

information, including course descriptions, instructors, and semesters when these courses will next be offered.

### Requirements for the Major in Biochemistry

All majors must complete the following courses: **Biology 109, 224** (same as **Chemistry 231**), **232** (same as **Chemistry 232**), **263** (same as **Chemistry 263**); **Chemistry 109, 225, 226, 251; Mathematics 161, 171; Physics 103, 104**. Students are encouraged to complete the required biochemistry core courses by the end of their junior year so that they may take upper-level courses and participate in research in the senior year. Majors must also complete two courses from the following: **Biology 210** (same as **Environmental Studies 210**), **212, 214, 217, 218, 253, 257, 266, 304, 306, 307, 314, 317, 333, 401–404; Chemistry 210, 240, 252, 305** (same as **Environmental Studies 305**), **325, 331, 401–404; Physics 223, 401–404**. Students may include as an elective one 400-level course. Students taking independent study courses for honors in the biochemistry major should register for **Biochemistry 401–404**.

**Bowdoin College does not offer a minor in biochemistry.**

### Advanced Courses

**401a–404a. Advanced Independent Study and Honors in Biochemistry.** THE DEPARTMENT.

## Biology

Bruce D. Kohorn, *Department Chair*  
Julie J. Santorella, *Department Coordinator*

*Professors:* Patsy S. Dickinson (Neuroscience), Amy S. Johnson, Bruce D. Kohorn (Biochemistry), Carey R. Phillips, Nathaniel T. Wheelwright†

*Associate Professors:* Philip Camill (Environmental Studies), John Lichter (Environmental Studies), Barry A. Logan\*\*, Anne E. McBride (Biochemistry), Michael F. Palopoli\*\*

*Assistant Professors:* Jack R. Bateman, Hadley Wilson Horch (Neuroscience), William R. Jackman

*Visiting Faculty:* Daniel J. Thornhill, Peter J. Woodruff

*Director of Bowdoin Scientific Station on Kent Island:* Damon P. Gannon

*Laboratory Instructors:* Pamela J. Bryer, Nancy J. Curtis, Kate R. Farnham, Janet Gannon, Stephen A. Hauptman, Nancy H. Olmstead, Jaret S. Reblin, Elizabeth Koski Richards, Peter E. Schlax

### 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 higher than **250**.

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

Majors must also complete one mathematics course, **Mathematics 165** or **171** (or higher). 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 81, 135, and 233.

#### **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.

#### **First-Year Seminars**

For a full description of first-year seminars, see pages 149–60.

#### **23a. Personal Genomes.** Spring 2010. JACK BATEMAN.

#### **Introductory, Intermediate, and Advanced Courses**

[53a - MCSR, INS. Biofuels.]

#### **55a - INS. Science of Food and Wine.** Fall 2009. RICHARD D. BROENE AND BARRY A. LOGAN.

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 credit for a chemistry course numbered **100** or higher. (Same as **Chemistry 55**.)

**61a - INS. Your First Nine Months: From Conception to Birth.** Every semester. CAREY R. PHILLIPS.

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.

[**79a - INS. Agriculture: Ancient and Modern.** (Same as **Environmental Studies 79**.)]

**86a - INS. Biotechnology and Bioengineering.** Fall 2009. 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.

**101a - MCSR, INS. Biological Principles I.** Every fall. Fall 2009. BRUCE D. KOHORN.

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.*

**102a - MCSR, INS. Biological Principles II.** Spring 2010. AMY S. JOHNSON.

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**.

**109a - MCSR, INS. Introductory Biology.** Every semester. Fall 2009. ANNE E. MCBRIDE AND MICHAEL F. PALOPOLI. Spring 2010. PATSY S. DICKINSON AND WILLIAM R. JACKMAN.

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.

[**154a. Ecology of the Gulf of Maine and Bay of Fundy.** (Same as **Environmental Studies 154**.)]

**158a - MCSR, INS. Perspectives in Environmental Science.** Every spring. Spring 2010. JOHN LICHTER AND DHARNI VASUDEVAN.

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.** Every fall. Fall 2009. 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, neurobiology, 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 2009. 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, techniques of molecular biology, and human genetic variation. Laboratory 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**.

**215a - MCSR, INS. Behavioral Ecology and Population Biology.** Fall 2010. NATHANIEL T. WHEELWRIGHT.

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.** Spring 2010. THE DEPARTMENT.

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**.

**217a - MCSR, INS. Developmental Biology.** Every fall. WILLIAM R. JACKMAN.

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.** Spring 2010. ANNE E. MCBRIDE.

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. **Chemistry 225** is recommended.

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

**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.**

**224a - MCSR, INS. Biochemistry and Cell Biology.** Every spring. BRUCE 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. **Chemistry 225** is recommended. (Same as **Chemistry 231**.)

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

**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.** Every fall. 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.** Fall 2009. 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 2010. 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.]

[258a. Ornithology.]

**263a - MCSR, INS. Laboratory in Molecular Biology and Biochemistry.** Every spring. 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**.

**274a - MCSR, INS. Marine Conservation Biology.** Fall 2009. DAMON GANNON.

Introduces key biological concepts that are essential for understanding conservation issues. Explores biodiversity in the world's major marine ecosystems; the mechanisms of biodiversity loss at the genetic, species, and ecosystem levels; and the properties of marine systems that pose unique conservation challenges. Investigates the theory and practice of marine biodiversity conservation, focusing on the interactions among ecology, economics, and public policy. Consists of lecture/discussion, lab, field trips, guest seminars by professionals working in the field, and student-selected case studies. (Same as **Environmental Studies 274**.)

Prerequisite: One of the following: **Biology 154** (same as **Environmental Studies 154**), **Biology 215** (same as **Environmental Studies 215**), **Biology 219** (same as **Environmental**

**Studies 219), Biology 225** (same as **Environmental Studies 225**), **Environmental Studies 101**, **Environmental Studies 201** (same as **Biology 158** and **Chemistry 105**), or permission of the instructor.

**280a. Plant Responses to the Environment.** Spring 2011. 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** or **225**, or permission of the instructor.

**291a–294a. Intermediate Independent Study in Biology.** THE DEPARTMENT.

**302a. Earth Climate History and Its Impacts on Ecosystems and Human Civilizations.**

Spring 2010. PHILIP CAMILL.

The modern world is experiencing rapid climate warming and some parts extreme drought, which will have dramatic impacts on ecosystems and human societies. How do contemporary warming and aridity compare to past changes in climate? Are modern changes human-caused or part of the natural variability in the climate system? What effects did past changes have on global ecosystems and human societies? Students use sediment and growth records (ocean, glacier, lake, coral, tree ring, and rodent middens) to assemble proxies for past changes in climate, atmospheric CO<sub>2</sub>, and disturbance to examine several issues: long-term carbon cycling and climate, the rise of C4 photosynthesis and the evolution of grazing mammals, orbital forcing and glacial cycles, glacial refugia and post-glacial species migrations, climate change and the rise of human civilizations, climate/overkill hypothesis of Pleistocene megafauna, climate variability, drought cycles, climate change impacts on fire, climate-related collapses of human civilizations, and determining natural variability vs. human-caused climate change. Prior enrollment in a 200- or 300-level environmental studies or geology course is recommended. (Same as **Environmental Studies 302** and **Geology 302**.)

Prerequisite: One of the following: **Biology 102, 104, 105, 109**, or **Geology 101**.

**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** (same as **Chemistry 231**), or **232**, (same as **Chemistry 232**), or permission of the instructor.

**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.

**314a. Advanced Genetics and Epigenetics.** Spring 2010. JACK BATEMAN.

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.

Prerequisite: **Biology 212**.

**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.]****[327a. Global Change Ecology.** (Same as **Environmental Studies 327**.)]**329a. Neuronal Regeneration.** Spring 2010. HADLEY WILSON HORCH.

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.

**333a. Advanced Cell and Molecular Biology.** Every fall. BRUCE D. KOHORN.

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.

**[367a. Topics in Infectious Diseases.]****394a. The Ecology and Environmental History of Merrymeeting Bay.** Fall 2009. JOHN LICHTER.

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 215** (same as **Environmental Studies 215**) or **Environmental Studies 201** (same as **Biology 158** and **Chemistry 105**).

**397a. Advanced Winter Field Ecology**. Spring 2011. NATHANIEL T. WHEELWRIGHT.

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** (same as **Environmental Studies 215**) or **258** or permission of the instructor.

**401a–404a. Advanced Independent Study and Honors in Biology**. THE DEPARTMENT.