Biology

*Professors:* Amy S. Johnson, Carey R. Phillips, Nathaniel T. Wheelwright  
*Associate Professors:* Barry A. Logan, Michael F. Palopoli  
*Joint Appointments with Biochemistry:* Professor Bruce D. Kohorn, Chair;  
  Associate Professor Anne E. McBride  
*Joint Appointments with Environmental Studies:* Associate Professor Philip Camill,  
  Associate Professor John Lichter  
*Joint Appointments with Neuroscience:* Professor Patsy S. Dickinson,  
  Assistant Professor Hadley Wilson Horch  
*Assistant Professors:* Jack R. Bateman, William R. Jackman  
*Visiting Assistant Professor:* Peter J. Woodruff  
*Director of the Bowdoin Scientific Station on Kent Island and Adjunct Assistant Professor of Biology:* Damon P. Gannon  
*Doherty Marine Biology Postdoctoral Scholar:* Daniel J. Thornhill  
*Coastal Studies Center Scholar in Residence and Visiting Assistant Professor of Biology:* Vladimir Douhovnikoff  
*Director of Laboratories:* Pamela J. Bryer  
*Laboratory Instructors:* Nancy Curtis, Kate R. Farnham, Lesley J. Gordon, Stephen A. Hauptman, Nancy H. Olmstead, Jaret S. Reblin, Elizabeth Koski Richards, Peter E. Schlax  
*Department Coordinator:* Julie J. Santorella

**Requirements for the Major in Biology**

The major consists of eight courses in the department exclusive of independent study and courses below the 100 level. Majors are required to complete *Biology 102* or *109*, and three of the twelve core courses. Core courses are divided into three groups. One course must be taken from each group. Majors are also required to complete four elective courses, at least two of which have to be above 250.

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genetics and Molecular Biology</td>
<td>Comparative Physiology</td>
<td>Behavioral Ecology and Population Biology</td>
</tr>
<tr>
<td>Microbiology</td>
<td>Plant Physiology</td>
<td>Biology of Marine Organisms</td>
</tr>
<tr>
<td>Developmental Biology</td>
<td>Developmental Biology</td>
<td>Evolution</td>
</tr>
<tr>
<td>Biochemistry and Cell Biology</td>
<td>Neurobiology</td>
<td>Community, Ecosystem and Global Change Ecology</td>
</tr>
<tr>
<td>Neurobiology</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Majors must also complete one mathematics course, *Mathematics 165* or *171* (or above). Another college statistics course and *Mathematics 161* may satisfy this requirement with permission of the department. Additional requirements are *Physics 103* (or any physics course that has a prerequisite of *Physics 103*), and *Chemistry 225*. Students are advised to complete *Biology 102* or *109* and the mathematics, physics, and chemistry courses by the end of the sophomore year. Students planning postgraduate education in science or the health professions should note that graduate and professional schools are likely to have additional admissions requirements in mathematics, physics, and chemistry. Advanced placement credits may not be used to fulfill any of the course requirements for the major.
Interdisciplinary Majors
The department participates in interdisciplinary programs in biochemistry, environmental studies, and neuroscience. See pages 80, 132, and 228.

Requirements for the Minor in Biology
The minor consists of two courses within the department at the 100 level or above, and two courses to be taken from two of the three core groups. See Requirements for the Major in Biology.

Introductory, Intermediate, and Advanced Courses

[53a - MCSR, INS. Biofuels.]

Methods of food and wine preparation and production emerged from essentially controlled scientific experiments, even if the techniques of cooking are often carried out without thought of the underlying physical processes at play. Considers the science behind food and wine using bread baking, cooking techniques, the role of microbes in our diet, and wine making and appreciation to explore the chemistry and biology that underlie our gastronomy. Molecular structures and complex interactions central to cooking and wine are examined in integrated laboratory exercises. Assumes no background in science. Not open to students who have taken a college-level chemistry course. (Same as Chemistry 55.)

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 Environmental Studies 56.)

Covers the biological events from the process of fertilization through early development and birth of a human. Intended for those who have had little biology or do not intend to major in biology. Explores the formation of the major organ systems and how the parts of the body are constructed in the correct places and at the correct times. Also discusses topics such as cloning and the effects of prenatal use of drugs as they relate to the biological principles involved in early human development. Includes a few in-class laboratory sessions in which students learn to do experiments, and collect, analyze, and interpret data.

Explores the biology of microorganisms implicated in new and recurrent infectious diseases in the context of their global impact. Emphasizes class discussion of topics including microbial growth and reproductive strategies, pathogen-host interactions, and social and economic issues relating to infectious diseases. Not open to students who have credit for Biology 76. See Biology 367 for more information about this course.
86a - INS. Biotechnology and Bioengineering. Fall 2008. Peter J. Woodruff.

Scientific advances over the last few decades have greatly expanded our understanding of the natural world. Some of these discoveries have been applied to other fields to improve human health or solve problems facing society. Examines contemporary application of scientific progress in areas such as genetic engineering, stem cells, drug discovery, biofuels, and environmental remediation. Analyzes ethical concerns raised by advances in biotechnology and bioengineering.


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. First-year students are required to take the biology placement examination during orientation.


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.

Prerequisite: Biology 101.


Lectures examine fundamental biological principles, from the subcellular to the ecosystem level. Topics include bioenergetics, structure-function relationships, cellular information systems, physiology, ecology, and evolutionary biology. Laboratory sessions are intended to develop a deeper understanding of the techniques and methods of science by requiring students to design and conduct their own experiments. Lecture and weekly laboratory/discussion groups.

Prerequisites: Biology 102, 104, 105, or 109.


The Gulf of Maine/Bay of Fundy system is a semi-enclosed sea bordered by three U.S. states and two Canadian provinces. It supports some of the world’s most productive fisheries and played a key role in European colonization of North America. Investigates how the species found in this body of water interact with each other and with the abiotic components of their environment. Topics will include natural history; geological and physical oceanography; characteristics of major habitats; biology of macroinvertebrates, fishes, seabirds, and marine mammals; biogeography; food webs; and fisheries biology. Examines how human activities, such as fishing, aquaculture, shipping, and coastal development affect the ecology of the region. Includes lectures, discussions of the primary literature, and field excursions. (Same as Environmental Studies 154.)

Prerequisite: Biology 102, 104, 105, or 109.


Functioning of the earth system is defined by the complex and fascinating interaction of processes within and between four principal spheres: land, air, water, and life. Leverages key principles of environmental chemistry and ecology to unravel the intricate connectedness of natural phenomena and ecosystem function. Fundamental biological and chemical concepts
are used to understand the science behind the environmental dilemmas facing societies as a consequence of human activities. Laboratory sessions consist of local field trips, laboratory experiments, group research, case study exercises, and discussions of current and classic scientific literature. (Same as Chemistry 105 and Environmental Studies 201.)

Prerequisite: One 100-level or higher course in biology, chemistry, geology, or physics.

174a - MCSR. Biomathematics. Fall 2008. MARY LOU ZEEMAN.

A study of mathematical methods driven by questions in biology. Biological questions are drawn from a broad range of topics, including disease, ecology, genetics, population dynamics, endocrinology and biomechanics. Mathematical methods include compartmental models, matrices, linear transformations, eigenvalues, eigenvectors, matrix iteration and simulation; ODE models and simulation, stability analysis, attractors, oscillations and limiting behavior, mathematical consequences of feedback, and multiple time-scales. Three hours of class meetings and two hours of computer laboratory sessions per week. 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 Mathematics 204 [formerly Mathematics 174].)

Prerequisite: Mathematics 161 or permission of the instructor.

202. 3-D Digital Animation Studio. Every fall. CAREY R. PHILLIPS.

Explores the uses of art and three-dimensional animations in communicating complex dynamic and spatial relationships, primarily as they pertain to explaining scientific concepts. Students use primary literature to explore a science problem in a seminar-type format. Study of filmmaking and use of high-end three-dimensional animation software. Concludes with a team effort to create a three-dimensional animated film of the science problem. (Same as Visual Arts 255.)

210a - MCSR, INS. Plant Physiology. Fall 2008. BARRY A. LOGAN.

An introduction to the physiological processes that enable plants to grow under the varied conditions found in nature. General topics discussed include the acquisition, transport, and use of water and mineral nutrients, photosynthetic carbon assimilation, and the influence of environmental and hormonal signals on development and morphology. Adaptation and acclimation to extreme environments and other ecophysiological subjects are also discussed. Weekly laboratories reinforce principles discussed in lecture and expose students to modern research techniques. (Same as Environmental Studies 210.)

Prerequisite: Biology 102, 104, 105, or 109.

212a - MCSR, INS. Genetics and Molecular Biology. Every fall. JACK R. BATEMAN.

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, the determination of gene order and sequence, and genetic engineering applications. Laboratory and problem-solving sessions are scheduled.

Prerequisite: Biology 102, 104, 105, or 109.

213a - MCSR, INS. Neurobiology. Every fall. HADLEY WILSON HORCH.

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.

Prerequisite: One of the following: Biology 102, 104, 105, 109, or Psychology 251.
214a - MCSR, INS. Comparative Physiology. Every spring. Patsy S. Dickinson.

An examination of animal function, from the cellular to the organismal level. The underlying concepts are emphasized, as are the experimental data that support our 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.

Prerequisite: Biology 102, 104, 105, or 109.


Study of the behavior of animals and plants, and the interactions between organisms and their environment. Topics include population growth and structure, and the influence of competition, predation, and other factors on the behavior, abundance, and distribution of plants and animals. Laboratory sessions, field trips, and research projects emphasize concepts in ecology, evolution and behavior, research techniques, and the natural history of local plants and animals. Optional field trip to the Bowdoin Scientific Station on Kent Island. (Same as Environmental Studies 215.)

Prerequisite: Biology 102, 104, 105, or 109.

216a - MCSR, INS. Evolution. Every spring. Michael F. Palopoli.

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.

Prerequisite: Biology 102, 104, 105, or 109.


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.

Prerequisite: Biology 102, 104, 105, or 109.

218a - INS. Microbiology. Every spring. Anne E. McBrine.

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.

Prerequisite: Biology 102, 104, 105, or 109. Chemistry 225 is recommended.

219a - MCSR, INS. Biology of Marine Organisms. Every fall. Amy Johnson.

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 three hours of laboratory or field trip per week. One weekend field trip included. (Same as Environmental Studies 219.)

Prerequisite: Biology 102, 104, 105, or 109.

An exploration of the interface between geological and biological processes. Focuses on the mutual effects of microorganisms and earth’s land, air, and water chemistry. Topics include biomineralization, origin and evolution of life, microbial energetics and diversity, and biological contributions to weathering, soil and rock formation, and the creation and remediation of environmental problems. Laboratories will include fieldwork, experiments, and light, fluorescence, and electron microscopy. (Same as Environmental Studies 223 and Geology 223.)

Prerequisite: One course in geology or biology, or permission of the instructor.

224a - MCSR, INS. Biochemistry and Cell Biology. Every spring. BRIECE D. KOHORN.

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. (Same as Chemistry 231.)

Prerequisite: Biology 102, 104, 105, or 109. Chemistry 225 is recommended.

225a - MCSR, INS. Community, Ecosystem, and Global Change Ecology. Fall 2009. JOHN LICHTER.

Community ecology is the study of dynamic patterns in the distribution and abundance of organisms. Ecosystem ecology is the study of the flow of energy and cycling of matter through ecological communities. Global change ecology examines how human activities alter communities and ecosystems and how these changes play out at the global scale. Topics include the creation and maintenance of biodiversity, the complexity of species interactions in food webs, the role of disturbance in ecological processes, the importance of biodiversity in ecosystem processes, and human influences on global biogeochemical cycles and climate change. Laboratory sessions consist of local field trips, team research exercises, and independent field research projects. Current and classic scientific literature is discussed weekly. (Same as Environmental Studies 225.)

Prerequisite: Biology 102, 104, 105, or 109.

232a - MCSR. Biochemistry. Fall 2008. DANIELLE H. DUBE.

Focuses on the chemistry of living organisms. Topics include structure, conformation, and properties of the major classes of biomolecules (proteins, nucleic acids, carbohydrates, and lipids); enzyme mechanisms, kinetics, and regulation; metabolic transformations; energetics and metabolic control. (Same as Chemistry 232.)

Prerequisite: Chemistry 226.

253a. Neurophysiology. Every fall. PATSY S. DICKINSON.

A comparative study of the function of the nervous system in invertebrate and vertebrate animals. Topics include the physiology of individual nerve cells and their organization into larger functional units, the behavioral responses of animals to cues from the environment, and the neural mechanisms underlying such behaviors. Lectures and four hours of laboratory work per week.

Prerequisite: Biology 102, 104, 105, or 109, and Biology 213, 214, or Psychology 218.
254a - MCSR, INS. Biomechanics. Spring 2009. AMY S. JOHNSON.

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. Lectures, labs, field trips, and individual research projects emphasize (1) analysis of morphology, including analyses of the shape of individual organisms as well as of the mechanical and molecular organization of their 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. Introductory physics and calculus are strongly recommended.

Prerequisite: Biology 102, 104, 105, or 109, or one 100-level course in chemistry, geology, mathematics, or physics.

257a. Immunology. Fall 2008. ANNE E. McBRIDE.

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 are also considered.

Prerequisite: Biology 212, 217, 218, or 224 (same as Chemistry 231), or permission of the instructor.

258a. Ornithology. Spring 2010. NATHANIEL T. WHEELWRIGHT.

Advanced study of the biology of birds, including anatomy, physiology, distribution, and systematics, with an emphasis on avian ecology and evolution. Through integrated laboratory sessions, field trips, discussion of the primary literature, and independent research, students learn identification of birds, functional morphology, and research techniques such as experimental design, behavioral observation, and field methods. Optional field trip to the Bowdoin Scientific Station on Kent Island.

Prerequisite: Biology 215 (same as Environmental Studies 215) or 225 (same as Environmental Studies 225).

263a - MCSR, INS. Laboratory in Molecular Biology and Biochemistry. Every spring. KATHERINE R. FARNHAM and PETER J. WOODRUFF.

Comprehensive laboratory course in molecular biology and biochemistry that reflects how research is conducted and communicated. Includes sequential weekly experiments, resulting in a cohesive, semester-long research project. Begins with genetic engineering to produce a recombinant protein, continues with its purification, and finishes with functional and structural characterization. Emphasis is on cloning strategy, controlling protein expression, and protein characterization using techniques such as polymerase chain reaction, affinity chromatography, isoelectric focusing, and high-performance liquid chromatography. Students also learn to manipulate data using structural and image analysis software. (Same as Chemistry 263.)

Prerequisite: Previous credit or concurrent registration in Biology 224 (same as Chemistry 231).

266a. Molecular Neurobiology. Every spring. HADLEY WILSON HORCH.

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. Weekly laboratories complement lectures by covering a range of molecular and cellular techniques used in neurobiology and culminate in brief independent projects.

Prerequisite: Biology 102, 104, 105, or 109, and one of the following: Biology 212, 213, 224 (same as Chemistry 231), 253, or Psychology 218.
280a. **Plant Responses to the Environment.** Spring 2009. BARRY A. LOGAN.

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 Environmental Studies 280.)

Prerequisite: Biology 210, 225, or 327.

291a–294a. **Intermediate Independent Study in Biology.** The Department.

304a. **Topics in Molecular Biology.** Fall 2009. ANNE E. McBRIDE.

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 covered 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.

Prerequisite: Biology 212, 218, 224, or 232, or permission of the instructor.

[306a. **Free Radicals and Antioxidants.**]

307a. **Evolutionary Developmental Biology.** Spring 2010. WILLIAM JACKMAN.

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.

Prerequisite: One of the following: Biology 216, 217, 218, 224 (same as Chemistry 231), 266, or permission of the instructor.

317a. **Molecular Evolution.** Every fall. MICHAEL F. PALOPOLI.

The dynamics of evolutionary change at the molecular level are examined. 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, and complete independent projects in the laboratory.

Prerequisite: One of the following: Biology 212, 216, 217, 218, or 224 (same as Chemistry 231), or permission of the instructor.

325a. **Topics in Neuroscience.** Spring 2010. PATSY S. DICKINSON.

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.

Prerequisite: One of the following: Biology 213, 253, 266, or Psychology 275 or 276.

327a. **Global Change Ecology.** Fall 2008. PHILIP CAMILL.

Human activities over the last several centuries have transformed landscapes, altered biogeochemical cycles, and moved species from one continent to another. These changes have resulted in widespread species extinction and climate change. Emphasis is on the implications of ecosystem degradation, climate change, and species introductions for biodiversity and ecosystem services. Course consists of lectures and student-led discussions of current and classic primary literature. (Same as Environmental Studies 327.)

Prerequisite: Biology 158 (same as Chemistry 105 [formerly Chemistry 180] and Environmental Studies 201), 215, or 219.

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. This course 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.

Prerequisite: One of the following: Biology 212, 213, 217, 224 (same as Chemistry 231), 253, 266, or Psychology 275 or 276, or permission of the instructor.


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.

Prerequisite: Biology 224 (same as Chemistry 231) or permission of the instructor.


Explores the biology of microorganisms implicated in new and recurrent infectious diseases. Topics include microbial growth and reproductive strategies, pathogen-host interactions, and vaccination strategies. Focuses on analysis of papers from the primary literature and scientific writing and oral presentation skills. Students also act as science mentors in Biology 67 for group discussions and final projects.

Prerequisite: Biology 212, 218, or 224 (same as Chemistry 231), or permission of the instructor.


Merrymeeting Bay, a globally rare, inland freshwater river delta and estuary that supports productive and diverse biological communities, is home to numerous rare and endangered species and is critical habitat for migratory and resident waterfowl, as well as anadromous fish. Explores the ecology and environmental history of Merrymeeting Bay in order to understand how its rare natural habitats might best be managed. Students participate in a thorough review of the scientific and historical literature related to Merrymeeting Bay, and help plan, conduct, and analyze a group study investigating some aspect of the ecology and/or environmental history of the bay, with the intent of submitting a manuscript for publication in an appropriate scientific journal. (Same as Environmental Studies 394.)

Prerequisite: Biology 158 (same as Chemistry 105 [formerly Chemistry 180] and Environmental Studies 201) or 215 (same as Environmental Studies 215).


Exploration of advanced concepts in ecology and evolutionary biology, and the natural history of plants, animals, and ecosystems in winter in Maine. Structured around group research projects in the field. Each week, field trips focus on a different study site, set of questions, and taxon (e.g., host specificity in wood fungi, foraging behavior of aquatic insects, estimation of mammal population densities, winter flocking behavior in birds). Students learn to identify local winter flora and fauna, evaluate readings from the primary literature, analyze data from field research projects, and present their results each week in a research seminar. Field trip to the Bowdoin Scientific Station on Kent Island. (Same as Environmental Studies 397.)

Prerequisite: Biology 215 or 258, or permission of the instructor.

401a–404a. Advanced Independent Study and Honors in Biology. The Department.