Biology

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; Director, WesMASS; Associate Professor, Neuroscience and Behavior; Associate Professor, Integrative Sciences

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
BS, Stanford University; PHD, Harvard University
Professor of Biology; Professor, Environmental Studies; Professor, Integrative Sciences

Joseph David Coolon
BS, Kansas State University; PHD, Kansas State University
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Professor of Biology; Professor, Neuroscience and Behavior

Laverne Melón
BA, Middlebury College; PHD, Purdue University
W. Lafayette
Assistant Professor of Biology

Janice R. Naegele
BA, Mount Holyoke College; PHD, Massachusetts Institute of Technology
Alan M. Dachs Professor of Science; Professor of Biology; Professor, Neuroscience and Behavior

Joyce Ann Powzyk
BS, Principia College; PHD, Duke University
Associate Professor of the Practice in Biology

Michael Singer
BS, University of Southern California; PHD, University of Arizona
Professor of Biology; Professor, Environmental Studies

Sonia Sultan
BA, Princeton University; MA, Harvard University; PHD, Harvard University
Professor of Biology; Professor, Environmental Studies

Michael P. Weir
BS, University of Sussex; PHD, University of Pennsylvania
Professor of Biology; Professor, Integrative Sciences; Co-Coordinator, Informatics and Modeling

VISITING FACULTY

James Paul Mulrooney
PHD, Wesleyan University
Visiting Assistant Professor of Biology

EMERITI

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

David Bodznick
BS, University of Illinois Urbana; MAA, Wesleyan University; PHD, University of Washington
Professor of Biology, Emeritus

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

Laura B. Grabel
BA, Brandeis University; MAA, Wesleyan University; PHD, University of California, San Diego
Lauren B. Dachs Professor of Science and Society, Retired; Professor of Biology, Emeritus; CPE Instructor
undergraduate program
departmental advising experts

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

BIOL140F Classic Studies in Animal Behavior (FYS)
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

BIOL145F Primate Behavior: The Real Monkey Business (FYS)
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: OPT
Credits: 1.00
Gen Ed Area: NSM-BIOL
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 microbiota 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

Identical With: MB&B155

Prereq: None

**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 covers biological principles at tissue, organ, organismic, and population levels of organization. We will review how animals regulate their internal environment to control or adapt to changes in temperature, salt levels, nutrients, levels of oxygen and carbon dioxide, and the presence of infectious agents. We will examine the molecular, cellular, and tissue mechanisms that underlie the hormonal, neuronal, and behavioral processes that underlie these responses. We will learn how these systems develop in the embryo. At the population level, we will review evidence for evolution, including the tenets of Darwin’s theory of evolution by natural selection. We will also discuss the nature and importance of variation among organisms, stochastic processes in evolution, and modern theories of speciation and macroevolution. Finally, the course addresses ecological aspects of population biology, including patterns and processes that inform the distribution and abundance of biodiversity, population growth, organisms' responses to environmental variation, and interactions among species. 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: A-F

Credits: 1.00

Gen Ed Area: NSM-BIOL

Identical With: MB&B182

Prereq: [MB&B181 or BIOL181]

**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

Prereq: None

**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-EEES
Identical With: EES197, ENV197
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 how cells function within the context of the multicellular organism or tissue—an environment that cells regulate as well as respond to. We also focus on the process of scientific discovery in the field of cell biology—how do we know what we know? Hence whilst the textbook will provide background reading, we will also discuss original research in class. We will cover cell and organelle structure and function, trafficking, cell adhesion and motility, proliferation, signal transduction, and cell differentiation, and consider how these processes are integrated to generate coherent cell behaviors, or go awry in disease.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-MBB
Identical With: MB&B212
Prereq: [MB&B181 or BIOL181]

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 MacroEvolution, Pattern and Process
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 origin 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, symbiosis, 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, overharvesting, 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]

BIOL231 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]

BIOL232 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: E&ES240, ENVS226
Prereq: [E&ES197 or BIOL197 or ENVS197] OR [BIOL182 or MB&B182] OR E&ES199

BIOL271 Neurogenetics

Genes are the basic functional units of heredity. This course is an introduction to the study of genes and their role in shaping neuronal structure, neuronal function, and behavior. We will learn about classic and modern approaches used to probe the relationship between genes and behavior, with a focus on studies using model organisms (flies, mice, worms). We will discuss the molecular genetics of neurological disorders with high heritability, the use of genetic tools to treat these conditions, and the ethics surrounding treatment and diagnosis of these disorders. Student assessment will include short written responses, in-class quizzes, and exams.

Offering: Host
Grading: A-F
Biology

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&B229
Prereq: [MB&B181 or BIOL181] AND CHEM251

BIO229 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]

BIO231 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]

BIO232 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
Gen Ed Area: NSM-MBB
Identical With: MB&B232
Prereq: [(MB&B181 or BIOL181) AND (BIOL182 or MB&B182)] OR [MB&B208 or BIOL208]

BIO233 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
Biology

BIO1243 Neurohistology
The aim of this course is to study the microscopic structure of the nervous system. Structural and functional relationships between neurons and glia, as well as the organization of major brain regions (cortex, hippocampus, and cerebellum) will be examined. In addition to traditional histological preparations, modern techniques including confocal microscopy and immunohistochemistry will be studied and performed. Laboratory exercises will include the preparation and visualization of microscopic slides using a variety of techniques. While this course will focus on mammalian nervous system, skills learned in this course will be applicable in a variety of research models.
Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-NSB
Identical With: NS&B243
Prereq: [NS&B213 or BIO1213 or PSYC240] OR [MB&B181 or BIO181]

BIO1245 Cellular Neurophysiology
This neurophysiology course is mostly a study of how neurons send, receive, and integrate the signals that produce nervous system activity. Using the tools of electrophysiology (the electrical recording and manipulation of neurons), we can better understand synaptic plasticity, neuronal oscillations, and network activity. In the last module of the course, students will use their knowledge of a diversity of voltage-gated channels, neurotransmitter systems, and neuron categories to better understand the neurophysiology of epileptic seizures and sensorimotor systems and locomotion. We will also examine articles about human-machine interfaces that are being developed in the diagnosis and treatment of epilepsy as well for the restoration of motor activity and somatosensation.
Offering: Host
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: NS&B245, BIOL599
Prereq: [NS&B213 or BIO1213 or PSYC240]

BIO1247 Laboratory in Neurophysiology
The course is designed to teach techniques and offer independent research experience. Students study living nervous systems and measure the electrical signals at the heart of nervous system function. In the first part, experiments include intracellular recordings of rest and action potentials, synaptic transmission, sensory coding and integration in simple nervous systems. Students learn surgical and electrophysiological recording techniques working with invertebrate and cold-blooded vertebrate animals including crayfish, mollusks (Aplysia), leeches, fish, and amphibians. In the second part of the course, students will use these techniques in novel, independent research projects.
Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: NS&B247
Prereq: ([NS&B213 or BIO1213 or PSYC240] AND [BIO1182 or MB&B182])

BIO1250 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 neuron 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: A-F
Credits: 1.00
Gen Ed Area: None
Prereq: BIO1181 AND BIO1182

BIO1256 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: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: MB&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: 0.50
Gen Ed Area: NSM-BIOL
Identical With: COMP266, MB&B266, 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]

BIOL295 Physiology and Cell Biology of Cancer
This course focuses on the cellular and physiological aspects of cancer, examining the major hallmarks of cancer. Recent advances in cancer treatment are also covered.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: None
Prereq: [MB&B181 or BIOL181] AND (MB&B182 or BIOL182) AND (BIOL212 or BIOL218)

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: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: NS&B299
Prereq: [MB&B213 or BIOL213 or PSYC240]

BIOL310 Genomics Analysis
This course is an introduction to genomics 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: NS&B299
Prereq: [MB&B181 or BIOL181]

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 ENVS220] OR [BIOL290 or BIOL590] OR [BIOL216 or ENVS216]

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
Prereq: BIOL214 OR BIOL218 OR [BIOL210 or MB&B210] OR [BIOL224 or NS&B224]

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
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: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: None
Identical With: MB&B533, MB&B333, BIOL533
Prereq: [MB&B181 or BIOL181] OR [MB&B182 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 to develop 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!

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area: SM-NSB
Identical With: NS&B328
Prereq: [NS&B213 or BIOL213 or PSYC240]

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:  NSM-BIOL
Identical With:  BIO357, ENV337
Prereq:  [BIOL182 or MB&B182]

**BIO340 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:  NSM-BIOL
Identical With:  BIOL540
Prereq:  BIO218 OR BIOL214

**BIO342 Molecules to Medicine**
This course will explore the process of drug development, including target selection, lead discovery using computer-based methods and combinatorial chemistry/high-throughput screening, organic synthesis, bioavailability, clinical trials, and other factors (some economics and politics) involved in bringing a drug to the marketplace. Critical consideration of the variables to contend with at each step will be described and discussed, including aspects of research ethics and patent law. The basic science of molecular recognition, computer-aided drug design, and the role of factors from synthetic chemistry to toxicology will be presented. Case studies of the development of drugs recently successful in making the journey from molecule to medicine will be discussed, as well as the story of some that did not, and why. Emerging new design strategies such as fusion-protein therapies, crisper technology, and enhanced use of rational design and combinatorial methods will be emphasized, and how pharmaceutical research is evolving in the postgenomic era, particularly with biologics. Job opportunities in the pharmaceutical industry will be discussed.

Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area:  NSM-CHEM
Identical With:  CHEM342, CIS342, MB&B342
Prereq:  CHEM252 OR MB&B208

**BIO343 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:  NSM-BIOL
Identical With:  NS&B543, BIO354, NS&B343
Prereq:  [BIOL218 OR (BIOL212 or MB&B182)] 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)]

**BIO345 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
Credits: 1.00
Gen Ed Area:  NSM-BIOL
Identical With:  NS&B345, NS&B545, BIO345

**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
Credits: 1.00
Gen Ed Area:  NSM-BIOL
Identical With:  BIO346, E&ES328, E&ES338, ENV340
Prereq:  [BIOL182 or MB&B182] OR [E&ES197 or BIOL197 or ENV340] OR E&ES199

**BIO347 Mammalian Cortical Circuits**
The mammalian cortex is where conscious perception and thought is generated, but the mechanistic details governing those processes are not well known. Studies of those circuits have revealed a heterogeneity of neuronal classes in the cortex and their proposed roles in these processes. Detailed wiring diagrams of local and long-distance cortical circuits are emerging, colored with dynamic connections that are helping us understand the cortex with these reverse-engineering strategies. Almost all of the readings for this course will be taken from the recent primary literature; areas of the cortex that will be studied include sensory cortex as well as studies of hippocampal cortical circuits.

Offering: Host
Grading: A-F
Credits: 1.00
Gen Ed Area:  NSM-BIOL
Identical With:  NS&B347
Prereq:  BIO1252 OR NS&B252 OR BIO245 OR NS&B245

**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
Credits: 1.00
Gen Ed Area: NSM-NSB
Identical With: NS&B335
Prereq: [NS&B213 or BIOL213 or PSYC240]

BIOL353 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
Credits: 1.00
Gen Ed Area: NSM-NSB
Identical With: NS&B335, PSYC353
Prereq: [NS&B213 or BIOL213 or PSYC240]

BIOL354 Agricultural Food Webs
Ecological communities are structured by feeding interactions, and agricultural systems are no exception to this rule. This course will focus on attributes of food webs that impact agriculture, including topics such as natural biological control of insect pests, 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
Credits: 1.00
Gen Ed Area: NSM-ENVS
Identical With: ENV5353
Prereq: BIOL182 or BIOL197

BIOL356 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, Tourette's, cerebral palsy, and some motor disorders including developmental coordination disorder, stereotypic movement disorder, sensory integration 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
Credits: 1.00
Gen Ed Area: NSM-NSB
Identical With: NS&B360
Prereq: [NS&B213 or BIOL213 or PSYC240]

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

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

BIOL492 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

BIOL496 Research Apprentice, Undergraduate
Project to be arranged in consultation with the tutor.
Offering: Host
Grading: Cr/U

BIOL500 Graduate Pedagogy
The elements of good teaching will be discussed and demonstrated through lectures, practice teaching sessions, and discussions of problems encountered in the actual teaching environment. The staff consists of faculty and experienced graduate students. An integral part of the course is a required one-day workshop BEFORE the first day of formal classes.
Training in pedagogy in the first semester of attendance is required for all incoming Wesleyan MA and PhD students who have not already fulfilled this requirement at Wesleyan. BA/MA students are not required to get training in pedagogy but may choose to do so.
Offering: Crosslisting
Grading: Cr/U
Credits: 0.50
Gen Ed Area: None
Identical With: E&E500, CHEM500, ASTR500, MB&B500, MUSC500, PHYS500, PSYC500, MATH500
Prereq: None

BIOL501 Individual Tutorial for Graduates
Topic to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

BIOL502 Individual Tutorial for Graduates
Topic to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

BIOL503 Selected Topics, Graduate Sciences
Topic to be arranged in consultation with the tutor. A seminar primarily concerned with papers taken from current research publications designed for, and required of, graduate students.
Offering: Host
Grading: OPT

BIOL504 Selected Topics, Graduate Sciences
Topic to be arranged in consultation with the tutor. A seminar primarily concerned with papers taken from current research publications designed for, and required of, graduate students.
Offering: Host
Grading: OPT

BIOL505 Cell and Development Journal Club I
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
**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
Credits: 0.25
Gen Ed Area: None
Prereq: None

**BIOL507 Evolution Journal Club I**
Presentation and active discussion of current research articles in evolutionary biology. Each semester the class will choose one theme within evolutionary biology to be the focus of discussion. Themes from recent semesters have included genome-based evolution studies, coevolution, speciation, phylogenetic approaches for investigating natural selection, the role of competition in evolution, the evolution of host-parasite relationships, the evolution of behavior, and the impact of niche construction on adaptive evolution. Articles for discussion generally come from the journals EVOLUTION, AMERICAN NATURALIST, GENETICS, SCIENCE, and NATURE.
Offering: Host
Grading: OPT
Credits: 0.25
Gen Ed Area: None
Prereq: None

**BIOL508 Evolution Journal Club II**
Presentation and active discussion of current research articles in evolutionary biology. Each semester the class will choose one theme within evolutionary biology to be the focus of discussion. Themes from recent semesters have included coevolution, speciation, phylogenetic approaches for investigating natural selection, the role of competition in evolution, evolution of host-parasite relationships, and the evolution of behavior. Articles for discussion generally come from the journals EVOLUTION, AMERICAN NATURALIST, GENETICS, SCIENCE, and NATURE.
Offering: Host
Grading: OPT
Credits: 0.25
Gen Ed Area: None
Prereq: None

**BIOL509 Neuroscience Journal Club I**
Presentation and discussion of current research articles in the field of neuroscience.
Offering: Host
Grading: Cr/U
Credits: 0.25
Gen Ed Area: None
Prereq: None

**BIOL510 Neurosciences Journal Club II**
Presentation and discussion of current research articles in the field of neuroscience.
Offering: Host
Grading: Cr/U
Credits: 0.25
Gen Ed Area: None
Prereq: None

**BIOL511 Group Tutorial, Graduate**
Topic to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

**BIOL512 Group Tutorial, Graduate**
Topic to be arranged in consultation with the tutor.
Offering: Host
Grading: OPT

**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&E5270, E&E5570, ENVS320
Prereq: None

**BIOLS27 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 MBB182] OR [BIOL196 or MB&B196] OR COMP112 OR
COMP211

**BIOLS33 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: MBB533, MB&B333, BIOL333
Prereq: [BIOL182 or MBB182]

**BIOLS37 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
Identical With: BIOL337, ENVS337
Prereq: [BIOL182 or MBB182]

**BIOLS40 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: BIOL218 OR BIOL214

**BIOLS43 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&B343, NS&B343
Prereq: BIOL218 OR ([BIOL182 or MBB182] AND [BIOL212 or MBB212]) OR
([BIOL182 or MBB182] AND [NS&B213 or BIOL213 or PSYC240]) OR ([BIOL196
or MBB196] AND [BIOL212 or MBB212]) OR ([BIOL196 or MBB196] AND
[NS&B213 or BIOL213 or PSYC240])

**BIOLS45 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
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
transitions in evolution.
Offering: Crosslisting
Grading: A-F
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: BIOL343, NS&B543, NS&B343
Prereq: BIOL218 OR ([BIOL182 or MBB182] AND [BIOL212 or MBB212]) OR
([BIOL182 or MBB182] AND [NS&B213 or BIOL213 or PSYC240]) OR ([BIOL196
or MBB196] AND [BIOL212 or MBB212]) OR ([BIOL196 or MBB196] AND
[NS&B213 or BIOL213 or PSYC240])
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: BIOL345, NS&B345, NS&B545

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

BIOL571 Teaching: Techniques and Theory
This course will help teaching assistants working with the Principles of Biology labs prepare to teach weekly lab sessions. Students will obtain hands-on experience with various techniques in the areas of molecular and cell biology. In addition, best teaching practices will be discussed and students will share their teaching experiences with each other.
This course may be repeated up to two times for credit.
Offering: Crosslisting
Grading: Cr/U
Credits: 0.25
Gen Ed Area: None
Identical With: MB&B571
Prereq: None

BIOL572 Teaching: Techniques and Theory
The course will help teaching assistants working with the Principles of Biology labs prepare to teach weekly lab sessions. Students will obtain hands-on experience with various techniques in the areas of anatomy and physiology, evolution, and ecology. In addition, best teaching practices will be discussed, and students will share their teaching experiences with each other.

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: 1.00
Gen Ed Area: NSM-BIOL
Identical With: BIOL290
Prereq: [BIOL182 or MB&B182]

BIOL599 Cellular Neurophysiology
This neurophysiology course is mostly a study of how neurons send, receive, and integrate the signals that produce nervous system activity. Using the tools of electrophysiology (the electrical recording and manipulation of neurons), we can better understand synaptic plasticity, neuronal oscillations, and network activity. In the last module of the course, students will use their knowledge of a diversity of voltage-gated channels, neurotransmitter systems, and neuron categories to better understand the neurophysiology of epileptic seizures and sensorimotor systems and locomotion. We will also examine articles about human-machine interfaces that are being developed in the diagnosis and treatment of epilepsy as well for the restoration of motor activity and somatosensation.
Offering: Crosslisting
Grading: OPT
Credits: 1.00
Gen Ed Area: NSM-BIOL
Identical With: BIOL245, NS&B245
Prereq: [NS&B213 or BIOL213 or PSYC240]