BOWDOIN BIOLOGY COURSES (Updated Spring 2022)

This guide is designed to help you explore the Biology curriculum by describing courses the Bowdoin Biology Department offers. It includes:

- Course descriptions
- Instructor names
- Frequency
- Enrollment limits

Although many classes are offered on a regular basis (every fall or every spring, every other fall or spring), ***faculty leaves and other considerations may impact course offerings in particular years. For long-term planning, consult Biology faculty about likely timing of future course offerings.***

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First-year seminars

BIOL 1023 (a) Personal Genomes

Jack Bateman
Non-Standard Rotation. Enrollment limit: 16.

An introduction to the field of genetics and its impact on the modern world. As the cost of DNA sequence analysis plummets, many believe that sequencing entire genomes of individuals will soon become part of routine preventative health care. How can information gleaned from genome affect decisions about health? Beyond medical applications, how might personal genetic information be used in other areas of life, and society as a whole? What ethical, legal, and social issues are raised by widespread use of genetic information? These questions are explored through readings, discussion, and writing assignments.

BIOL 1026 (a) Approaches to Neuroscience

Hadley Horch
Non-Standard Rotation. Enrollment limit: 16.

Students will be introduced to the basics of neurobiology, and begin to understand the challenges inherent to studying the brain. Topics will include basic neuronal function, animal behavior, mutations and mental illness, drugs and addiction, neuroethics, and consciousness. Readings from journal articles, websites, and popular press science books will be used. Critical thinking skills will be practiced through several writing assignments as well as in-class discussions and debates.

BIOL 1027 (a, FYS) Evolutionary Links

William Jackman
Non-Standard Rotation. Enrollment limit: 16.

Seminar exploring our deep evolutionary history from the first multicellular animals to Homo sapiens. Emphasizes the living and fossil species that illustrate important transitions that resulted in the evolution of new anatomical features, physiology, and behavior. Includes an embryo observation unit with data collection and analysis. Readings from online media, popular science books, and primary scientific articles. Frequent writing with an emphasis on styles used in modern biology.

Courses with no pre-requisites that meet the Inquiry in the Natural Sciences requirement

BIOL 1056 (a, INS) Ecology and Society
Vladimir Douhovnikoff.
Non-Standard Rotation. Enrollment limit: 50.

Presents an overview of ecology covering basic ecological principles and the relationship between human activity and the ecosystems that support us. Examines how ecological processes, both biotic (living) and abiotic (non-living), influence the life history of individuals, populations, communities, and ecosystems. Encourages student investigation of environmental interactions and how human-influenced disturbance is shaping the environment. Required field trips illustrate the use of ecological concepts as tools for interpreting local natural history. (Same as: ENVS 1056)

BIOL 1060 (a, INS, MCSR) Prove It!: The Power of Data to Address Questions You Care About
Mary Rogalski
Non-Standard Rotation. Enrollment limit: 24.

Climate change, biodiversity loss, pollution, and other environmental issues present significant threats to ecological integrity, human health, and social justice. An overwhelming amount of information exists on these topics, from a variety of perspectives—some reliable, some not. Strategies are required for processing this information and drawing conclusions. Students develop skills in accessing reliable information, data analysis and interpretation, as well as science communication. In small groups, students implement these skills exploring a research question of interest using data available online. Additional sessions provide time for group research and discussion. (Same as: ENVS 1060)

BIOL 1066 (a, INS) The Molecules of Life
Bruce Kohorn
Every Other Spring. Enrollment limit: 50.

An exploration of the basic molecules of life. Starting with DNA we will explore how cells use and pass on this stored information to produce a variety of products used to form cells and organisms. This basic science will be related to every-day examples of biology, health, agriculture, and social issues arising from these applications; genetic modification for health and food production, drug and vaccine development, C02 and our warming the planet. Hands-on experience with DNA, protein, lipids and complex carbohydrates will be included in the regular class meeting time. The class will be a combination of lecture, discussion and exploration in a lab setting and outdoors.

BIOL 1090 (a, INS) Understanding Climate Change
David Carlon
Every Spring. Enrollment limit: 20.

Why is the global climate changing and how will biological systems respond? Includes sections on climate systems and climate change, reconstructing ancient climates and past biological responses, predicting future climates and biological responses, climate policy, the energy crisis, and potential solutions. Incorporates a few field trips and laboratories designed to illustrate approaches to climate change science at the cellular, physiological, and ecological levels. (Same as: ENVS 1090)

BIOL 1099 (a, INS) Brains in Motion: Exploring the Interface between Mind and Body
Manuel Diaz-Rios.
Every Fall. Enrollment limit: 24.

This course is an introductory exploration of the nervous system as it relates to bodily functions. It explores neurons as the basic building blocks of brain and behavior. Through lectures and classroom experiments, students would learn how electrochemical nerve signals control body movement, cardiovascular function, reflexes, and brain activity. Further, students explore how the nervous system can interact with machine interfaces, including prosthetics. (Same as: NEUR 1099)

Introductory Biology courses (Biology Placement test required for registration)

BIOL 1101 (a, INS, MCSR) Biological Principles I

Every Fall. Enrollment limit: 35.

The first in a two-semester introductory biology sequence. Topics include fundamental principles of cellular and molecular biology with an emphasis on providing a problem-solving approach to an understanding of genes, RNA, proteins, and cell structure and communication. Focuses on developing quantitative skills, as well as critical thinking and problem solving skills. Lecture and weekly laboratory/discussion groups. To ensure proper placement, students must take the biology placement examination and must be recommended for placement in Biology 1101. Students continuing in biology will take Biology 1102 , not Biology 1109 , as their next biology course.

Prerequisites: Placement in BIOL 1101.

BIOL 1102 (a, INS, MCSR) Biological Principles II

Every Spring. Enrollment limit: 35.

The second in a two-semester introductory biology sequence. Emphasizes fundamental biological principles extending from the physiological to the ecosystem level of living organisms. Topics include physiology, ecology, and evolutionary biology, with a focus on developing quantitative skills as well as critical thinking and problem solving skills. Lecture and weekly laboratory/discussion groups.

Prerequisites: BIOL 1101.

BIOL 1109 (a, INS, MCSR) Scientific Reasoning in Biology

Every Semester. Enrollment limit: 40.

Lectures examine fundamental biological principles, from the sub-cellular to the ecosystem level with an emphasis on critical thinking and the scientific method. Laboratory sessions will help develop a deeper understanding of the techniques and methods used in the biological science by requiring students to design and conduct their own experiments. Lecture and weekly laboratory/discussion groups. To ensure proper placement, students must take the biology placement examination and must be recommended for placement in Biology 1109.

Prerequisites: Placement in BIOL 1109.

1100-level elective courses

BIOL 1158 (a, INS, MCSR) Perspectives in Environmental Science
Environmental Studies Science faculty
Every Spring. Spring 2022. Enrollment limit: 35.

Understanding environmental challenges requires scientific knowledge about the different spheres of the Earth -- land, water, air, and life -- and how they interact. Presents integrated perspectives across the fields of biology, chemistry, and earth and oceanographic science to examine the scientific basis for environmental change from the molecular to the global level. Foundational principles are developed to address major course themes, including climate change, energy, soil/air/water pollution, chemical exposure and risk, land use change, and biodiversity loss. Laboratory sessions consist of local field trips, laboratory experiments, group research, case study exercises, and discussions of current and classic scientific literature. (Same as: ENVS 2201, CHEM 1105)

Prerequisites: BIOL 1101 or BIOL 1109 or CHEM 1091 - 2260 or PHYS 1130 or PHYS 1140 or EOS 1105 or EOS 1305 (same as ENVS 1104) or EOS 1505 (same as ENVS 1102) or EOS 2005 (same as ENVS 2221) or EOS 2115 or EOS 2335 or EOS 2345 (same as ENVS 2270) or EOS 2365 or EOS 2525 (same as ENVS 2251) or EOS 2535 or EOS 2585 (same as ENVS 2282) or ENVS 1101.

BIOL 1174 (a, MCSR) Biomathematics
Mary Lou Zeeman
Every Fall. Enrollment limit: 30.

A study of mathematical modeling in biology, with a focus on translating back and forth between biological questions and their mathematical representation. Biological questions are drawn from a broad range of topics, including disease, ecology, genetics, population dynamics, and neurobiology. Mathematical methods include discrete and continuous (ODE) models and simulation, box models, linearization, stability analysis, attractors, oscillations, limiting behavior, feedback, and multiple time-scales. Within the biology major, this course may count as the mathematics credit or as biology credit, but not both. Students are expected to have taken a year of high school or college biology prior to this course. (Same as: MATH 1808)

Prerequisites: MATH 1600 or higher or Placement in MATH 1700 (M) or Placement in MATH 1750 (M) or Placement in MATH 1800 (M) or Placement in 2000, 2020, 2206 (M) or Placement in MATH 2020 or 2206(M).

“Core” biology courses with labs

Molecular and Cellular-level biology core courses

BIOL 2112 (a, INS, MCSR) Genetics and Molecular Biology

Jack Bateman
Every Spring. Enrollment limit: 35.

Integrated coverage of organismic and molecular levels of genetic systems. Topics include modes of inheritance, the structure and function of chromosomes, the mechanisms and control of gene expression, recombination, mutagenesis, techniques of molecular biology, and human genetic variation. Laboratory sessions are scheduled.

Prerequisites: BIOL 1102 or BIOL 1109 or Placement in BIOL 2000 level.

BIOL 2118 (a, INS) Microbiology

Anne McBride
Every Spring. Enrollment limit: 35.

An examination of the structure and function of microorganisms, from viruses to bacteria to fungi, with an emphasis on molecular descriptions. Subjects covered include microbial structure, metabolism, and genetics. Control of microorganisms and environmental interactions are also discussed. Laboratory sessions every week.

Prerequisites: BIOL 1102 or BIOL 1109 or Placement in BIOL 2000 level.
Previous terms offered: Spring 2021, Spring 2020, Spring 2019, Spring 2018.

BIOL 2124 (a, INS, MCSR) Biochemistry and Cell Biology

Bruce Kohorn
Every Fall. Enrollment limit: 35.

Focuses on the structure and function of cells as we have come to know them through the interpretation of direct observations and experimental results. Emphasis is on the scientific (thought) processes that have allowed us to understand what we know today, emphasizing the use of genetic, biochemical, and optical analysis to understand fundamental biological processes. Covers details of the organization and expression of genetic information, and the biosynthesis, sorting, and function of cellular components within the cell. Concludes with examples of how cells perceive signals from other cells within cell populations, tissues, organisms, and the environment. Three hours of lab each week. Not open to students who have credit for Biology 2423. (Same as: BIOC 2124)

Prerequisites: BIOL 1102 or BIOL 1109 or Placement in BIOL 2000 level.
Previous terms offered: Fall 2021, Fall 2020, Fall 2019, Fall 2018.

Molecular, Cellular, Physiology and Organismal-level biology core courses

BIOL 2135 (a, INS, MCSR) Neurobiology

Hadley Horch
Every Fall. Enrollment limit: 35.

Examines fundamental concepts in neurobiology from the molecular to the systems level. Topics include neuronal communication, gene regulation, morphology, neuronal development, axon guidance, mechanisms of neuronal plasticity, sensory systems, and the molecular basis of behavior and disease. Weekly lab sessions introduce a wide range of methods used to examine neurons and neuronal systems. (Same as: NEUR 2135)

Prerequisites: BIOL 1102 or BIOL 1109 or Placement in BIOL 2000 level.

BIOL 2175 (a, INS, MCSR) Developmental Biology

William Jackman
Every Fall. Enrollment limit: 35.

An examination of current concepts of embryonic development, with an emphasis on experimental design. Topics include cell fate specification, morphogenetic movements, cell signaling, differential gene expression and regulation, organogenesis, and the evolutionary context of model systems. Project-oriented laboratory work emphasizes experimental methods. Lectures and three hours of laboratory per week.

Prerequisites: BIOL 1102 or BIOL 1109 or Placement in BIOL 2000 level.

Physiology and Organismal-level biology core courses

BIOL 2210 (a, INS, MCSR) Plant Ecophysiology

Barry Logan
Every Spring. Enrollment limit: 35.

Examines the functional attributes of plants and the manner in which they vary across the plant kingdom by the processes of evolution and acclimation. Topics of focus include photosynthesis and protection again high-light stress, the acquisition and distribution of water and mineral nutrients, and environmental and hormonal control of development. Special topics discussed may include plant parasitism, carnivory, the origins and present state of agriculture, plant responses to global climate change, plant life in extreme environments, and the impacts of local land-use history on plant communities. Contemporary research instrumentation is used in weekly laboratories, some conducted in the field, to enable first-hand exploration of phenomena discussed in lecture. (Same as: ENVS 2223)

Prerequisites: BIOL 1102 or BIOL 1109 or Placement in BIOL 2000 level.

BIOL 2214 (a, INS, MCSR) Comparative Animal and Human Physiology

Daniel Powell
Every Spring. Enrollment limit: 35.

An examination of animal function, from the cellular to the organismal level. The underlying concepts are emphasized, as are the experimental data that support current understanding of animal function. Topics include the nervous system, hormones, respiration, circulation, osmoregulation, digestion, and thermoregulation. Labs are short, student-designed projects involving a variety of instrumentation. Lectures and four hours of laboratory work per week.

Prerequisites: BIOL 1102 or BIOL 1109 or Placement in BIOL 2000 level.

Ecology and Evolution core courses

BIOL 2232 (a, INS, MCSR) Benthic Ecology

See Bowdoin Marine Science Semester courses

BIOL 2316 (a, INS, MCSR) Evolution

Michael F Palopoli.
Every Spring. Enrollment limit: 35.

Examines one of the most breathtaking ideas in the history of science -- that all life on this planet descended from a common ancestor. An understanding of evolution illuminates every subject in biology, from molecular biology to ecology. Provides a broad overview of evolutionary ideas, including the modern theory of evolution by natural selection, evolution of sexual reproduction, patterns of speciation and macro-evolutionary change, evolution of sexual dimorphisms, selfish genetic elements, and kin selection. Laboratory sessions are devoted to semester-long, independent research projects.

Prerequisites: BIOL 1102 or BIOL 1109 or Placement in BIOL 2000 level.

BIOL 2319 (a, INS, MCSR) Biology of Marine Organisms

Amy Johnson.
Every Fall. Enrollment limit: 35.

The study of the biology and ecology of marine mammals, seabirds, fish, intertidal and subtidal invertebrates, algae, and plankton. Also considers the biogeographic consequences of global and local ocean currents on the evolution and ecology of marine organisms. Laboratories, field trips, and research projects emphasize natural history, functional morphology, and ecology. Lectures and four hours of laboratory or field trip per week. One weekend field trip included. Students have the opportunity to take an optional field trip to the Bowdoin Scientific Station on Kent Island in the Bay of Fundy. (Same as: ENVS 2229)

Prerequisites: BIOL 1102 or BIOL 1109 or Placement in BIOL 2000 level.

BIOL 2327 (a, INS) Ecology
Patricia Jones/Mary Rogalski
Every Fall. Enrollment limit: 35.

Ecology, the study of how organisms interact with each other and their environment, incorporates topics from how organisms cope with environmental stressors to global carbon cycling. Addresses current questions in ecology, from global change to food security to invasive species. Lectures, labs, primary and popular literature emphasize how scientists use the tenets of ecology to address current environmental issues. Labs, discussions and activities focus on practical applications of ecological theory, scientific writing and data analysis on topics such as plant-insect interactions, amphibian decline, river restoration and natural history. (Same as: ENVS 2227)

Prerequisites: BIOL 1102 or BIOL 1109 or ENVS 2201 (same as BIOL 1158 and CHEM 1105) or Placement in BIOL 2000 level.

Additional 2000-level elective courses

BIOL 2284 (a) Ecology of Rivers
Vladimir Douhovnikoff.
Every Other Fall. Enrollment limit: 12.

Explores the ecology of river systems. Rivers are linear features through watersheds and across the landscape where ecosystem influences are reflected, focused, and transported from hilltops to coastal estuaries, and sometimes back again. Considers the role of rivers as corridors connecting a wide range of ecosystems, as indicators of broader landscape ecology, and as ecosystems in their own right with particular focus on the interaction of geomorphology, hydrology, and biology in the development and function of these dynamic and essential ecosystems. (Same as: ENVS 2284)

Prerequisites: BIOL 2315 (same as ENVS 2224) or BIOL 2316 or BIOL 2319 (same as ENVS 2229) or BIOL 2325(same as ENVS 2225) or BIOL 2330 (same as ENVS 2233).

BIOL 2423 (a, INS) Biochemistry of Cellular Processes
Jake Muscato
Every Spring. Enrollment limit: 35.

Explores the biochemical mechanisms that underlie the basis of life. Starts with the chemistry of proteins, DNA, lipids, and carbohydrates to build the main elements of a cell. Moves on to the process of gene organization and expression, emphasizing the biochemical mechanisms that regulate these events. Explores next the organization of the cell with emphasis on genetic and biochemical regulation. Concludes with specific examples of multicellular interactions, including development, cancer, and perception of the environment. This course does NOT satisfy a requirement for the biochemistry major and is not open to students who have credit for Biology 2124. Students who intend to enroll in Biology 2124 should not register for Biology 2423. (Same as: BIOC 2423)

Prerequisites: Two of: either BIOL 1102 or BIOL 1109 or BIOL 2100 or higher and CHEM 1092 or either CHEM 1102 or CHEM 1109 or CHEM 2250.

Bowdoin Marine Science Semester courses

The Bowdoin Marine Science Semester (BMSS) is a fall semester intensive immersion experience in marine field work, lab work, and independent research. Students in the program enroll in four modular courses including the three courses described below.

BIOL 2232 (a, INS, MCSR) Benthic Ecology
Every Fall. Enrollment limit: 12.

The principles of ecology emphasizing the hard- and soft-bottom communities of Casco Bay and Harpswell Sound. Field trips and field exercises demonstrate the quantitative principles of marine ecological research, including good practices in sampling designs and field experiments. A class field project designs and implements a long-term study, based at the Bowdoin Marine Laboratory, to monitor and detect changes in community structure driven by climate change in the twenty-first century. Assumes a basic knowledge of biological statistics. Taught in residence at the Schiller Coastal Studies Center. Benthic Ecology is a course module in the Bowdoin Marine Science Semester and is taught with three other co-requisite courses. (Same as: ENVS 2232)

Prerequisites: Two of: either BIOL 1102 or BIOL 1109 and MATH 1000 or higher.

BIOL 2503 (a, INS, MCSR) Methods in Ocean Change Ecology
Every Fall. Enrollment limit: 12.

Explores how marine organisms, populations, communities, and ecosystems will respond to global ocean change. Concepts in ecology, behavior, physiology, and evolution will be highlighted to demonstrate how marine systems are affected by ocean change factors like warming, ocean acidification, hypoxia, habitat loss, and invasive species. Emphasizes in-depth discussion of key literature to exemplify the theory, study design, and analysis tools marine scientists employ to research current and projected ocean change. Also integrates laboratory, fieldwork, and computer activities to illustrate approaches to monitoring and predicting shifts in biological communities. Taught in residence at the Schiller Coastal Studies Center. Biology 2503/Environmental Studies 2235 is a course-module in the Bowdoin Marine Science Semester. Biology 2232 (same as Environmental Studies 2232), Biology 3117 (same as Environmental Studies 2217), and History 2129 (same as Environmental Studies 2449) are co-requisites of this course. (Same as: ENVS 2235)

Prerequisites: Two of: either BIOL 1102 or BIOL 1109 and MATH 1000 or higher.

BIOL 3117 (a, INS, MCSR) Current Topics and Research in Marine Science
Every Fall. Enrollment limit: 12.

Current Topics and Research in Marine Science is an experiential research course in which students design and carry out an individual semester long research project. In an advanced seminar setting, students choose topics and learn to (1) search for information in the scientific literature; (2) evaluate the utility of papers to their research topic; (3) identify gaps in existing understanding; (4) formulate hypothesis-driven research questions; and (5) utilize the R programming environment for analysis and presentation of scientific data. Ultimately, students design and carry out a research project that includes integration of their understanding of the scientific literature. Students present their results in a final oral presentation and written paper. Taught in residence at the Schiller Coastal Studies Center. Biology 3117/Environmental Studies 2217 is a course-module in the Bowdoin Marine Science Semester. Biology 2232 (same as Environmental Studies 2232), Biology 2503 (same as Environmental Studies 2235), and History 2129 (same as Environmental Studies 2449) are co-requisites of this course. (Same as: ENVS 2217)

Prerequisites: Two of: either BIOL 1102 or BIOL 1109 and MATH 1000 or higher.

Advanced elective courses

BIOL 2503 (a, INS, MCSR) Methods in Ocean Change Ecology
See Bowdoin Marine Science Semester

BIOL 2510 (a, INS) Neuropharmacology
Manuel Diaz-Rios
Every Spring. Enrollment limit: 24.

This course will discuss drug-induced changes in the functioning of the nervous system. The specific focus will be to provide a description of the cellular and molecular actions of drugs (natural or artificial) on the communication between neurons (known as synaptic transmission) and on the production of behaviors such as walking, breathing, heart function, and learning/memory, among others. This course will also refer to specific diseases of the nervous system and their treatment, in addition to giving an overview of the techniques used for the study of neuropharmacology. (Same as: NEUR 2510)

Prerequisites: Two of: either BIOL 1102 or BIOL 1109 and either BIOL 2135 (same as NEUR 2135) or BIOL 2214 (same as NEUR 2214) or PSYC 2050 (same as NEUR 2050).

BIOL 2553 (a, INS) Neurophysiology
Daniel Powell
Every Fall. Enrollment limit: 20.

A comparative study of the function of the nervous system in invertebrate and vertebrate animals. Topics include the mechanism that underlie both action potentials and patterns of spontaneous activity in individual nerve cells, interactions between neurons, and the organization of neurons into larger functional units. Lectures and four hours of laboratory work per week. (Same as: NEUR 2553)

Prerequisites: Two of: either BIOL 1102 or BIOL 1109 and either BIOL 2135 or BIOL 2214 or PSYC 2050.

BIOL 2557 (a, INS) Immunology
Stephanie Richards/Anne McBride
Non-Standard Rotation. Enrollment limit: 35.

Covers the development of the immune response, the cell biology of the immune system, the nature of antigens, antibodies, B and T cells, and the complement system. The nature of natural immunity, transplantation immunology, and tumor immunology also considered.

Prerequisites: BIOL 2112 or BIOL 2118 or BIOL 2124 (same as BIOC 2124) or BIOL 2175.

BIOL 2566 (a, INS) Molecular Neurobiology
Hadley Horch
Every Spring. Enrollment limit: 24.

Examination of the molecular control of neuronal structure and function. Topics include the molecular basis of neuronal excitability, the factors involved in chemical and contact-mediated neuronal communication, and the complex molecular control of developing and regenerating nervous systems. Laboratory sessions are devoted to exploring the molecular basis of compensatory plasticity in the cricket auditory system. (Same as: NEUR 2566)

Prerequisites: Two of: either BIOL 1102 or BIOL 1109 or Placement in BIOL 2000 level and either BIOL 2112 or BIOL 2124 (same as BIOC 2124) or BIOL 2135 (same as NEUR 2135) or BIOL 2553 (same as NEUR 2553) or PSYC 2050 (same as NEUR 2050).

BIOL 2581 (a, INS) Forest Ecology and Conservation
Vladimir Douhovnikoff
Every Other Fall. Enrollment limit: 15.

An examination of how forest ecology and the principles of silviculture inform forest ecosystem restoration and conservation. Explores ecological dynamics of forest ecosystems, the science of managing forests for tree growth and other goals, natural history and historic use of forest resources, and the state of forests today, as well as challenges and opportunities in forest restoration and conservation. Consists of lecture, discussions, field trips, and guest seminars by professionals working in the field. (Same as: ENVS 2281)

3000-level seminar courses

BIOL 3117 (a, INS, MCSR) Current Topics and Research in Marine Science

See Bowdoin Marine Science Semester

BIOL 3280 (a, INS) Plant Responses to the Environment

Barry Logan
Non-Standard Rotation. Enrollment limit: 16.

Plants can be found growing under remarkably stressful conditions. Even your own backyard poses challenges to plant growth and reproduction. Survival is possible only because of a diverse suite of elegant physiological and morphological adaptations. The physiological ecology of plants from extreme habitats (e.g., tundra, desert, hypersaline) is discussed, along with the responses of plants to environmental factors such as light and temperature. Readings from the primary literature facilitate class discussion. Excursions into the field and laboratory exercises complement class material. (Same as: ENVS 3280)

Prerequisites: BIOL 2210 (same as ENVS 2223) or BIOL 2325 (same as ENVS 2225).

BIOL 3304 (a, INS) The RNA World

Anne McBride.
Non-standard rotation. Enrollment limit: 15.

Seminar exploring the numerous roles of ribonucleic acid, from the discovery of RNA as a cellular messenger to the development of RNAs to treat disease. Topics also include RNA enzymes, interactions of RNA viruses with host cells, RNA tools in biotechnology, and RNA as a potential origin of life. Focuses on discussions of papers from the primary literature.

Prerequisites: BIOL 2112 or BIOL 2118 or BIOL 2124 (same as BIOC 2124) or BIOL 2423 (same as BIOC 2423) or CHEM 2320 (same as BIOC 2320).

BIOL 3307 (a, INS) Evolutionary Developmental Biology

William R Jackman
Every Spring. Enrollment limit: 15.

Advanced seminar investigating the synergistic but complex interface between the fields of developmental and evolutionary biology. Topics include the evolution of novel structures, developmental constraints to evolution, evolution of developmental gene regulation, and the generation of variation. Readings and discussions from the primary scientific literature.

Prerequisites: BIOL 2175 or BIOL 2316.

BIOL 3308 (a, INS) Research in Ecology, Evolution, and Marine Biology
Patricia Jones/David Carlon
Every Spring. Enrollment limit: 16.

Focuses on research methods in field biology, reading the primary literature, and training in scientific writing and presentation, careers in ecology, and next steps to pursuing those careers. Prepares students for productive future research experiences in areas of ecology, marine biology, animal behavior, and evolution. Students will focus on a research topic of their interest, for which they will read the primary literature, design experiments, produce a draft of a scientific paper, deepen their understanding of statistics and present their proposed research. Includes field excursions to marine and terrestrial environments. (Same as: ENVS 3308)

Prerequisites: Two of: either BIOL 1102 or BIOL 1109 and either BIOL 2315 (same as ENVS 2224) or BIOL 2316 or BIOL 2319 (same as ENVS 2229) or BIOL 2325 (same as ENVS 2225) or BIOL 2330 (same as ENVS 2233) or BIOL 2210 (same as ENVS 2223) or BIOL 2327 (same as ENVS 2227).

BIOL 3309 (a, INS) Ecotoxicology: Pollution Impacts on Ecosystems and Human Health
Mary Rogalski
Every Other Spring. Enrollment limit: 15.

Chemical exposure can strongly impact both ecological communities and human health, often in complex and unexpected ways, yet limited data and scientific uncertainty make pollution regulation challenging. Examines pollution impacts on biological systems, from the organism to the ecosystem scale, with a focus on emerging research areas, including evolutionary ecotoxicology and the potential synergy of multiple environmental stressors. Investigates how society might use available toxicological data to protect ecological integrity and human health. Guest visitors explore political, historical, and social justice aspects, providing an interdisciplinary lens. Reading–, writing–, and discussion-focused seminar (Same as: ENVS 3930)

Prerequisites: BIOL 2000 - 2969 or CHEM 2000 - 2969 or EOS 2000 - 2969 or ENVS 2201 (same as BIOL 1158 and CHEM 1105).

BIOL 3311 (a) Motor Systems Neurobiology
Manuel Diaz-Rios.
Non-Standard Rotation. Enrollment limit: 16.

In this course you will learn about the main animal models used in the study of how the nervous system controls motor behavior as animals, including humans, interact with the environment. The course will cover the principal motor systems (including those for walking, flying, swimming, breathing, and others), focusing in particular on bridging the gap between molecular/cellular neuroscience and higher-level perception and behavior. Topics to be covered include neuroanatomy, neurophysiology and functions of the most studied animal behaviors, and the groups of interconnected neurons (termed neural circuits) that control them. Students will read, interpret, analyze, and discuss seminal (classical) and recent scientific papers from influential motor systems neurobiology laboratories. The course will also discuss the relevance of these neuronal motor systems to human diseases. (Same as: NEUR 3311)

Prerequisites: BIOL 2112 or BIOL 2124 (same as BIOC 2124) or BIOL 2135 (same as NEUR 2135) or BIOL 2175 or BIOL 2553 (same as NEUR 2553) or BIOL 2566 (same as NEUR 2566) or PSYC 2750 (same as NEUR 2750) or PSYC 2751.

BIOL 3314 (a, INS) Advanced Genetics and Epigenetics
Jack Bateman
Every Fall. Enrollment limit: 15.

A seminar exploring the complex relationship between genotype and phenotype, with an emphasis on emerging studies of lesser-known mechanisms of inheritance and gene regulation. Topics include dosage compensation, parental imprinting, paramutation, random monoallelic expression, gene regulation by small RNAs, DNA elimination, copy number polymorphism, and prions. Reading and discussion of articles from the primary literature.

Prerequisites: BIOL 2112.

BIOL 3317 (a, INS) Molecular Evolution
Michael Palopoli.
Every Fall. Enrollment limit: 15.

Examines the dynamics of evolutionary change at the molecular level. Topics include neutral theory of molecular evolution, rates and patterns of change in nucleotide sequences and proteins, molecular phylogenetics, and genome evolution. Students read and discuss papers from the scientific literature.

Prerequisites: BIOL 2112 or BIOL 2118 or BIOL 2124 or BIOL 2175 or BIOL 2316.

BIOL 3325 (a, INS) Topics in Neuroscience
Daniel Powell
Every Spring. Enrollment limit: 15.

An advanced seminar focusing on one or more aspects of neuroscience, such as neuronal regeneration and development, modulation of neuronal activity, or the neural basis of behavior. Students read and discuss original papers from the literature. (Same as: NEUR 3325)

Prerequisites: BIOL 2135 (same as NEUR 2135) or BIOL 2553 (same as NEUR 2553) or BIOL 2566 (same as NEUR 2566) or BIOL 2588 (same as NEUR 2588) or PSYC 2750 (same as NEUR 2750)- 2751 or PSYC 2775(same as NEUR 2775).

BIOL 3329 (a, INS) Neuronal Regeneration
Hadley Horch.
Every Fall. Enrollment limit: 15.

The consequences of neuronal damage in humans, especially in the brain and spinal cord, are frequently devastating and permanent. Invertebrates, on the other hand, are often capable of complete functional regeneration. Examines the varied responses to neuronal injury in a range of species. Topics include neuronal regeneration in planaria, insects, amphibians, and mammals. Students read and discuss original papers from the literature in an attempt to understand the basis of the radically different regenerative responses mounted by a variety of neuronal systems. (Same as: NEUR 3329)

Prerequisites: BIOL 2112 or BIOL 2124 or BIOL 2135 or BIOL 2175 or BIOL 2553 or BIOL 2566 or PSYC 2750 or PSYC 2751.

BIOL 3333 (a, INS) Advanced Cell and Molecular Biology
Bruce Kohorn.
Every Spring. Enrollment limit: 15.

An exploration of the multiple ways cells have evolved to transmit signals from their external environment to cause alterations in cell architecture, physiology, and gene expression. Examples are drawn from both single-cell and multi-cellular organisms, including bacteria, fungi, algae, land plants, insects, worms, and mammals. Emphasis is on the primary literature, with directed discussion and some background introductory remarks for each class.

Prerequisites: BIOL 2124 or CHEM 2310 or BIOL 2423.

BIOL 3381 (a) Ecological Genetics
Vladimir Douhovnikoff
Non-Standard Rotation. Enrollment limit: 15.

Covers the principles of population and quantitative genetics from an ecological perspective. Focuses on key concepts in the evolution of natural and managed populations, including subjects such as the heritability of ecologically important traits, inbreeding effects, and random genetic drift. Discusses various field and lab methods using genetic information in the study of ecology.

Prerequisites: BIOL 2000 - 2999.

BIOL 3554 (a, INS, MCSR) Biomechanics
Amy Johnson
Non-Standard Rotation. Enrollment limit: 15.

Examines the quantitative and qualitative characterization of organismal morphology and explores the relationship of morphology to measurable components of an organism's mechanical, hydrodynamic and ecological environment. Students read, interpret, analyze, and discuss scientific papers. Discussions, lectures, problem sets, and a final literature-based paper emphasize (1) the analysis of morphology, including analyses of the shape of individual organisms, different modes of locomotion, and the mechanical and molecular organization of the tissues; (2) characterization of water flow associated with organisms; and (3) analyses of the ecological and mechanical consequences to organisms of their interaction with their environment.

Prerequisites: BIOL 1102 or BIOL 1109 or BIOL 2100 or higher or CHEM 1100 or higher or EOS 1100 or higher or MATH 1100 or higher or PHYS 1100 or higher.

Independent Study and Honors in Biology

Three levels of courses focus on conducting independent research in Biology for credit during the academic year. These courses require a time commitment of at least 12 hours per week and count as one of four courses in a semester towards the 32 credits for graduation. It does not fulfill any Biology major requirements.

Enrolling in one of these courses requires:

- Considering what topic(s) you are interested in exploring
- Contacting potential faculty mentors (usually faculty with related interests) to determine availability
- Discussing possible research projects and expectations (including time commitments and scheduling constraints)

BIOL 2900-level: Intermediate Independent or Collaborative Study in Biology

These courses usually focus on a "directed reading"[1] (literature-based) research project that may or may not be linked to faculty research. These projects usually are a single semester, include at least weekly meetings with a faculty mentor, and culminate in a final research paper. Collaborative studies allow students to work in small groups guided by a member of the faculty.

BIOL 4000-level: Advanced Independent Study in Biology
BIOL 4050-level: Honors in Biology

These courses usually involve lab-, field- and/or bioinformatics-based research projects that are linked to faculty research and "culminate in substantial and original research."[1]

Advanced Independent Study projects can be one- or two-semester projects with exact requirements determined by the faculty mentor. Expectations for advanced independent study projects include active and regular engagement in the project—from reading the literature, to experiment design and execution, to data analysis--and usually a final presentation and/or research paper.

Honors research projects are two-semester projects that include oral presentations at the end of each semester and a fall midyear report that leads to a full honors thesis in the spring. The award of honors reflects efforts in all elements of the research experience and active participation in the biology research community based on:

- engagement in the project
- independence in laboratory/field and analysis
- ability to incorporate feedback from your advisor and reader in written and oral assignments
- the final quality of your written and oral assignments.

More information about how to get involved in research with the Biology department at Bowdoin is available at the following website, including details on specific faculty research interests: https://www.bowdoin.edu/biology/student-research/how-to-get-involved.html

[1] https://bowdoin-public.courseleaf.com/academic-standards-regulations/#text