Colby

BIOLOGY

Chair, Associate Professor Catherine Bevier
Associate Chair, Associate Professor Judy Stone
Professors Frank Fekete, Paul Greenwood, and W. Herbert Wilson Jr.; Associate Professors Catherine Bevier, Lynn Hannum, Russell Johnson, Judy Stone, and Andrea Tilden; Assistant Professors Syed Tariq Ahmad, Cathy Collins, Joshua Kavaler, and Raymond Phillips; Visiting Assistant Professors Susan Childers and Sarah Sloan-Barton; Senior Teaching Associates Timothy Christensen, Scott Guay, and Lindsey Colby; Teaching Associate Tina Beachy; Teaching Assistant Sarah Gibbs; Research Scientist Bets Brown; Research Associate Louis Bevier; Animal Care Technician Austin Segel

The Department of Biology provides its students with a background in, and an appreciation for, important aspects of classical and modern biology. To provide a broad and comprehensive investigation of the biological sciences, the departmental curriculum emphasizes the study of the biology of plants, animals, and microorganisms at the molecular, cellular, organismal, and population levels of organization. Special facilities include the Perkins Arboretum, the Colby-Marston Bog, a four capillary DNA sequencer, a microscopy suite, a flow cytometer, several laboratory microcomputer clusters, a well-equipped GIS laboratory, a radioisotope laboratory, a cell culture facility, two greenhouses, herbarium, numerous environmental chambers, and animal and aquarium rooms. Colby is a member of the Idea Network of Biomedical Research Excellence (INBRE), supported by the National Institutes of Health. Department graduates enroll in all fields of biology and in medical schools, dental schools, and veterinary colleges. Others are employed as research assistants, as teachers, and by private firms and government agencies.

To promote interdisciplinary education, the Biology Department maintains close ties (often including cross-listed courses) with other departments and programs including Chemistry, Computer Science, Environmental Studies, Geology, and Psychology.

Three optional concentrations and an interdisciplinary option are offered in addition to the basic major. The **concentration in ecology and evolution** is designed to provide students with a background to work in ecology, evolutionary biology, or related disciplines. Recent graduates in this area have enrolled in masters and doctoral programs in ecology, evolution, marine biology, and natural resource management. Others are employed by federal and state agencies, private and public organizations, and consulting firms.

The **concentration in cell and molecular biology/biochemistry** focuses biology majors on the interdisciplinary field that lies at the interface between biology and chemistry and also prepares students for graduate study or employment in the biomedical fields. Recent graduates have pursued interests in gene therapy, genetic counseling, and biomedical research, or they have attended medical school or graduate school in a variety of disciplines.

The **concentration in neuroscience** allows students to explore the interdisciplinary field at the interface between biology and psychology. This program prepares students for graduate study or employment in neuroscience or biomedical fields. Recent graduates have pursued research in neurodegenerative diseases, molecular neuroscience, and neuroimmunology.

The major in **biology-interdisciplinary computation** allows students to develop a coherent plan for the integration of computer science with biology, culminating in an integrative capstone experience. Students completing this major will be well-prepared to pursue research in fields such as computational biology and bioinformatics.

Students interested in teaching are urged to read the “Education” section of the catalogue and to contact a member of the Education Program. Students majoring in biology and preparing for dental, medical, or veterinary schools must take a year of organic chemistry and a year of introductory college physics with laboratory in addition to the courses required for the major; students preparing for graduate study in the biological sciences also should elect these courses. Students are encouraged to take courses at summer laboratories and field stations. With prior approval, such courses may be credited toward the major requirement.

Colby is a member of a consortium sponsoring the Center for Sustainable Development Studies, through which qualified students are provided the opportunity for a semester of study in Costa Rica. Studies combine biology with social and political issues to address sustainable development problems. Colby also maintains affiliate status with the School for Field Studies and with the Semester in Environmental Science at the Marine Biological Laboratory, Woods Hole.

General Requirements for All Major Programs (Except Biology-Interdisciplinary Computation)

For all major programs offered by the department, the point scale for retention of the major applies to all courses required for the major and all elected biology courses. Courses required for the major may not be taken satisfactory/unsatisfactory. At least eight biology courses must be taken for the major (at least seven with a laboratory component and at least two at the 300 level or above). An independent study may be counted as one of the eight courses. A maximum of four credit hours of independent study and two credit hours of seminar may be counted toward the major. No more than eight credit hours in a semester or 12 credit

hours in total from off-campus study programs can be counted toward the major requirements. The academic honor of "Distinction in the Major" will be awarded to students who have an average of at least 3.5 in the biology major.

Requirements for the Basic Major in Biology

Thirty-five hours of course work in biology (excluding Advanced Placement credit), including Biology 163, 164, one course with laboratory in field biology (Biology 237, 256, 257j, 259j, 271, 334, 354, 358j, 373), and one course with laboratory in cellular biology (Biology 225, 232, 238, 248, 252, 274, 275, 279, 315, 367). Seniors must enroll in Biology 401 or 402. In addition, Chemistry 141, 142; Mathematics 121 or 161 or equivalent; and one of the following courses: Computer Science 151, Mathematics 122, 162, 212, 253.

Requirements for the Concentration in Ecology and Evolution

Thirty-five hours of course work in biology (excluding Advanced Placement credit), including Biology 163, 164, 320, and 382, Environmental Studies 271, one research-based course (Biology 354, 373 with lab, 452, 483/484*), and one course with laboratory in cellular biology (Biology 225, 232, 238, 248, 252, 274, 275, 279, 315, 367). Seniors must enroll in Biology 401 or 402. In addition, Chemistry 141, 142; Mathematics 121 or 161 or equivalent, Mathematics 212; Geology 146 or 251 or 372: and one course with laboratory selected from the following: Biology 211, 237, 254, 256, 257j, 259j, 273, 276, 334, 357; Environmental Studies 352, 358j.

*with an approved topic

Requirements for the Concentration in Cell and Molecular Biology/Biochemistry

Thirty-five hours of course work in biology (excluding Advanced Placement credit), including Biology 163, 164, 279 (with laboratory), 367 (with laboratory), 368 (with laboratory), 378, and one course with laboratory in field biology (Biology 237, 256, 257j, 259j, 271, 334, 354, 358j, 373). Seniors must enroll in Biology 401 or 402. In addition, Chemistry 141, 142, 241, 242; Mathematics 121 or 161 or equivalent; and one of the following courses: Computer Science 151, Mathematics 122, 162, 212, 253; and one course with laboratory chosen from Biology 225, 232, 238, 252, 274, 315, 379, Chemistry 331, or Physics 145. In addition, each concentrator must complete an independent study project equivalent to two (or preferably three) credit hours. This requirement can be satisfied through independent study, January Program, or a summer research project.

Requirements for the Major in Biology-Interdisciplinary Computation

Students will design an integrative course of study in collaboration with academic advisors from the Biology and Computer Science departments. Students without Advanced Placement credit in biology must complete Biology 163, 164, 279, one additional 200-level biology elective course, and either Biology 320 or 379. Students with Advanced Placement credit in biology must complete two 200-level biology elective courses, Biology 279, 320, and 379. Typically, each major must complete Computer Science 151, 231, 251, 341, 441, and the capstone independent study 491 and 492.

Requirements for the Concentration in Neuroscience

Thirty-five hours of course work in biology (excluding Advanced Placement credit), including Biology 163, 164, 274, and one course with laboratory in field biology (Biology 237, 256, 257j, 259j, 271, 334, 354, 358j, 373). Seniors must enroll in Biology 401 or 402. In addition, Chemistry 141, 142; Mathematics 121 or 161 or equivalent and one of the following courses: Computer Science 151, Mathematics 122, 162, 212, 253; Psychology 111; two courses from the following: Psychology 232, 233, 254, 272, 335, 341, 343, 345, 349, 374 (this list is frequently updated as new courses are introduced; please contact your advisor if you have questions about a specific course); one elective course in psychology (200-level or above) or physics (141 or above) or computer science (151 or above) or mathematics (in addition to the mathematics requirement).

Honors Program in Biology

Biology majors with a minimum cumulative grade point average of 3.5 at the end of the January term of the junior year or with permission of the department are eligible to apply for the Biology Honors Research Program during spring registration of the junior year. Honors research projects will earn a total of seven to nine credits and will be conducted during each semester of the senior year (and may include Jan Plan). Completion of the honors program will include a written thesis, an oral presentation at the Colby Undergraduate Research Symposium, and successful completion of an oral examination given by the student's honors committee. Successful completion of the honors program will result in the degree being awarded "With Honors in Biology."

Course Offerings

[BI115] Biology of Women An introduction to the biology of the female throughout her life span. Topics include reproductive anatomy, the menstrual cycle and related hormones, aspects of sexual function, contraception, pregnancy and infertility,

childbirth, lactation, menopause, and other gynecological considerations. Myths surrounding women's biology will also be discussed. Satisfies the non-laboratory science distribution requirement. Cannot be counted toward the biology major. Normally offered in alternate years. *Three credit hours.* **N**

BI118j Sustainable Agriculture and Food Systems Agriculture is a fundamental way in which humans interact with their environment and is at the nexus of ecological, social, and economic systems. An introduction to the ecological bases, practicalities, and philosophies of food and agricultural systems. Provides a foundation in such concepts as agroecology, sustainable soil management, pest and weed control, and organic farming. Also considers social, economic, and public-policy issues. Field trips to local farms and other agricultural institutions. Satisfies the non-laboratory science distribution requirement. Cannot be counted toward the biology major. Formerly offered as Biology 197A. *Three credit hours.* **N** MARSHALL

[BI129] Islands and Evolution Beginning with the writings of Darwin on his visit to the Galapagos Islands of Ecuador, students will learn the pivotal role the Galapagos Islands and other islands have played in the development of the theory of evolution. Students will understand the process of natural selection and other evolutionary processes in shaping the flora and fauna of islands around the world. The biota of the Galapagos Islands in particular continue to play a major role in evolutionary research and will be a focus of study. Part of the three-course Integrated Studies 129 cluster, "Islands in the Sun." *Prerequisite:* Concurrent enrollment in English 129 and Geology 129. (Elect IS129.) *Four credit hours.* **N,Lb**

BI131f Biodiversity Biodiversity examines the variety and variability of life on Earth, the causes of this variety, and the natural complex of relationships. Topics include habitat diversity, taxonomic diversity, evolution and speciation, interrelationships in ecosystems, and conservation biology. Also how humans influence and are influenced by biodiversity. Laboratory sessions focus on exploring biological diversity in different local ecosystems, using taxonomic keys, and applying the scientific method. Students with prior credit for Biology 164 may not receive credit for Biology 131. Lab section B is reserved for Integrated Studies 126, "The Green Cluster," and requires concurrent enrollment in English 126 and Environmental Studies 126. *Four credit hours.* **N,Lb** BEVIER

BI133s Microorganisms and Society An introduction to the importance of microorganisms to human health and the functioning of planet Earth. The diversity of the microbial world presented with relevant examples of how microorganisms affect our daily lives. Discussions and lectures based on the roles microorganisms and viruses play in disease, the food industry, ecological relationships, and biotechnology. Satisfies the laboratory science distribution requirement. Cannot be counted toward the biology major. Lecture and laboratory. *Four credit hours.* **N,Lb** CHILDERS

BI163f The Cellular Basis of Life An examination of cells as the fundamental unit of life. Aspects of evolutionary biology, cell biology, molecular biology, and genetics are discussed. A major objective is development of the intellectual tools to be able to ask and answer interesting biological questions. The objectives of the laboratory are to allow each student to design and conduct experiments, to analyze and present data, to write accurate scientific papers, and to critically evaluate the scientific literature. *Four credit hours.* **N,Lb** AHMAD, HANNUM, JOHNSON

BI164s Evolution and Diversity An introduction to the theory of evolution and to the diversity of organisms. Topics will include the theory of natural selection, transmission genetics, speciation, and the adaptive radiation of all domains and kingdoms of organisms. Lecture and laboratory. *Prerequisite:* Biology 163. *Four credit hours.* **N,Lb** COLLINS, STONE

[BI211] Taxonomy of Flowering Plants An overview of evolutionary relationships among flowering plants and their nearest living relatives, and the study of evolutionary processes leading to those relationships. Students will prepare a collection of plant specimens from the local flora, learn to recognize important plant families, use technical keys to identify plants, and become familiar with analytical methods for constructing and evaluating phylogenetic hypotheses. *Prerequisite:* Biology 164. *Four credit hours.*

[BI214] Plant Physiology The essential mechanisms of plant function. Students will learn about plant-water relations, mineral nutrition, photosynthesis, respiration, nitrogen fixation, and stress physiology through lectures and class discussion, addressing the importance of these physiological processes in the context of both agricultural and natural ecosystems. The laboratory portion focuses on developing skills in experimental design, good laboratory technique, and proper interpretation of data, and it entails presentation of the results of experiments in the form of a scientific paper and an oral presentation. *Prerequisite:* Biology 164. *Four credit hours.*

BI225s Immunology An introduction to the cellular and molecular components of immune recognition and effector responses against pathogens, with emphasis on the human immune system. Topics will include immune deficiency, allergy, and autoimmunity. Lecture and laboratory. *Prerequisite:* Biology 164. *Four credit hours.* HANNUM

[BI232] Developmental Biology A study of development, with emphasis on the experimental findings that have led to present ideas of the morphological and chemical processes underlying the development and growth of organisms. Fourth credit hour for laboratory. *Prerequisite:* Biology 164. *Three or four credit hours.*

BI237f Woody Plants Introduction to anatomy, physiology, reproduction, and ecology of woody plants. Field trips emphasize identification and ecology; laboratory sessions focus on structure and function; one laboratory includes a Saturday field trip. *Prerequisite:* Biology 164. *Four credit hours.* STONE

[BI245] Biology of Race and Gender The biological basis of race, gender, and sex. Topics include the Human Genome Project and eugenics; reproductive physiology, hormones, and sex determination; brain function and intelligence; and adaptation and human evolution. Cannot be counted toward the biology major. *Four credit hours.* **N, I**

BI248f Microbiology Provides an understanding of the nature and diversity of microorganisms and viruses and the roles they play in the biosphere. Emphasis will be on the microbe itself—its functional, ecological, and evolutionary relationships—as well as the activities it carries out that are of interest to humans. The approach will be fundamental, stressing principles, but with considerable emphasis on how these principles are applied to practical problems in medicine, industry, and the environment. Credit cannot be earned for both this course and Biology 238. *Prerequisite:* Biology 164 (prerequisite), Chemistry 141 or 145 (may be taken concurrently). *Four credit hours.* CHILDERS

[BI252] Plant Development A study of the structures and underlying genetic mechanisms that are important for plant growth and development. We will address how the many diverse groups of plants evolved by developing different tissues and organs to carry out specific functions. The influence of genes, hormones, and the environment on plant morphogenesis will be considered across plant diversity. Fourth credit hour for laboratory. *Prerequisite:* Biology 164. *Three or four credit hours.*

[BI254] Marine Invertebrate Zoology A survey of the major phyla of free-living marine invertebrates and the study of the evolutionary relationships of those groups. Students will learn to classify marine invertebrates and to understand their role in marine communities. They will work collaboratively to produce Wiki accounts on topics of current interest in marine invertebrates. Each student will give a talk on a topic of her/his choice based on a critical survey of the primary literature. A comprehensive lab practical will test the students' mastery of marine invertebrate morphology. *Prerequisite:* Biology 164. *Four credit hours.*

[BI256] Ichthyology The biology of the most numerous and diverse group of vertebrates occurring in every aquatic environment from intermittent streams, rivers, and lakes to the open oceans and deep oceanic trenches. An exploration of the 400 million years of fish evolutionary adaptations, which have resulted in the development of more than 20,000 species of the most morphologically, physiologically, and behaviorally adapted creatures on Earth. Lecture and laboratory. *Prerequisite:* Biology 164. *Four credit hours.*

[BI257] Winter Ecology Study of the diverse adaptations plants and animals use to survive the stresses of the winter environment. Students will learn general principles of heat transfer, basic principles of weather, changes of state of water in the winter (snow, frost, rime, sleet), and identification of winter plants and animal signs. Teams will undertake extensive fieldwork to gather data to test explicit hypotheses, to analyze the data, and to present the results. Each student will give a talk to the class on the results of a journal article and prepare a critical analysis of an article on winter ecology. A comprehensive lab practical will test each student's mastery of winter plant and animal identification. *Prerequisite:* Biology 164 and permission of the instructor. *Three credit hours.*

BI259j Plants of the Tropics An intensive three and one half week course that will focus on tropical plant biology in Costa Rica. Emphasis will be on the physiology and ecology of plants in both wild and agricultural settings. The importance of plants and agriculture for tropical Latin American cultures will also be addressed. We will visit two distinct environments in Costa Rica: a lowland tropical rain forest (La Selva Biological Reserve), and a tropical dry forest (Santa Rosa National Park). Students will complete a field research project during the final week. Cost: $2,300. Limited scholarship funds may be available. *Prerequisite:* Biology 164 and permission of the instructor. *Three credit hours.* JOHNSON

BI265j Introduction to Human Anatomy and Physiology Designed especially for students interested in health professions (e.g., physician, nurse, allied health, dentistry), and for anyone who wishes to learn more about how the human body works. Students will understand how physiological functions are performed by specific anatomical structures, and that these functions follow physical and chemical principles. They will also learn anatomical terms used to describe body sections, regions, and relative positions, and about the organ systems in the human body and how these systems work together. Credit cannot be earned for both this course and Biology 275. Fulfills non-lab science requirement. *Prerequisite:* Biology 131 or 163 or equivalent. *Three credit hours.* **N** DARLINGTON

BI266s The Environment and Human Health Listed as Environmental Studies 266. *Four credit hours.* **N** CARLSON

BI271f Introduction to Ecology Listed as Environmental Studies 271. *Prerequisite:* Biology 131 or 164. *Four credit hours.* **N,Lb** COLE

[BI273] The Ecology of Wildlife Diseases Wild animals are hosts to whole communities of macro- and micro-parasites. The patterns of disease dynamics they cause affect which strains or competing species dominate in the ecosystem. Designed to provide students with a sound understanding of the ecology, pathology, host population dynamics, and spatial aspects of fish and wildlife diseases. The laboratory provides an appreciation of the diagnostic and surveillance tools necessary to develop disease surveillance, control, and prevention. *Prerequisite:* Biology 164. *Four credit hours.*

BI274f Neurobiology Discussion of the molecular and cellular fundamentals of neurophysiology and neuroanatomy. Topics include structure and function of neurons, molecular basis of signaling and communication within and between neurons, sensory and motor systems, and mechanisms of learning and memory. The lab portion will involve acquiring skills in electrophysiology

(including electrode construction and testing on animal models), effects of modulators and anesthetics on electrophysiology of cardiac activity, and an independent research project. *Prerequisite:* Biology 164. *Four credit hours.* TILDEN

BI275s Mammalian Physiology A study of mammalian homeostasis and mechanisms of disease. Topics include endocrinology, neurobiology, osmoregulation, cardiovascular system, respiratory system, metabolism, reproduction, and the physiology of exercise. Lecture and optional laboratory. Credit cannot be earned for both this course and Biology 265. *Prerequisite:* Biology 164. *Three or four credit hours.* TILDEN

[BI276] Comparative Vertebrate Anatomy Comparative studies of basic vertebrate anatomical systems and their structural, functional, and evolutionary relationships among the major vertebrate groups. Laboratories emphasize comparisons of anatomical structure across different vertebrate species through dissection. Lecture and laboratory. *Prerequisite:* Biology 164. *Four credit hours.*

BI279fs Genetics The mechanisms of inheritance, with emphasis on experimental findings. The physical and chemical bases for the behavior of genes, and applications of genetic principles to society. Lecture and laboratory. *Prerequisite:* Biology 164. *Four credit hours.* KAVALER

BI281j Marine Microbiology: From Viruses to Whales Listed as Environmental Studies 281. *Three credit hours.* **N** EMERSON

BI283j Introductory Bioinformatics Listed as Computer Science 283. *Three credit hours.* **Q** MCCLELLAN

BI297j Pills, Potions, and Poisons Listed as Biochemistry 297. *Three credit hours.* **N** ANTONIELLO

BI315f Animal Cells, Tissues, and Organs A study of how cells are organized into tissues and organs in animals. Class discussions focus on critically analyzing tissue disorders as a means of understanding normal tissue function. Class assignments focus on developing problem-solving skills and analyzing medical case studies. Laboratories investigate the microanatomy of mammalian tissues and the pathology of organ systems. Students learn to articulate the important aspects of tissue biology and pathology. *Prerequisite:* Biology 164 and Chemistry 142 and junior standing. *Four credit hours.* KOHN

[BI319] Conservation Biology Listed as Environmental Studies 319. *Four credit hours.*

BI320s Evolutionary Analysis An examination of the mechanisms of evolution at single and multiple loci, including natural selection, genetic drift, and inbreeding. Reconstruction of the evolutionary history of both organisms and genes. Applications to human health and conservation biology. Optional fourth credit hour for laboratory includes an independent research component. *Prerequisite:* Biology 164 and a 200-level biology course. *Three or four credit hours.* STONE

BI325f Advanced Immunology In-depth exploration of topics in immunology through reading and discussion of primary literature. Focuses on several main topics per semester, with an emphasis on the human immune system and human health. Students will learn to communicate their understanding of basic and clinical immunology research to others through class discussions and a formal presentation. The laboratory focuses on enhancing students' laboratory skills through a semester-long research project that will result in a scientific paper. Optional fourth credit for laboratory. *Prerequisite:* Biology 225. *Three or four credit hours.* HANNUM

BI334s Ornithology A broad survey of the biology of birds including their evolutionary history, morphology, physiology, flight adaptations, behavior, vocalizations, nesting, life history, conservation, and phylogeny. Students will prepare three critiques of the primary literature on particular controversial topics in ornithology. An independent research project (groups of one to four students) is required and will be presented in the form of a poster. A lab practical will test each student's knowledge of skeletal, feather, and internal anatomy. The final exam will be a test of visual and aural identification of all the species found during the field trips. *Prerequisite:* Biology 164, and junior standing. *Four credit hours.* WILSON

[BI342] Past Terrestrial Ecosystems Listed as Geology 342. *Three credit hours.*

[BI348] Pathogenic Bacteriology Objectives are to provide an understanding of 1) the nature and diversity of pathogenic bacteria, 2) the roles they play as infectious agents of disease, and 3) the mechanisms of the mammalian defense against infectious disease. The approach will be fundamental, stressing principles, but with considerable emphasis on how these principles are applied to practical problems in medicine and public health. Credit cannot be earned for both this course and Biology 238. *Prerequisite:* Biology 248, Chemistry 141 or 145, and Chemistry 142 (may be taken concurrently). *Three credit hours.*

BI352s Advanced and Applied Ecology Listed as Environmental Studies 352. *Four credit hours.* COLE

[BI354] Marine Ecology A study of the interactions that determine the distribution and abundance of marine organisms. Emphasis will be on North Atlantic communities. One weekend field trip to the coast for all students. *Prerequisite:* Junior standing, Biology 164 and 271. *Three credit hours.*

[BI356] Aquatic Ecology Listed as Environmental Studies 356. *Four credit hours.*

[BI357] Physiological Ecology An examination of the physiological and behavioral adaptations of organisms to environmental conditions and consideration of how such adaptations affect the interactions of organisms. Examples drawn from terrestrial, marine, and freshwater plants and animals. *Prerequisite:* Biology 271. *Three credit hours.*

BI358j Ecological Field Study Listed as Environmental Studies 358. *Prerequisite:* Biology 131 or Biology 164. *Three credit hours.* COLE, RUEGER

BI362f Medical Biochemistry Listed as Biochemistry 362. *Four credit hours.* MILLARD

BI367f Biochemistry of the Cell I Listed as Biochemistry 367. *Four or five credit hours.* RICE

BI368s Biological Basis of Metabolism A focus on the biological basis of metabolism, bioenergetics, and regulatory processes that are essential to the functioning of the cell, stressing the development of problem-solving, critical-thinking, and communication skills in both the lecture and optional laboratory. Topics include how cells transduce and integrate information to coordinate cellular function, how cells use metabolic energy, how transport occurs, and special topics of particular interest to biochemists. The laboratory will employ a case study approach, applying biochemistry tools to real-world problems. Students cannot receive credit for both Biology 368 and Chemistry 368, nor can they earn credit for Biology 368 if they have previously taken Biochemistry 362 or 368. *Prerequisite:* Biochemistry 367. Biochemistry 367 laboratory is prerequisite to Biology 368 laboratory. *Four or five credit hours.* KOHN

BI373f Animal Behavior An examination of animal behavior from a biological perspective. Topics include the control, development, function, and evolution of behavior. Fourth credit hour for laboratory. *Prerequisite:* Biology 164 and junior standing. *Three or four credit hours.* SLOANE-BARTON

BI374s Advanced Neurobiology An in-depth discussion of the principles and current research in various fields of neurobiology at the molecular and cellular level through extensive review of primary literature. Topics include neurodevelopment (axon guidance), regeneration (stem cells), disorders (neurodegenerative and neuropsychiatric), and behavior. Students will discuss and present a topic of their choice and interest. The (optional) lab will involve experiments with fluorescence microscopy, neuronal morphology through GFP labeling, animal models of olfaction, paralysis, neurodegenerative diseases, and an independent research project. *Prerequisite:* Biology 274. *Three or four credit hours.* AHMAD

BI378s Molecular Biology Listed as Biochemistry 378. *Four credit hours.* JOHNSON

[BI379] Advanced Genetics and Genomics Study of advanced genetics with an emphasis on genomics and bioinformatic approaches to addressing biological questions. Investigation of current issues in comparative genomics, proteomics, computational biology, and gene expression, learning how to use online genomics tools and databases for computational analyses. The relationships between genome research and biomedicine will be discussed. In the laboratory, students will design and carry out an experiment to investigate gene function using state-of-the-art molecular genetic techniques and will present this work to the class. *Prerequisite:* Biology 279 with lab. *Four credit hours.*

BI382f Ecological Modeling Examines the development and application of models that form the basis for theoretical ecology. Students will use model-building approaches to inform their understanding of fundamental ecological principles, exploring topics such as spatial and temporal dynamics of populations, competition and predation, and community composition and diversity. They will also learn statistical approaches for modeling data using large-scale, long-term datasets. Includes a lab in which students combine modeling with empirical approaches to generate and test predictions in population and community ecology. *Prerequisite:* Environmental Studies or Biology 271, and Mathematics 212. *Four credit hours.* COLLINS

BI392s The Cell Cycle and Cancer A detailed investigation of the cellular mechanisms that control the cell cycle and how defects in these systems lead to cancer. In addition, complexities of diagnosing, treating, and living with cancer are considered. A broad combination of detailed content provided by primary and secondary literature, student-led discussions, creative essays, and a detailed oral presentation. *Prerequisite:* Biology 164, Chemistry 142, and junior standing. *Three credit hours.* KOHN

BI398s Environmental Microbiology Students will learn how microorganisms continue to shape our Earth by exploring past and present interactions of microorganisms with the solid earth, including microbial interactions on early Earth, microbiology of extreme environments, and modern-day bio-geochemical cycles. *Prerequisite:* Biology 238 or 248. *Three credit hours.* CHILDERS

BI401f, 402s Biology Seminar Participation in selected department seminars during the fall or spring semester. Seminars will focus on student-led discussions of readings from the primary literature and will also include playing host to several outside speakers. Required of all senior biology majors. *Prerequisite:* Senior standing. *One credit hour.* FACULTY

BI452s Behavioral and Physiological Ecology Advanced study of the behavior and physiology of animals in ecological and

evolutionary contexts. Topics include how individuals adjust to environmental changes and how particular behavior patterns contribute to an animal's chances of survival and its reproductive success. Extensive review of primary literature. Lecture and laboratory. *Prerequisite:* Biology 271, 275, 357, or 373. *Four credit hours.* BEVIER

BI474j Neuroscience Research A laboratory-intensive course designed to familiarize students with modern cellular and molecular approaches to neuroscience research. Two weeks spent at the Mount Desert Island Biological Laboratory, with the rest of the time spent on campus. *Prerequisite:* Biology 274 and permission of the instructor. *Three credit hours.* TILDEN

BI483f, 484s Honors Research in Biology Research conducted under the guidance of a faculty member and focused on an approved topic leading to the writing of an honors thesis and an oral presentation of the research results. *Prerequisite:* Senior standing as a biology major and permission of the department chair. *One to four credit hours.* FACULTY

BI491f, 492s Independent Study Individual projects in areas where the student has demonstrated the interest and competence necessary for independent work. *Prerequisite:* Permission of a faculty sponsor. *One to four credit hours.* FACULTY

BI493f Problems in Environmental Science Listed as Environmental Studies 494. *Five credit hours.* SCHMIDT