sustainable resource use, and many other areas. They can also bring the intellectual excitement of these investigations to students whose major focus is in the arts, humanities, or social sciences. We welcome students of all backgrounds and interests to join us.

FACULTY

Gloster B. Aaron
BA, Oberlin College; PHD, University of Pennsylvania
Associate Professor of Biology; Chair, Neuroscience and Behavior; Associate Professor, Neuroscience and Behavior; Associate Professor, Integrative Sciences

David Bodznick
BS, University of Illinois Urbana; MAA, Wesleyan University; PHD, University of Washington
Professor of Biology; Professor, Neuroscience and Behavior

Ann Campbell Burke
AB, New York University; MA, Harvard University; PHD, Harvard University
Professor of Biology; Chair, Biology

Barry Chernoff
BS, SUNY at Stony Brook; MS, Adelphi University; PHD, University of Michigan
Robert Schumann Professor of Environmental Studies; Professor of Earth and Environmental Sciences; Professor of Biology; Chair, Environmental Studies Program; Director, College of the Environment; Professor, Environmental Studies

Frederick M. Cohan
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Lauren B. Dachs Professor of Science and Society; Professor of Biology; Professor, Feminist, Gender, and Sexuality Studies

Ruth Ineke Johnson
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Alan M. Dachs Professor of Science; Professor of Biology; Professor, Neuroscience and Behavior

Joyce Ann Powzyk
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Assistant Professor of the Practice in Biology

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Professor of Biology; Professor, Environmental Studies

Sonia Sultan
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Michael P. Weir
BS, University of Sussex; PHD, University of Pennsylvania
Professor of Biology; Professor, Integrative Sciences

EMERITI

Allan Berlind
BA, Swarthmore College; MA, Harvard University; PHD, Harvard University
Professor of Biology, Emeritus

J. James Donady
BS, SUNY at Stony Brook; PHD, University of Iowa
Professor of Biology, Emeritus

UNDERGRADUATE PROGRAM

All departmental faculty

• Undergraduate Biology Major (catalog.wesleyan.edu/departments/biol/ugrd-biol)
• Graduate Biology Program (catalog.wesleyan.edu/departments/biol/grad-biol)

BIOL106 The Biology of Sex
This course is featured as a general education course within the Department of Biology. Serving to complement courses currently offered within biology that only touch upon the subject of sex, this course will dive into specifics regarding sexual behavior and will serve to highlight new discoveries that have been facilitated by novel scientific techniques and approaches. As we study the
biology of sex in the animal world, it becomes apparent that sex is achieved in a multitude of ways, many appearing rather bizarre and flamboyant. Yet under these guises, animals are still able to mate and reproduce. Sex is often defined according to sexual reproduction, whereby two individuals that are male and female mate and have offspring. However, many organisms engage in asexual reproduction and/or a combination of the two reproductive strategies. Reproductive anatomy and behavior will be addressed as we explore a variety of organisms, ranging from marine clown fish and their "sex changes" to the (female) marmoset monkey that can give birth to twin male chimeras. As an organism pursues sex, what are the mating strategies? What are the chemicals of sex (pheromones and hormones)? By examining the biology of sex in detail, we will also debate age-old topics such as whether sexual reproduction is sexist, the competing strategies of males and females, and whether human cultural displays are yet another way to decipher quality in a potential mate.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Prereq: None

BIOL118 Reproduction in the 21st Century
This course will cover basic human reproductive biology, new and future reproductive and contraceptive technologies, and the ethics raised by reproductive issues.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: FGSS118, PHIL118, SISP118
Prereq: None

BIOL137 Writing About Evolution
This class will explore various interesting problems in natural history, using short writing assignments to build familiarity with concepts of organismic evolution.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Prereq: None

BIOL140 Classic Studies in Animal Behavior
This course will focus on the major concepts in the field of animal behavior. We will discuss the selection pressures that shape animal behavior and whether the study of primate social and mating systems can provide insight into human behavior. Other questions include, Why do certain animal species exhibit altruistic behavior and others do not? What are the limiting resources for male and female animals, and why do they behave so differently? This is but a sampling of the subjects to be covered in a course that is specifically designed for students to gain a clearer understanding of the mechanisms that drive the natural world around them. We will commence with the early pioneers in ethology who were the first to describe the behavioral repertoire of a single species and progress onto the more current, comparative approach, in which two animals are compared for a more fine-tuned analysis. Biological jargon will be defined as original research is discussed.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Prereq: None

BIOL145 Primate Behavior: The Real Monkey Business
This course will examine the full spectrum of the primate order. How has evolution shaped these different primate species, and what underlying mechanisms have fueled their development? We will discuss primate ancestry, primate environments, and primate competition, all factors that mediate primate behavior. In addition, we will take the lessons learned from primate studies to determine how humans might use this knowledge toward the preservation and conservation of their nonhuman relatives.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Prereq: None

BIOL148 Biology of Women
This course will cover a range of topics relating to the biology of women, including sex determination, the X chromosome, menstruation and menopause, assisted reproductive technologies, gender differences in brain function, and aging.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: FGSS148
Prereq: None

BIOL149 Neuroethology: Sensory Basis of Animal Orientation and Navigation
This course is about the sensory and neuronal processes underlying the ability of animals to orient in and move through their environments. We will consider the basic functions of sensory and nervous systems that underlie the remarkable abilities of animals to orient themselves in personal space, move through their home range, and move through the world in long-distance migrations and in homing. Animals from invertebrates through fish, birds, and mammals will be considered. The format of the course will be seminar/discussion and some lectures with heavy student participation. The course is intended for first-year students with high school-level courses in at least two of the following: biology, chemistry, or physics.

Offering: Crosslisting
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-NSB
Identical With: NS&B149
Prereq: None

BIOL155 Tiny Organisms with a Big Effect: The Microbiome
With the advent of advanced sequencing technology, we are able to characterize the microflora that lives on and inside of multicellular organisms, including humans. It follows that there are still many unknowns with respect to the function and dynamics of relationships between bacterial communities and their hosts. These bacterial communities, colonizing humans and other organisms with millions of microbes, have captured the interest of the public. Popular news outlets have made the disparate claims that the right human microbiome can act as a panacea and the wrong microbiome is such a calamity that it can destroy an individual's health. This course will look at the true nature of the microbiome, to the extent that current research has revealed. We will discuss both normal and abnormal bacterial community compositions and any related disease states. Similarly, we will cover changes in microbiome composition over time and with respect to host development. In class, we will also consider the microbiomes of other organisms and how the presence and composition of the microbiome relates to disease states and/or life history.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Prereq: None

BIOL158 Crosslist
BIOL173 Global Change and Infectious Disease
Among the most insidious effects of global change are the expanded geographical ranges and increased transmission of infectious diseases. Global warming is bringing tropical diseases, such as malaria, poleward from the tropics; the extreme weather events of a changed world are leading to outbreaks of zoonotic diseases, such as those caused by Hantaviruses; and nonclimatic anthropogenic factors, such as forest fragmentation, are taking their toll on human health, for example, by increasing the incidence of Lyme disease. This course will cover the evidence that global change has increased the geographical ranges and rates of incidence of infectious diseases in humans, in agricultural animals and plants, and in endangered species. We will explore how interactions between different anthropogenic effects (for example, habitat loss and pollution) exacerbate the effects of global warming on infectious diseases. We will analyze and critique projections for future changes in geographic ranges in infectious diseases. Finally, we will cover how revolutions in bioinformatics will increase the resolution of tracking and predicting responses of disease organisms to global change. The course has no formal prerequisites and will introduce material from ecology and microbiology, as needed, to allow students to read and interpret the recent literature on global change and infectious disease.
Offering: Host
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: ENVS260
Prereq: None

BIOL181 Principles of Biology I: Cell Biology and Molecular Basis of Heredity
This course presents an exploration of the contemporary view of the cell and an introduction to the molecules and mechanisms of genetics and gene function. The course will have two major themes. First, we will focus on the central dogma of molecular biology, describing the process of information transfer from genetic code in DNA through protein synthesis and function. Topics include DNA replication and repair, chromosome dynamics, RNA transcription, protein translation, gene regulation, and genomics. Second, we will focus on cell theory and the underlying molecular mechanisms of cellular activity, including cell signaling, energetics, cell motility, and cell cycling. Lectures will stress the experimental basis of conclusions presented and highlight important details and major themes. The course will also emphasize problem solving approaches in cell and molecular biology.
Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-MBB
Identical With: MB&B181
Prereq: None

BIOL182 Principles of Biology II
This course concerns biological principles as they apply primarily at tissue, organismic, and population levels of organization. Course topics include developmental biology, animal physiology and homeostatic control systems, endocrinology, neurophysiology and the neuronal basis of behavior. Evidence for evolution is reviewed, as are the tenets of Darwin’s theory of evolution by natural selection. The nature and importance of variation among organisms and of stochastic processes in evolution are discussed, as are modern theories of speciation and macroevolution. Finally, the course addresses interactions between organisms and their environments as well as the interactions among organisms in natural communities. Each of the topics of the course is explored from a comparative viewpoint to recognize common principles as well as variations among organisms that indicate evolutionary adaptation to different environments and niches.
Offering: Host
Grading: OPT
Credits: 1.00

BIOL186 Introduction to the Biology of Nutrition and Impact on Human Health
This course will introduce students to the concepts of nutrition. It will cover the biology of the different food groups that make a balanced diet (carbohydrates, fats, proteins) and how our bodies obtain energy and important molecules, such as vitamins, from our food. The course will also cover the relevant anatomy involved in digestion and excretion. Other topics such as the effects of food production on the environment, fad diets, and disease states will also be studied, along with the latest hot topics in the news.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL

BIOL191 Principles of Biology I–Laboratory
This laboratory course, to be taken concurrently with MB&B181 or BIOL181, provides direct experience with techniques used in cell biology and molecular biology. These include polymerase chain reaction (PCR), electrophoresis, enzyme assays, microscopy, and spectrophotometry. The lab course is a chance to learn these key techniques firsthand.
Offering: Crosslisting
Grading: Cr/U
Credits: 0.50
Gen Ed Area: NSM-MBB
Identical With: MB&B191
Prereq: None

BIOL192 Principles of Biology II–Laboratory
This laboratory course, designed to be taken concurrently with BIOL182 or MB&B182, will introduce students to experimental design, laboratory methods, data analysis, and empirical approaches to developmental biology, physiology, ecology, and evolution. Laboratory exercises use the techniques of electrophysiology, microscopy, computer simulations, and analyses of DNA sequence data. Some exercises will include exploration of physiological processes in living animals.
Offering: Host
Grading: Cr/U
Credits: 0.50
Gen Ed Area: NSM-BIOL
Identical With: MB&B192
Prereq: [MB&B191 or BIOL191]

BIOL194 Principles of Biology II: Advanced Topics
This course provides an optional supplement to the introductory course in physiology, development, evolution, and ecology (BIOL182, which should be taken concurrently). It is designed for highly motivated biology students who seek to enrich their understanding by engaging with current research in an intensive seminar setting. Students in BIOL194 will read and discuss recent journal articles that probe in greater depth some of the subjects covered in BIOL182. Weekly meetings will consist of a short lecture by the professor followed by group discussion of the readings.
Offering: Host
Grading: Cr/U
Credits: 0.25
Gen Ed Area: NSM-BIOL
Identical With: MB&B194
Prereq: BIOL181 or MB&B181

BIOL197 Introduction to Environmental Studies
This interdisciplinary study of human interactions with the environment and the implications for the quality of life examines the technical and social causes of
environmental degradation at local and global scales, along with the potential for developing policies and philosophies that are the basis of a sustainable society. This will include an introduction to ecosystems, climatic and geochemical cycles, and the use of biotic and abiotic resources over time. It includes the relationship of societies and the environment from prehistoric times to the present. Interrelationships, feedback loops, cycles, and linkages within and among social, economic, governmental, cultural, and scientific components of environmental issues will be emphasized.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-MBB
Identical With: NSM-EE
Prereq: None

BIOL208 Molecular Biology
This course is a comprehensive survey of the molecules and molecular mechanisms underlying biological processes. It will focus on the cornerstone biological processes of genome replication, gene expression, and protein function. The major biomacromolecules–DNA, RNA, and proteins–will be analyzed to emphasize the principles that define their structure and function. We will also consider how these components interact in larger networks within cells to permit processing of external and internal information during development and discuss how these processes become perturbed in disease states.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-MBB
Identical With: MB&B208
Prereq: ([MB&B181 or BIOL181] AND [BIOL182 or MB&B182])

BIOL210 Genomics: Modern Genetics, Bioinformatics, and the Human Genome Project
Genetics has provided a foundation for modern biology. We will explore the classical genetics and go on to consider how genomics has transformed this field. This course is intended to introduce students to the fields of genetics and genomics, which encompass modern molecular genetics, bioinformatics, and the structure, function, and evolution of genomes. We will discuss important new areas of research that have emerged from the genome projects, such as epigenetics, polymorphisms, transgenics, systems biology, stem cell research, and disease mapping. Students will also discuss bioethical issues we face in this new postgenome era.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: MB&B210
Prereq: [MB&B181 or BIOL181]

BIOL212 Principles and Mechanisms of Cell Biology
The cell is the smallest structural and functional unit of an organism. Understanding the molecular basis for its behavior and function is critical to understand biological function at all levels, from molecular to organismic. The primary goal of this course is to understand the process of scientific discovery in the field of cell biology—how do we know what we know? The textbook will provide a background to read and discuss original research articles. We will cover cell and organelle structure and function, trafficking, cell adhesion and motility, proliferation, signal transduction, and cell differentiation. To demonstrate how basic biological processes combine to form a coherent whole, we will discuss examples of integration of biological functions in tissues—and when these go awry in disease.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-EE
Identical With: E&ES197, ENVS197
Prereq: None

BIOL213 Behavioral Neurobiology
This course will introduce the concepts and contemporary research in the field of neuroscience and behavior. The course is intended for prospective neuroscience and behavior majors (for whom it is required) and for biology and psychology majors who wish a broad introduction to neuroscience. The initial few weeks will be devoted to fundamental concepts of neuroanatomy and neurophysiology. Subsequent classes will deal in-depth with fundamental problems of nervous system function and the neural basis of behavior, including neurotransmitter systems; organization of the visual system and visual perception; the control of movement; neurological and neuropsychiatric disorders; the neuroendocrine system; control of autonomic behaviors such as feeding, sleep, and temperature regulation; the stress response; and language, learning, and memory. Experimental results from a variety of species, including humans, will be considered.

Offering: Crosslisting
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-NSB
Identical With: NS&B213, PSYC240
Prereq: None

BIOL214 Evolution
This course covers current areas of research in evolutionary biology. Topics include the evidence for evolution, the nature of variation, adaptive and random evolutionary processes in natural populations, mechanisms of speciation, origin of major groups, reconstruction of the history of life through comparative analysis of morphological and DNA sequence data, evolutionary developmental biology, coevolution of plant-animal interactions, and the application of evolutionary principles to conservation biology.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Prereq: [BIOL182 or MB&B182]

BIOL215 Evolution in Human-Altered Environments
Human activities have altered natural environments and, indeed, have created entirely novel ecosystems such as cities and high-input farms. This course examines how these human alterations to the environment affect the evolution and coevolution of diverse organisms. Starting with an intensive overview of microevolutionary processes, we will consider a number of contemporary scenarios: evolutionary response to environmental contaminants, exploitation of natural populations, and global climate change; evolution in urban and agricultural ecosystems; and the evolutionary impact of nonnative, invasive, and genetically modified organisms.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: BIOL515
Prereq: [BIOL182 or MB&B182]

BIOL216 Ecology
Ecology is the scientific study of interactions between organisms and their environment, both biotic and abiotic. We will look at how these interactions shape fundamental characteristics of populations, communities, and ecosystems. Topics will include predation, competition, symbioses, and effects of stress and resource limitation in diverse environments. We will cover important consequences of interactions such as coevolution, population outbreaks, ecological coexistence, patterns of biodiversity, ecological succession, species
Invasions, food web dynamics, nutrient and energy cycling, variation in ecosystem goods and services, and global change.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: ENVS216
Prereq: [BIOL182 or MB&B182]

BIOL218 Developmental Biology
This course covers the mechanisms of development at the molecular, cellular, and organismal levels. Special attention will be paid to the process of scientific discovery: the experiments. Students will read and discuss both original research articles and the secondary review literature. We will discuss ethical and medical considerations for some of the topics covered.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Prereq: [BIOL182 or MB&B182]

BIOL220 Conservation Biology
This course will focus on the biology of conservation rather than cultural aspects of conservation. However, conservation issues will be placed in the context of ethics, economics, and politics. We will cover the fundamental processes that threaten wild populations, structure ecological communities, and determine the functioning of ecosystems. From this basis, we will explore important conservation issues such as habitat loss and alteration, overhunting, food web alteration, invasive species, and climate change. We will use readings from the primary literature and field projects to learn about current research methods used in conservation biology.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: ENVS220
Prereq: [BIOL182 or MB&B182]

BIOL224 Hormones, Brain, and Behavior
Hormones coordinate the anatomical, physiological, and behavioral changes necessary for developmental, seasonal, and diurnal transition in animals. These molecules have profound effects on the development of the brain and on adult brain function. How do hormones orchestrate brain assembly and the expression of specific behaviors? How do behavior, social context, and the environment influence hormone secretion? This course will provide a critical survey of our understanding of the relationship between endocrinology, the brain, and behavior in a variety of animal systems. Select topics include insect metamorphosis; sexual differentiation of the vertebrate brain and behavior; reproductive and aggressive behavior in birds, lizards, and rodents; song learning and song production in birds; and the effects of hormones on sexual behavior and cognitive function in primates, including humans. The exploration of a variety of systems will provide students with an appreciation of the ways in which the relationships between hormones and behavior vary across species, as well as the extent to which these relationships are conserved.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: NS&B224
Prereq: [NS&B213 or BIOL213 or PSYC240] OR [BIOL182 or MB&B182]

BIOL226 Invasive Species: Biology, Policy, and Management
Invasive species account for 39 percent of the known species extinctions on Earth, and they are responsible for environmental damages totaling greater than $138 billion per year. However, the general population has little knowledge of what invasive species are or what threats they pose to society. In this course, we will explore the biological, economic, political, and social impacts of invasive species. We will begin by exploring a definition of an invasive species and looking at the life history characteristics that make them likely to become pests. Then we will consider the effects of invasive species expansion on the conservation of biodiversity and ecosystem function, as well as their global environmental and political impacts. Finally, we will explore the potential future changes in invasive species distributions under a changing climate.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: ENVS240, ENVS226
Prereq: [E&ES197 or BIOL197 or ENVS197] OR [BIOL182 or MB&B182] OR E&ES199

BIOL228 Introductory Medical Biochemistry
This introductory course will focus on the essential concepts of biochemistry important to students interested in the health professions, including the chemical and biological foundations of cellular metabolism and related disease states. Major topics will include the structure and function of biological molecules in the human body (proteins, carbohydrates, fats, nucleic acids, vitamins), enzyme catalysis, cellular signaling, and digestion, absorption, and processing of nutrients for energy and growth.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-MBB
Identical With: MB&B228
Prereq: [MB&B181 or BIOL181] AND CHEM251

BIOL229 Geobiology Laboratory
This laboratory course will explore more deeply some of the concepts introduced in E&ES234. Both the fundamental patterns and practical applications of the fossil record will be emphasized.

Offering: Crosslisting
Grading: A-F
Credits: 0.50
Gen Ed Area: NSM-EES
Identical With: E&ES235
Prereq: E&ES101 OR E&ES115 OR E&ES199 OR [E&ES197 or BIOL197 or ENVS197]

BIOL231 Microbiology
This course will study microorganisms in action, as agents of disease, in ecological situations, and as tools for research in molecular biology, genetics, and biochemistry. Particular emphasis will be placed on new ideas in the field.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-MBB
Identical With: MB&B231
Prereq: [MB&B181 or BIOL181] OR [MB&B208 or BIOL208]

BIOL232 Immunology
In this introduction to immunology, particular emphasis will be given to understanding both the innate immune response and its agents as well as the acquired immune response mediated by B and T cells. Cellular and antibody responses in health and disease will be addressed, along with mechanisms of immune evasion by pathogens, autoimmune disease, and cancer.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
BIOL233 Geobiology
Fossils provide a glimpse into the form and structure of ancient ecosystems. Geobiology is the study of the two-way interactions between life (biology) and rocks (geology); typically, this involves studying fossils within the context of their sedimentary setting. In this course we will explore the geologic record of these interactions, including the fundamentals of evolutionary patterns, the origins and evolution of early life, mass extinctions, and the history of the impact of life on climate.
Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-NSB
Identical With: NSM-MBB
Prereq: MB&B213 or BIOL181
Identical With: NS&B239, PSYC239
Prereq: [NS&B213 or BIOL213 or PSYC240] OR [MB&B219 or BIOL219]

BIOL243 Cellular Neurophysiology
This course will deal with basic aspects of neuronal physiology, including the function of excitable membranes and the transfer of information between cells (e.g., synaptic physiology, neurochemistry, membrane receptors). In connection with each of these topics, consideration will be given to short- and long-term modification of neuronal function. Toward the end of the course, we will examine the neurophysiology of epileptic seizures as well as the neurophysiology of motor systems.
Offering: Host
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: MB&B237
Prereq: [MB&B213 or BIOL213 or PSYC240] OR [MB&B191 or BIOL191] AND [MB&B192 or BIOL192]

BIOL245 Cellular Neurophysiology
This course will deal with basic aspects of neuronal physiology, including the function of excitable membranes and the transfer of information between cells (e.g., synaptic physiology, neurochemistry, membrane receptors). In connection with each of these topics, consideration will be given to short- and long-term modification of neuronal function. Toward the end of the course, we will examine the neurophysiology of epileptic seizures as well as the neurophysiology of motor systems.
Offering: Host
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: MB&B244
Prereq: [MB&B213 or BIOL213 or PSYC240] OR [MB&B213 or BIOL181]
BIOL250 Laboratory in Cellular and Behavioral Neurobiology

"The goals of the course are to introduce students to a number of contemporary laboratory techniques in neuroscience and behavior. The laboratory introduces students to experimental method and techniques including neuroanatomy, immunohistochemistry, primary neuronal and astrocyte cell culture methods, analyses of electrical activity in the brain, and behavioral analyses of learning, memory, social behavior, and social dominance in inbred strains of mice.

Students will learn to analyze experimental data and write a series of laboratory reports on the experiments done during class. In addition, students will write a term paper related to one of the experimental approaches."

Offering: Host
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: NS&B249
Prereq: [(BIOL182 or MB&B182) AND (NS&B213 or BIOL213 or PSYC240)]

BIOL252 Cell Biology of the Neuron

Neuronal cell biology is an important and fast-moving field. The brain cannot be understood without first elucidating the properties and functions of its component neurons. This course will focus on cellular biological studies of the nervous system. We will explore the structure and function of neurons, synapses, and circuits. Using both text books and primary literature, we will examine the basic cell biological mechanisms that underlie the formation, function, and plasticity of neurons and circuits. Areas studied will include polarity, synapse formation, synaptic transmission, intracellular transport, plasticity, and regeneration.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-NSB
Identical With: NS&B252
Prereq: [NS&B213 or BIOL213 or PSYC240]

BIOL254 Comparative Animal Behavior

This course explores the scientific study of animal behavior. All animals face similar challenges and we will examine the common, and sometimes unique, behavioral strategies used to meet these challenges. There are two sorts of questions one might ask about the behavior of a given individual or species. First, how is that behavior executed? Second, why is that behavior, rather than another, exhibited? What is the adaptive significance of the behavior? To fully understand the behavior of any organism, both sorts of questions must be addressed. This course will introduce students to the many ways these questions are grappled with for a wide range of organisms. As such, this course will provide an overview of mechanistic, ecological, and evolutionary explanations of behavior.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: NS&B254
Prereq: [BIOL182 or MB&B182] OR [BIOL196 or MBB196] OR [NS&B213 or BIOL213 or PSYC240]

BIOL265 Bioinformatics Programming

This course is an introduction to bioinformatics and programming for students with interest in the life sciences. It introduces problem areas and conceptual frameworks in bioinformatics. The course assumes little or no prior programming experience and will introduce the fundamental concepts and mechanisms of computer programs and examples (e.g., sequence matching and manipulation, database access, output parsing, dynamic programming) frequently encountered in the field of bioinformatics.

Offering: Host
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: NS&B265, COMP113, CIS265
Prereq: [MB&B181 or BIOL181]

BIOL266 Bioinformatics

This course is an introduction to bioinformatics for students with interest in the life sciences. The course is similar to BIOL265 but only meets in the second half of the semester (with BIOL265) and is designed for students with programming background, ideally in Python. The course introduces problem areas and conceptual frameworks in bioinformatics and discusses programming approaches used in bioinformatics such as sequence matching and manipulation algorithms using dynamic programming, clustering analysis of gene expression data, analysis of genetic nets using Object Oriented Programming, and sequence analysis using Hidden Markov Models, Regular Expressions, and information theory.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: MB&B265, COMP266, CIS266
Prereq: [MB&B181 OR BIOL181]

BIOL290 Plant Form and Diversity

The course begins with an overview of plant evolutionary history, then covers the basic structure and function of the plant body, the plant life cycle in nature, including interactions with animals, and ecological diversity of plants in contrasting habitats. Special events include a field trip to the Smith College Botanic Garden, two hands-on days for working with living specimens, and a special guest lecture by a local plant biologist.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: BIOL590
Prereq: [BIOL182 or MB&B182]

BIOL299 Waves, Brains, and Music

Pressure waves bounce against the ear, and we create perceptions called sounds from them. We organize sounds to make music, making more waves, and the cycle goes forward. This course will provide an introduction to the fraction of these phenomena that can be measured and analyzed, focusing on the mathematics of signal analysis, auditory physiology, and the physiology of musical perception and production. Periodic waveforms include musical tones and the voltage fluctuations that can be measured from brains. The first third of this course (waves) is an introduction to the quantitative analysis of periodic waveforms, with the goal that the student will have a better understanding of how to interpret the analysis of both musical sounds and neuronal recordings. The second part of the course (brains) examines the known mechanical processes (physiology) by which the mammalian brain analyzes the periodic waveforms that we interpret as sound. The third part of the course uses these lessons to examine original research articles about the neuroscience of music, that is, how neuronal networks produce musical perception.

Offering: Host
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: NS&B299  
Prereq: [NS&B213 or BIOL213 or PSYC240]

**BIOL310 Genomics Analysis**
This course is an introduction to genomics and analysis for students with interest in life sciences. It introduces current applications of genomics techniques, covers how to build a genomics workflow, and introduces statistical analyses in R programming language. This course assumes little or no prior programming experience and will provide hands-on experience in taking raw next-generation sequencing data through a custom workflow and ending with analyses in R statistical software.

Offering: Host  
Grading: A-F  
Credits: 1.00  
Gen Ed Area: NSM-BIOL  
Identical With: CIS310, MB&B311  
Prereq: [MB&B181 or BIOL181]

**BIOL313 Microbes and Human-Caused Environmental Change**
This is a time of unprecedented change in the world we share with billions of species. Unlike the previous catastrophic changes seen over geological time, the changes we see today are caused primarily by just one species, our own. In this new human-dominated era, the Anthropocene, humans have critically changed the conditions of life through a great diversity of activities, including release of greenhouse gases into the atmosphere, accelerated transport of organisms, fragmentation of forests, consumption of antibiotics, agriculture, hunting prey to near extinction, bushmeat hunting, and many other activities. This course will address two kinds of effects of each of these activities on microbes: (1) that humans and agricultural animals and plants are being subjected to new infectious diseases, and the geographical and temporal patterns of infection are changing; and (2) microbes are being challenged to adapt to new environmental challenges, both biotic and abiotic. Students will read and discuss articles from the scientific literature, and each student will write a research proposal.

Offering: Crosslisting  
Grading: OPT  
Credits: 1.00  
Gen Ed Area: NSM-ENVS  
Identical With: ENV5313  
Prereq: [BIOL182 or MB&B182]

**BIOL316 Plant-Animal Interactions**
This course will explore the ecology and evolution of interactions between plants and animals, including mutualism (e.g., pollination, frugivory) and antagonism (e.g., herbivory, granivory), that are central to the functioning of ecosystems and the generation of biodiversity. The format will be seminar-style, involving reading, discussion, and student presentations of key papers on chosen topics.

Offering: Host  
Grading: A-F  
Credits: 1.00  
Gen Ed Area: NSM-BIOL  
Identical With: BIOL516  
Prereq: BIOL214 OR [BIOL220 or ENV5220] OR [BIOL290 or BIOL590] OR [BIOL216 or ENV5216]

**BIOL318 Nature and Nurture: The Interplay of Genes and Environment**
In this advanced seminar, we consider how genetic and environmental factors interact to shape the development and behavior of organisms, including humans. After an initial series of lectures and discussions on foundational readings, the class will consist of in-depth student presentations and class discussion.

Offering: Host  
Grading: A-F  
Credits: 1.00  
Gen Ed Area: NSM-BIOL  
Identical With: BIOL518

**BIOL320 Quantitative Methods for the Biological and Environmental Sciences**
This course offers an applied approach to statistics used in the biological, environmental, and earth sciences. Statistics will be taught from a geometric perspective so that students can more easily understand the derivations of formulae. We will learn about deduction and hypothesis testing as well as the assumptions that methods make and how violations affect applied outcomes. Emphasis will be on analysis of data, and there will be many problem sets to solve to help students become fluent with the methods. The course will focus on data and methods for continuous variables. In addition to basic statistics, we will cover regression, ANOVA, and contingency tables.

Offering: Host  
Grading: A-F  
Credits: 1.00  
Gen Ed Area: NSM-BIOL  
Identical With: BIOL520, E&ES270, E&ES570, ENVS320  
Prereq: None

**BIOL325 Stem Cells: Basic Biology to Clinical Application**
This course will cover recent advances in stem cell biology, including tissue-specific and pluripotent stem cells. Clinical applications will be covered and we will examine the ethics and politics as well as the science of this emerging field.

Offering: Host  
Grading: A-F  
Credits: 1.00  
Gen Ed Area: NSM-BIOL  
Identical With: NS&B325  
Prereq: ([MB&B181 or BIOL181] AND [BIOL182 or MB&B182])

**BIOL327 Evolutionary and Ecological Bioinformatics**
Bioinformatic analysis of gene sequences and gene expression patterns has added enormously to our understanding of ecology and evolution. For example, through bioinformatic analysis of gene sequences, we can now reconstruct the evolutionary history of a species, even though no traces of physiology exist in the fossil record. We can determine the adaptive history of one gene and all the genes’ descendants. We can now construct the evolutionary tree of all of life. Bioinformatics is particularly promising for analyzing the evolution and biodiversity of microbial communities, since well over 99 percent of microorganisms cannot be cultured; our only knowledge of these organisms is through analysis of their gene sequences and gene expression patterns. For example, even when we cannot culture most of a microbial community, we can determine which metabolic pathways are of greatest significance through analysis of community-level gene expression. All these research programs are made accessible not only by breakthroughs in molecular technology but also by innovation in the design of computer algorithms. This course, team-taught by an evolutionary biologist and a computer scientist, will present how bioinformatics is revolutionizing evolutionary and ecological research and will present the design and construction of bioinformatic computer algorithms underlying the evolution in biology. Students will learn algorithms for reconstructing phylogeny, for sequence alignment, and for analysis of genomes, and students will have an opportunity to create their own algorithms.

Offering: Host  
Grading: A-F  
Credits: 1.00  
Gen Ed Area: NSM-BIOL  
Identical With: COMP327, BIOL527, COMP527, CIS327  
Prereq: [BIOL182 or MB&B182] OR [BIOL196 or MB&B196] OR COMP112 OR COMP211

**BIOL328 Chemical Senses**
The least well understood of the senses, chemical sensation, is key to survival and behavior of many species. This course covers the structure and function
of sensory neurons in both the gustatory and olfactory systems, as well as in chemo-sensory irritation. We will examine coding of sensory information to understand how higher cortical areas interpret stimuli. We will look at a variety of animal models and discover common organizing principles across phyla. Emphasis will be placed on the cell biology of these systems. Students will participate in reading, analyzing, and presenting recent studies from different areas within chemical sense to highlight recent findings and where the emphasis in chemosensory research is focused.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: None
Identical With: NS&B333, BIOL533
Prereq: [BIOL182 or MB&B182]

BIOL333 Gene Regulation
This course aims to develop a genome perspective on transcriptional gene regulation. The genome sequence, now completed in a number of organisms, is described as a blueprint for development. More than simply a parts list (i.e., genes), this blueprint is an instruction manual as well (i.e., regulatory code). A next critical phase of the genome project is understanding the genetic and epigenetic regulatory codes that operate during development. Through a combination of lectures and discussion of primary literature, this course will explore current topics on promoters and transcription factors, chromatin structure, regulatory RNA, chromosomal regulatory domains, and genetic regulatory networks. An overarching theme is how genomes encode and execute regulatory programs as revealed by a global systems biology approach in modern genomics research.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: None
Identical With: MB&B533, MB&B333, BIOL533
Prereq: [BIOL182 or MB&B182]

BIOL334 Shaping the Organism
"We are composed of tissues and organs of distinct shapes, but how are these shapes formed? To answer this question, biologists turn to the embryos and developing tissues of model organisms to study the mechanisms that build tissues with distinctive shapes and patterns. These mechanisms include changes in the cytoskeleton and cell adhesion, changes in cell shape, changes in the forces within a cell and across a tissue, and signals that determine whether cells live or die. It turns out that most of the processes required to correctly shape embryos and tissues have also been found to function incorrectly in a variety of human diseases!

This is a part-seminar, part-laboratory course that examines tissue and pattern generation in Drosophila (the fruit fly), an accessible model organism that has been extensively used to study the conserved processes and proteins that shape tissues. First, we will examine how the Drosophila embryo is shaped and patterned. Second, we examine how the Drosophila eye is assembled and patterned. Students will set up Drosophila crosses, use popular techniques to manipulate protein expression, and dissect and image fly tissues."

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: None

BIOL337 The Origins of Bacterial Diversity
Wherever there is life, there are bacteria. Free-living bacteria are found in every environment that supports eukaryotes, and no animal or plant is known to be free of bacteria. There are most likely a billion or more species of bacteria, each living in its unique ecological niche. This course will explore the origins of bacterial biodiversity: how bacteria evolve to form new species that inhabit new ecological niches. We will focus on how the peculiarities of bacterial sex and genetics facilitate bacterial speciation. Topics will include the characteristics of bacterial sex, why barriers to genetic exchange are not necessary for speciation in bacteria, the great potential for formation of new bacterial species, the evolutionary role of genetic gifts from other species, and the use of genomics to identify ecologically distinct populations of bacteria.

Offering: Host
Grading: A-F
Credits: 0.50
Gen Ed Area: None
Identical With: BIOL537, ENV5337
Prereq: [BIOL182 or MB&B182]

BIOL340 Issues in Development and Evolution
This advanced seminar explores the relationship between embryonic development and morphological evolution. The course will include a combination of lectures, discussion, and student presentations of papers chosen from the primary literature. Subjects covered will include broad, fundamental issues such as the concept of homology and developmental characters and phylogeny, as well as the evolutionary significance of specific developmental phenomena such as animal segmentation, direct development, and major morphological transitions in evolution.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: None
Identical With: BIOL540
Prereq: BIOL218 OR BIOL214

BIOL343 Muscle and Nerve Development
This course will examine the structure and function of muscle cells, the development of muscle cell identity, the development of motor neurons, and the interactions between nerve and muscle that lead to a functioning neuromuscular system. The primary focus will be on vertebrate model systems such as chick, mouse, and fish. We will also examine human diseases, including muscular dystrophies and other neuromuscular disorders.

Offering: Host
Grading: OPT
Credits: 1.00
Gen Ed Area: None
Identical With: NS&B543, BIOL543, NS&B343
Prereq: BIOL218 OR ([BIOL182 or MB&B182] AND [BIOL212 or MB&B212]) OR ([BIOL182 or MB&B182] AND [NS&B213 or BIOL213 or PSYC240]) OR ([BIOL196 or MB&B196] AND [BIOL212 or MB&B212]) OR ([BIOL196 or MB&B196] AND [NS&B213 or BIOL213 or PSYC240])

BIOL345 Developmental Neurobiology
Near the top of the list of unsolved mysteries in biology is the enigma of how the brain constructs itself. Here is an organ that can make us feel happy, sad, amused, and in love. It responds to light, touch, and sound; it learns; it organizes movements; it controls bodily functions. An understanding of how this structure is constructed during embryonic and postnatal development has begun to emerge from molecular-genetic, cellular, and physiological studies. In this course, we will discuss some of the important events in building the brain and explore the role of genes and the environment in shaping the brain. With each topic in this journey, we will ask what the roles of genes and the environment are in forming the nervous system. We will also discuss developmental disorders resulting from developmental processes that have gone astray. This is a reading-intensive seminar course emphasizing classroom discussions, with readings from a textbook and the primary scientific literature.

Offering: Host
Grading: A-F
BIO346 The Forest Ecosystem
This course examines basic ecological principles through the lens of forest ecosystems, exploring the theory and practice of forest ecology at various levels of organization from individuals to populations, communities, and ecosystems. Lectures, lab exercises, and writing-intensive assignments will emphasize the quantification of spatial and temporal patterns of forest change at stand, landscape, and global scales.
Offering: Host
Grading: A-F

BIO347 Mammalian Cortical Circuits
While scientists are still very unsure of how the mammalian cortex enables conscious perception and thought, there has been a tremendous explosion of knowledge recently concerning the wide heterogeneity of neuronal classes and specific kinds of connections between these classes. Detailed wiring diagrams of local cortical circuits are emerging, colored with dynamic connections that have created a wellspring of ideas motivated toward understanding the cortex with reverse-engineering strategies. This course will focus on cortical circuit studies in the neocortex. Students will come to know, for example, many different varieties of inhibitory interneurons in terms of their firing properties, synaptic plasticities, the connections they make with other neurons, and what roles they might play in governing cortical dynamics.
Offering: Host
Grading: OPT

BIO351 Neurobiology of Learning and Memory
Animals as varied as sea slugs and humans display a number of types of learning, ranging from the capacity to acquire species-specific behavior to the ability to form arbitrary associations. Just as varied are the philosophies governing the choice of how to best study the neurobiology of learning and memory. Through lectures, class discussion, student presentations, and a critical reading of the primary literature, the advantages and disadvantages of these various approaches will be investigated. While the specific focus of this class will be on learning and memory, other ways in which the brain learns will also be explored. Normal brain ontogeny relies to some extent on invariant cues in the animal's environment, making this process somewhat analogous to learning. In fact, the neural substrates for learning are likely to be a subset of the basic steps used during brain development. Moreover, the developmental rules guiding brain assembly place constraints on the what, how, and when of brain function and learning. Therefore, this course will also cover select topics in basic developmental neurobiology.
Offering: Host
Grading: A-F

BIO353 Neurobiology of Neurological Disorders
This course aims to provide a foundation in the underlying mechanisms of neurological and psychiatric disorders. We will explore through lectures and readings of primary literature a number of important neurological and psychiatric diseases, including autism, schizophrenia, Alzheimer's disease, mental retardation, epilepsy, and Parkinson's disease. This course focuses on the fundamental molecular and cellular mechanisms that underlie neurological disorders and is designed to engage students who wish to study basic aspects of brain function.
Offering: Crosslisting
Grading: A-F

BIO354 Agricultural Food Webs
Ecological communities are structured by feeding interactions, and agricultural systems are no exception to this rule. This class will focus on attributes of food webs that impact agriculture, including topics such as natural biological control of insect pests, to soil microbes and nutrient cycling, to causes of honeybee colony collapse disorder. This course includes a rigorous survey of both ecological theory and applied environmental problems. Students will read primary literature from the fields of food web ecology and agroecology and discuss the implications through group work.
Offering: Crosslisting
Grading: A-F

BIO356 Neurodevelopmental Disorders
This course aims to provide a foundation in the underlying mechanisms of neurodevelopmental disorders. We will explore through lectures and readings of primary literature a number of important neurological and psychiatric diseases, including genetic disorders such as Down syndrome, Fragile X, and Williams syndrome; spectrum disorders such as autism and fetal alcohol syndrome; ADHD, Tourettes, cerebral palsy, and some motor disorders including developmental coordination disorder, stereotypic movement disorder, sensory inattention disorder, and neonatal hypoxia. This course focuses on the fundamental molecular and cellular mechanisms that underlie neurological disorders and is designed to engage students who wish to study basic cellular aspects of brain function.
Offering: Crosslisting
Grading: A-F

BIO360 Neuroplasticity: How Experience Changes the Brain
Neuroplasticity refers to the brain's ability to change throughout life. In this course, we will examine functional and structural plasticity of the brain. Functional plasticity refers to the brain's ability to move functions from a damaged area of the brain to other undamaged areas. Structural plasticity refers to the brain's ability to change its physical structure, as a result of learning or to reorganize itself by forming new connections, strengthening existing connections, or pruning away old synaptic connections. We will examine critical periods in development when sensory experiences change and sculpt the wiring of the brain, how exercise and diet influence adult neurogenesis and cognition, and how neural activity regulates structural plasticity and gene programs. This is a writing-intensive course. Students will analyze the readings through discussions and writing assignments including blogs, short reviews, and commentaries.
Students will have opportunities for extensive feedback on their writing and revisions.

**Offering:** Crosslisting
**Grading:** OPT
**Credits:** 1.00
**Gen Ed Area:** NSM-NSB
**Identical With:** NS&B360
**Prereq:** [NS&B213 or BIOL213 or PSYC240]

**BIOL369 Ecological Resilience: The Good, the Bad, and the Mindful**

“This course will examine the concepts of resilience, fragility, and adaptive cycles in the context of ecosystem and social-ecological-system (SES) structures. These concepts have been developed to explain abrupt and often surprising changes in complex ecosystems and SES that are prone to disturbances. We will also include nonhierarchical interactions among components of systems (termed panarchy) to compare the interactions and dependencies of ecological and human community systems. A systems approach will be applied to thinking about restoration ecology, community reconstruction, and adaptive management theory.

All of the terms—resilience, fragility, adaptation, restoration, reconstruction—are fraught with subjectivity and valuation. We will use mindfulness and meditation techniques (including breathing and yoga) to more objectively and dynamically engage in the subject matter, leaving behind prejudice or bias. Students will be expected to approach these techniques with an open mind and practice them throughout the semester. The objective is to provide students with a more comprehensive framework with which to gain deeper understanding and integration of the science with the social issues.”

**Offering:** Crosslisting
**Grading:** A-F
**Credits:** 1.25
**Gen Ed Area:** NSM-ENVS
**Identical With:** ENVS369, E&ES242
**Prereq:** [E&ES197 or BIOL197] OR [BIOL182 or MB&B182]

**BIOL401 Individual Tutorial, Undergraduate**
Topic to be arranged in consultation with the tutor.

**Offering:** Host
**Grading:** OPT

**BIOL402 Individual Tutorial, Undergraduate**
Topic to be arranged in consultation with the tutor.

**Offering:** Host
**Grading:** OPT

**BIOL407 Senior Tutorial (downgraded thesis)**
Downgraded Senior Thesis Tutorial - Project to be arranged in consultation with the tutor. Only enrolled in through the Honors Coordinator.

**Offering:** Host
**Grading:** A-F

**BIOL408 Senior Tutorial (downgraded thesis)**
Downgraded Senior Thesis Tutorial - Project to be arranged in consultation with the tutor. Only enrolled in through the Honors Coordinator.

**Offering:** Host
**Grading:** A-F

**BIOL409 Senior Thesis Tutorial**
Topic to be arranged in consultation with the tutor.

**Offering:** Host
**Grading:** OPT

**BIOL410 Senior Thesis Tutorial**
Topic to be arranged in consultation with the tutor.

**Offering:** Host
**Grading:** OPT

**BIOL411 Group Tutorial, Undergraduate**
Topic to be arranged in consultation with the tutor.

**Offering:** Host
**Grading:** OPT

**BIOL412 Group Tutorial, Undergraduate**
Topic to be arranged in consultation with the tutor.

**Offering:** Host
**Grading:** OPT

**BIOL419 Student Forum**
Student-run group tutorial, sponsored by a faculty member and approved by the chair of a department or program.

**Offering:** Host
**Grading:** Cr/U

**BIOL420 Student Forum**
Student-run group tutorial, sponsored by a faculty member and approved by the chair of a department or program.

**Offering:** Host
**Grading:** Cr/U

**BIOL421 Undergraduate Research, Science**
Individual research projects for undergraduate students supervised by faculty members.

**Offering:** Host
**Grading:** OPT

**BIOL422 Undergraduate Research, Science**
Individual research projects for undergraduate students supervised by faculty members.

**Offering:** Host
**Grading:** OPT

**BIOL423 Advanced Research Seminar, Undergraduate**
Advanced research tutorial; project to be arranged in consultation with the tutor.

**Offering:** Host
**Grading:** OPT

**BIOL424 Advanced Research Seminar, Undergraduate**
Advanced research tutorial; project to be arranged in consultation with the tutor.

**Offering:** Host
**Grading:** OPT

**BIOL465 Education in the Field, Undergraduate**
Students must consult with the department and class dean in advance of undertaking education in the field for approval of the nature of the responsibilities and method of evaluation.

**Offering:** Host
**Grading:** OPT

**BIOL470 Independent Study, Undergraduate**

**Offering:** Host
**Grading:** OPT
**Credits:** 1.00
**Gen Ed Area:** None
**Prereq:** None

**BIOL471 Teaching Apprentice Tutorial**
The teaching apprentice program offers undergraduate students the opportunity to assist in teaching a faculty member’s course for academic credit.

**Offering:** Host
**Grading:** OPT

**BIOL491 Teaching Apprentice Tutorial**
The teaching apprentice program offers undergraduate students the opportunity to assist in teaching a faculty member’s course for academic credit.

**Offering:** Host
**Grading:** OPT
BIOL506 Cell and Development Journal Club II
Presentation and active discussion of a series of current research articles in the field of cell and developmental biology from journals including CELL, JOURNAL OF CELL BIOLOGY, DEVELOPMENT, GENES AND DEVELOPMENT, DEVELOPMENTAL BIOLOGY, SCIENCE, and NATURE.
Offering: Host
Grading: OPT
Prereq: None
BIOL515 Evolution in Human-Altered Environments

Human activities have altered natural environments and, indeed, have created entirely novel ecosystems such as cities and high-input farms. This course examines how these human alterations to the environment affect the evolution and coevolution of diverse organisms. Starting with an intensive overview of microevolutionary processes, we will consider a number of contemporary scenarios: evolutionary response to environmental contaminants, exploitation of natural populations, and global climate change; evolution in urban and agricultural ecosystems; and the evolutionary impact of nonnative, invasive, and genetically modified organisms.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: BIOL215
Prereq: [BIOL182 or MB&B182]

BIOL516 Plant-Animal Interactions

This course will explore the ecology and evolution of interactions between plants and animals, including mutualism (e.g., pollination, frugivory) and antagonism (e.g., herbivory, granivory), that are central to the functioning of ecosystems and the generation of biodiversity. The format will be seminar-style, involving reading, discussion, and student presentations of key papers on chosen topics.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: BIOL316
Prereq: [BIOL214 OR [BIOL220 or ENVS220] OR [BIOL290 or BIOL590] OR [BIOL216 or ENVS216]

BIOL518 Nature and Nurture: The Interplay of Genes and Environment

In this advanced seminar, we consider how genetic and environmental factors interact to shape the development and behavior of organisms, including humans. After an initial series of lectures and discussions on foundational readings, the class will consist of in-depth student presentations and class discussion.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: BIOL318
Prereq: [BIOL214 OR BIOL218 OR [BIOL210 or MB&B210] OR [BIOL224 or NS&B224]

BIOL520 Quantitative Methods for the Biological and Environmental Sciences

This course offers an applied approach to statistics used in the biological, environmental, and earth sciences. Statistics will be taught from a geometric perspective so that students can more easily understand the derivations of formulae. We will learn about deduction and hypothesis testing as well as the assumptions that methods make and how violations affect applied outcomes. Emphasis will be on analysis of data, and there will be many problem sets to solve to help students become fluent with the methods. The course will focus on data and methods for continuous variables. In addition to basic statistics, we will cover regression, ANOVA, and contingency tables.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: BIOL320, E&ES270, E&ES570, ENVS320
Prereq: None

BIOL527 Evolutionary and Ecological Bioinformatics

Bioinformatic analysis of gene sequences and gene expression patterns has added enormously to our understanding of ecology and evolution. For example, through bioinformatic analysis of gene sequences, we can now reconstruct the evolutionary history of physiology, even though no traces of physiology exist in the fossil record. We can determine the adaptive history of one gene and all the gene’s descendants. We can now construct the evolutionary tree of all of life. Bioinformatics is particularly promising for analysis of the ecology and biodiversity of microbial communities, since well over 99 percent of microorganisms cannot be cultured; our only knowledge of these organisms is through analysis of their gene sequences and gene expression patterns. For example, even when we cannot culture most of a microbial community, we can determine which metabolic pathways are of greatest significance through analysis of community-level gene expression. All these research programs are made accessible not only by breakthroughs in molecular technology but also by innovation in the design of computer algorithms. This course, team-taught by an evolutionary biologist and a computer scientist, will present how bioinformatics is revolutionizing evolutionary and ecological investigation and will present the design and construction of bioinformatic computer algorithms underlying the revolution in biology. Students will learn algorithms for reconstructing phylogeny, for sequence alignment, and for analysis of genomes, and students will have an opportunity to create their own algorithms.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: BIOL327, COMP327, COMP527, CIS327
Prereq: [BIOL182 or MB&B182] OR [BIOL196 or MB196] OR COMP112 OR COMP211

BIOL533 Gene Regulation

This course aims to develop a genome perspective on transcriptional gene regulation. The genome sequence, now completed in a number of organisms, is described as a blueprint for development. More than simply a parts list (i.e., genes), this blueprint is an instruction manual as well (i.e., regulatory code). A next critical phase of the genome project is understanding the genetic and epigenetic regulatory codes that operate during development. Through a combination of lectures and discussion of primary literature, this course will explore current topics on promoters and transcription factors, chromatin structure, regulatory RNA, chromosomal regulatory domains, and genetic regulatory networks. An overarching theme is how genomes encode and execute regulatory programs as revealed by a global systems biology approach in modern genomics research.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: None
Identical With: MB&B533, MB&B333, BIOL333
Prereq: [BIOL182 or MB&B182]

BIOL537 The Origins of Bacterial Diversity

Wherever there is life, there are bacteria. Free-living bacteria are found in every environment that supports eukaryotes, and no animal or plant is known to be free of bacteria. There are most likely a billion or more species of bacteria, each living in its unique ecological niche. This course will explore the origins of bacterial biodiversity: how bacteria evolve to form new species that inhabit new ecological niches. We will focus on how the peculiarities of bacterial sex and genetics facilitate bacterial speciation. Topics will include the characteristics of bacterial sex, why barriers to genetic exchange are not necessary for speciation in bacteria, the great potential for formation of new bacterial species, the evolutionary role of genetic gifts from other species, and the use of genomics to identify ecologically distinct populations of bacteria.

Offering: Crosslisting
Grading: A-F
Credits: 0.50
Gen Ed Area: NSM-BIOL
Lectures, lab exercises, and writing-intensive assignments will emphasize the process of organization from individuals to populations, communities, and ecosystems. This course examines basic ecological principles through the lens of forest ecology at various levels of organization, resulting from developmental processes that have gone astray. This is a reading-intensive seminar course emphasizing classroom discussions, with readings from a textbook and the primary scientific literature.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: BIOL340
Prereq: BIOL218 OR BIOL214

BIOL540 Issues in Development and Evolution
This advanced seminar explores the relationship between embryonic development and morphological evolution. The course will include a combination of lectures, discussion, and student presentations of papers chosen from the primary literature. Subjects covered will include broad, fundamental issues such as the concept of homology and developmental characters and phylogeny, as well as the evolutionary significance of specific developmental phenomena such as animal segmentation, direct development, and major morphological transitions in evolution.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: BIOL340
Prereq: [BIOL182 or MB&B182]

BIOL543 Muscle and Nerve Development
This course will examine the structure and function of muscle cells, the development of muscle cell identity, the development of motor neurons, and the interactions between nerve and muscle that lead to a functioning neuromuscular system. The primary focus will be on vertebrate model systems such as chick, mouse, and fish. We will also examine human diseases, including muscular dystrophies and other neuromuscular disorders.

Offering: Crosslisting
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: BIOL343, NS&B543, NS&B343
Prereq: BIOL218 OR ([BIOL182 or MB&B182] AND [BIOL212 or MB&B212]) OR ([BIOL182 or MB&B182] AND [NS&B213 or BIOL213 or PSYC240]) OR ([BIOL196 or MB&B196] AND [BIOL212 or MB&B212]) OR ([BIOL196 or MB&B196] AND [NS&B213 or BIOL213 or PSYC240])

BIOL545 Developmental Neurobiology
Near the top of the list of unsolved mysteries in biology is the enigma of how the brain constructs itself. Here is an organ that can make us feel happy, sad, amused, and in love. It responds to light, touch, and sound; it learns; it organizes movements; it controls bodily functions. An understanding of how this structure is constructed during embryonic and postnatal development has begun to emerge from molecular-genetic, cellular, and physiological studies. In this course, we will discuss some of the important events in building the brain and explore the role of genes and the environment in shaping the brain. With each topic in this journey, we will ask what the roles of genes and the environment are in forming the nervous system. We will also discuss developmental disorders resulting from developmental processes that have gone astray. This is a reading-intensive seminar course emphasizing classroom discussions, with readings from a textbook and the primary scientific literature.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: BIOL345, NS&B345, NS&B545

BIOL546 The Forest Ecosystem
This course examines basic ecological principles through the lens of forest ecosystems, exploring the theory and practice of forest ecology at various levels of organization from individuals to populations, communities, and ecosystems. Lectures, lab exercises, and writing-intensive assignments will emphasize the quantification of spatial and temporal patterns of forest change at stand, landscape, and global scales.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: BIOL346, E&ES238, E&ES538, ENVS340
Prereq: [BIOL182 or MB&B182] OR [E&ES197 or BIOL197 or ENVS197] OR E&ES199

BIOL549 Advanced Research Seminar, Graduate
Advanced research tutorial; project to be arranged in consultation with the tutor.

Offering: Host
Grading: OPT

BIOL550 Advanced Research Seminar, Graduate
Advanced research tutorial; project to be arranged in consultation with the tutor.

Offering: Host
Grading: OPT

BIOL557 Advanced Research Seminars in Biology
This course focuses on the specific research projects of individual graduate students in the Department of Biology, and it comprises student presentations and discussion including the department faculty, graduate students and post doctoral fellows. The course offers a forum for presenting new results and exploring new ideas, as well as for providing researchers with feedback and suggestions for solving methodological problems. It also provides an opportunity for students to become familiar with the wide range of biological research taking place in the department.

Offering: Host
Grading: Cr/U
Credits: 0.50
Gen Ed Area: None
Prereq: None

BIOL590 Plant Form and Diversity
The course begins with an overview of plant evolutionary history, then covers the basic structure and function of the plant body, the plant life cycle in nature, including interactions with animals, and ecological diversity of plants in contrasting habitats. Special events include a field trip to the Smith College Botanic Garden, two hands-on days for working with living specimens, and a special guest lecture by a local plant biologist.

Offering: Crosslisting
Grading: A-F
Credits: 0.50
Gen Ed Area: NSM-BIOL
Identical With: BIOL290
Prereq: [BIOL182 or MB&B182]