BIOLOGY

Chair, Associate Professor Lynn Hannum
Associate Chair, Associate Professor Syed Tariq Ahmad
Professors Catherine Bevier, Frank Fekete, Russell Johnson, Judy Stone, and W. Herbert Wilson Jr.; Associate Professors Syed Tariq Ahmad, Lynn Hannum, and Andrea Tilden; Assistant Professors David Angeli, Joshua Martin, Christopher Moore, Suegene Noh, and Ronald Peck; Visiting Assistant Professors Susan Childers, Thomas Klepach, Allison Moloney and Johanna van Oers; Senior Laboratory Instructors Tina Beachy, Scott Guay and Sarah Staffiere; Laboratory Instructors I Lyndell Bade and April Chiriboga; Research Scientists Paul Berkner, Bets Brown, Susan Childers, Phillip de Maynadier, William Feero, Josh Kavaler, and Ross Zaftone; Research Associate Louis Bevier

The Biology Department ensures that students gain exposure to the breadth of biological science and become proficient in the methods of scientific inquiry. The curriculum emphasizes the study of plants, animals, and microorganisms from the molecular to the ecosystem level. Through laboratory and field experiences and the opportunity to carry out original research, students gain proficiency in gathering, interpreting, and communicating scientific knowledge. Department graduates continue their education in all fields of biology and in professional schools, and they pursue careers in scientific research, biotechnology, education, agriculture, medicine, and public health.

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, and with external partners including the Jackson Laboratory and the Bigelow Laboratory for Ocean Sciences.

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 on the interdisciplinary field 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 biomedical research, genomics, and molecular biology; others have attended medical school or graduate school in various 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 computational biology 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 obtain employment or 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, veterinary, or other health professions must carefully plan how to fit prerequisite courses in other disciplines into their course of study. Students interested in health professions should, in addition to working closely with their major advisor, consult regularly with the health professions advisor in the Career Center.

General Requirements for All Major Programs (Except Computational Biology)

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 32 credit hours must be taken for the major, including at least six courses with a laboratory component and at least two courses at the 300 level or above. 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 may 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-two hours of course work in biology (excluding Advanced Placement credit), including Biology 163, 164, one course with laboratory in field biology (Biology 211, 237, 259, 271, 277, 334, Environmental Studies 358), and one course with laboratory in cellular biology (Biology 225, 227, 248, 274, 279, 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, 152, Mathematics 122, 162, 253, Statistics 212.

Requirements for the Concentration in Ecology and Evolution

Thirty-two hours of course work in biology (excluding Advanced Placement credit), including Biology 163, 164, 271, 320 (with or without the lab), and 382; one relevant summer research experience or research-based course (Biology 354, 373 with lab, 451, 483/484*);
Environmental Studies 343 or 494); and one course with laboratory in cellular biology (Biology 225, 227, 248, 274, 279, 367). Seniors must enroll in Biology 401 or 402. In addition, Chemistry 141, 142; Mathematics 121 or 161 or equivalent, and Statistics 212; and one course selected from the following: Biology 211, 237, 259, 276, 277, 334, 376; Environmental Studies 244, 276, 356, or 358; Geology 141.

*with an approved topic

Requirements for the Concentration in Cell and Molecular Biology/Biochemistry

Thirty-two hours of course work in biology (excluding Advanced Placement credit), including Biology 163, 164, 279, 367 (with laboratory), 368 (with laboratory), 378, and one course with laboratory in field biology (Biology 211, 237, 259, 271, 277, 334, Environmental Studies 358). 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, 152, Mathematics 122, 162, 253, Statistics 212; and one course with laboratory chosen from Biology 225, 248, 274, Chemistry 331, or Physics 145.

Requirements for the Concentration in Neuroscience

Thirty-two hours of course work in biology (excluding Advanced Placement credit), including Biology 163, 164, 279, and one course with laboratory in field biology (Biology 211, 237, 259, 271, 277, 334, Environmental Studies 358). 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, 152, Mathematics 122, 162, 253, Statistics 212; Psychology 111; two courses from the following: Psychology 232, 233, 236, 275, 374, 375 (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).

Requirements for the Major in Computational Biology

Students will design an integrative course of study in collaboration with academic advisors from the Biology and Computer Science departments. Foundational courses (may be satisfied by AP or other placement exams): Biology 163 and 164, Computer Science 151 or 152, and Mathematics 121. In addition, Biology 278 and 279, and one of 320, 371, or 378; Computer Science 231 and 251, and two of 333, 341, 361, 365, or 441; Statistics 212; and two additional courses in Biology, Computer Science, or Statistics at the 300-level or above, chosen in consultation with the advisor.

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 Liberal Arts 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

**BI101f  First-Year Seminar in Biology**  Students will meet with members of the faculty in the Department of Biology to discuss faculty research programs. Students will be expected to read papers from the primary literature to prepare for class. Introduces a wide range of subdisciplines within biology along with the associated research methods. Open to first-year students who also enroll in a biology class during their first year. Nongraded.  One credit hour.  HANNUM

**BI111j  Emergency Medical Technician Training**  Prepares students to administer out-of-hospital emergency medical care. Provides practice in patient assessment, airway management, CPR, automatic external defibrillation, oxygen delivery, dressings and hemorrhage control, splinting, spinal immobilization, childbirth, lifting and moving patients, and extrication. Also includes clinical experience in a hospital emergency department and/or ambulance service. Provides eligibility to sit the National Registry of EMT and State of Maine licensure examination. Meets the requirements outlined in the National Highway Transportation Administration EMT Education Standards and Maine EMS EMT Curriculum. Supplemental cost of $770 covers materials, uniform shirt, and a required CPR course, but not text and workbook. Students are required to wear the uniform shirt and dark blue chinos to class. In addition, there is a national registry fee of $80. Nongraded. Cannot be counted toward the biology majors.  Two credit hours.  BERKNER

**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. Cannot be counted toward the biology major.  Prerequisite: Senior standing.  Three credit hours.  N.  MARSHALL
[BI131] 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, interrelationships in ecosystems, conservation science, evolution, and speciation. Additionally, explores 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. Four credit hours. N, Lb.

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. Lecture and laboratory. Cannot be counted toward the biology majors. Four credit hours. N, Lb. FEKETE

[BI152] Human-Microbe Connection Presents an overview of the diversity of microorganisms and the impacts they have on our daily lives and activities. The role of microbes in medicine and human health, the food industry, and sustaining our environment will be discussed. Students will gain a basic understanding of what microorganisms are, their activities, and how they function in medical, practical, and environmental applications. They will learn fundamental concepts related to medical, food, and environmental microbiology that will help them make reasoned decisions throughout their lives. Cannot be counted toward the biology majors. Students with prior credit for Biology 133 or 248 may not receive credit for Biology 152. Three credit hours. N.

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, MARTIN, PECK

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. BEVIER, WILSON

[BI176] Exercise Physiology Listed as Biochemistry 176. Three credit hours. N, Lb.

BI197Af Biochemistry of Food Explores the biochemistry of food, including an introduction to the biomolecular families of food, the basic physiology of the gastrointestinal system, fundamental nutritional metabolism, biochemical transformations in raw, cooked, and otherwise processed foods, an overview of modern biotechnology as it relates to food production, and a survey of the biochemical connections between human diet, health, and disease. Students will produce podcasts on a relevant topic of their choice. Lecture and laboratory. Significant civic engagement component built into lecture and lab activities. Cannot be counted towards the biology major. Four credit hours. N, Lb. KLEPACH

[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. Lecture and laboratory. Prerequisite: Biology 164. Four credit hours.

[BI214] Plant Physiology The essential mechanisms of plant function. Emphasis will be placed on plant water relations and the regulation of plant growth and development by hormones and environmental signals. These physiological processes will be addressed in the context of both natural and agricultural 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.

[BI223] Science and Baseball Explores principles of statistics, probability, evolution, animal behavior, physiology, psychology, and physics using examples drawn from baseball. Statistics problem sets, discussions of assigned readings, and posting viewpoints on controversial topics on a class blog will allow students to improve their critical analysis and scientific thinking skills. Credit cannot be earned for both this course and Biology 123. Cannot be counted toward the biology majors. Prerequisite: Sophomore or higher standing. Four credit hours. N.

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. Prerequisite: Biology 164. Three credit hours. HANNUM
Bi227f  Cell Biology  All living organisms consist of at least one cell. A comprehensive overview of eukaryotic cell biology, covering topics such as metabolism, cellular structure, cell-to-cell communication, and gene regulation. Learning strategies will include lecture, discussion, and small group work. Laboratory exercises will be aimed at familiarizing students with techniques commonly encountered in cell biology research labs, including cell culture, microscopy, flow cytometry, and mathematical modeling. Lecture and laboratory. Prerequisite: Biology 164.  Four credit hours.  MOLONEY

Bi237i  Woody Plants  Exploration of the processes that determine forest structure and species composition. Students will learn about the abiotic and biotic features of forest sites and the ways in which physiology and life history of individual tree species predict their responses to climate, soil, and land use history. In field-based laboratories, students will learn how to interpret forests and to describe how human actions interact with other factors to shape our forested environment. Prerequisite: Biology 164.  Four credit hours.

Bi240f  Microbes in the Environment  An exploration of the function of microorganisms in natural and man-made ecosystems. Broad themes include plant and animal symbioses and diseases, element cycling, remediation of pollutants, and global climate change. Students gain an in-depth understanding of how to identify, collect, and quantify environmental microbes and microbial activities. They explore cutting-edge research, applying knowledge of microbes and microbial processes to advance global efforts focused on managing food production, reclaiming contaminated soils and water, and modeling climate change. Previously listed as Bi298 (2015). Prerequisite: Biology 131 or 164.  Three credit hours.  N.

Bi244s  Marine Communities  Listed as Environmental Studies 244.  Four credit hours.  N.  MCCLENACHAN

Bi246f  Parasitology  A study of parasitic organisms with a focus on eukaryotic parasites of animals. General principles including advantages and challenges of the parasitic life strategy will be introduced, then applied to parasites from a variety of phylogenetic backgrounds with a particular emphasis on medically relevant organisms. Current research in the field will be discussed, highlighting articles that address possible preventive and therapeutic approaches to parasites that cause human disease. Prerequisite: Biology 164.  Three credit hours.  PECK

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. Lecture and laboratory. Credit cannot be earned for both this course and Biology 238. Prerequisite: Biology 164 (prerequisite), Chemistry 131, 141, 142, or 145 (may be taken concurrently).  Four credit hours.  FEKETE

Bi259j  Plants of the Tropics  An intensive study of tropical plant biology taught in Costa Rica during the January term. Emphasis is on the physiology, ecology, and conservation of plants in both wild and agricultural settings, and the importance of plants for human cultures in tropical Latin America. We 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 complete a field research project during the final week. Students must cover expenses of approximately $2,300. Limited scholarship funds may be available. Prerequisite: Biology 164 and permission of the instructor.  Three credit hours.

Bi265j  Introduction to Human Anatomy and Physiology  Designed for students interested in health professions (e.g., physician, nurse, dentist, allied health) 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. Lecture and laboratory. Significant civic engagement component built into lecture and lab activities. Students cannot earn credit for this course if they have previously taken Biology 275. Prerequisite: Biology 131 or 163 or equivalent.  Three credit hours.  N.  KLEPACH

Bi271f  Introduction to Ecology  Ecology is the study of interactions among organisms and their environment. Studying these interactions provides us with the theoretical foundation for understanding many of the most pressing environmental problems. This course will examine ecological interactions at a wide range of scales from individuals, through populations and communities, to ecosystems. We will study how these interactions produce the patterns and processes we observe in biomes around the world. In the field-based laboratory, we will generate hypotheses, develop experimental designs, and apply statistical analyses to ecological data, while gaining first-hand familiarity with local ecological communities. Previously listed as Environmental Studies 271. Prerequisite: Biology 164.  Four credit hours.  N, Lb.  BECKNELL, MOORE

Bi274fs  Neurobiology  Exploration 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 involves 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. Lecture and optional laboratory. Prerequisite: Biology 164. Three or four credit hours. AHMAD, MARTIN

**BI275s  Human Physiology** A study of human homeostasis, organ system function, and mechanisms of disease. Topics include tissue types, endocrine function, central, peripheral and autonomic nervous systems, cardiovascular, respiratory and gastrointestinal systems, and renal physiology. Lecture and laboratory. Significant oral presentation and civic engagement component built into lecture activities. Students cannot earn credit for this course if they have previously taken Biology 265 or Biochemistry 362. Prerequisite: Biology 164. Four credit hours. KLEPACH

**[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.

**BI277f  Vertebrate Natural History** A study of the vertebrates with emphasis on natural history, evolutionary relationships, adaptations, functional anatomy, and conservation. Features species found in New England, and addresses specific questions about the distribution and abundance of vertebrates across a range of habitat types. In the primarily field-based laboratory, we will learn and use wildlife techniques to identify and study local vertebrates in their natural environments. Previously listed as Biology 297 (Fall 2014). Prerequisite: Biology 131 or 164. Four credit hours. BEVIER

**BI278f  Genomics** The genomics era is producing vast quantities of data that are revolutionizing our understanding of evolution, disease, and variation. Publicly accessible and rapidly expanding databases now hold entire genomes and transcriptomes for numerous species. We will take a computational bioinformatics approach to exploring this data, from single genes and proteins to entire genomes. We will explore the technologies used to produce the data, as well as other current, emerging, and controversial genomic technologies. While the laboratory is computer based, no prior computational experience is necessary. Prerequisite: Biology 164. Four credit hours. NOH

**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. ANGELINI, VAN OERS

**BI282j  Extreme Climate Change in the Gulf of Maine** The Gulf of Maine has undergone extreme climate-related changes, resulting in changes to marine population structure and instances of harmful, toxic, or otherwise undesirable species. We will explore the causes of, impacts of, and potential adaptations to climate change in the Gulf of Maine. Includes a weeklong experiment at Bigelow Laboratory for Ocean Sciences using indoor seawater mesocosms to simulate rapid ecosystem change and to investigate the biological response of marine microbes. Students will be introduced to traditional and modern oceanographic data collection techniques for estimating the impacts of climate change. Previously offered as Biology 297B (Jan Plan 2016). Prerequisite: Biology 164. Three credit hours. COUNTWAY

**BI286f  Global Change Ecology** Listed as Environmental Studies 276. Four credit hours. BRUESEWITZ

**BI297j  Biology of Vaccines** Infectious disease has decimated populations throughout human history. The success of pathogen-specific vaccines evolved commensurate with our understanding of themammalian protective immune responses. This course focuses on the science of vaccinology and the development of safe and efficacious vaccines. Goals are to understand how vaccines work, to gain a practical understanding of the human immune response, and to learn the issues involved in developing new vaccines against known and emerging pathogens. Students cannot earn credit for both this course and Biology 325. Prerequisite: Biology 164. Three credit hours. HOBART

**[BI306]  Topics in Epidemiology** Listed as Statistics 306. Four credit hours.

**BI319f  Conservation Biology** Listed as Environmental Studies 319. Four credit hours. NYHUS

**BI320s  Evolutionary Analysis** Focuses on the mechanisms that drive evolutionary change and on the long-term consequences of these mechanisms. We develop analytical techniques to infer the causes and consequences of genetic variation within species. These techniques can be applied to any species, including those of particular relevance to humans such as agricultural species, introduced invasive species, species of conservation concern, and parasites. Students will develop a grant proposal in the form of a National Science Foundation Graduate Research Fellowship. Prerequisite: Biology 164 and junior or higher standing. Three credit hours. NOH

**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 optional laboratory, when offered, earns a fourth credit and focuses on enhancing students' laboratory skills through a semester-long research project. *Prerequisite:* Biology 225.  *Three credit hours.*  HANNUM

**[BI327]**  **The Biology of Cancer**  Cancer is the leading cause of death in Americans under the age of 85. Annually, the disease costs the United States more than $200 billion. Students will examine the public health impacts of cancer, the biological basis of the disease, and current advances in diagnostics and therapeutics. Class sessions will include lecture, discussion, and presentation, with focus on the analysis and critique of scientific research. During an optional discussion section (for a fourth credit), students will survey different types of science writing dealing with cancer, from popular press to specialized, professional literature. Previously offered as Biology 398 (Spring 2014).  *Prerequisite:* One 200-level biology lab course (Biology 225, 227, 274, 275, or 279).  *Three or four credit hours.*  ANGELINI

**[BI332f]**  **Developmental Biology**  The study of the formation and growth of individual organisms focusing on experimental evidence from several model species. Examines developmental processes as they relate to animal structure, physiology, biochemistry and cell processes, classical and molecular genetics, and evolution. Students learn the history and methods of developmental biology, from descriptive embryology to current molecular genetic tools, and gain experience using primary literature sources for writing in scientific format. The optional lab section requires students to make careful observation, develop a hypothesis, and design experiments to address a novel question regarding development.  *Prerequisite:* Biology 225, 227, or 327, or Biochemistry 362 or 367.  *Three credit hours.*  BECKNELL

**[BI334]**  **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. 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.*  BECKNELL

**[BI338s]**  **Forest Ecosystems**  Listed as Environmental Science 338.  *Four credit hours.*  N, Lb.  BECKNELL  

**[BI345]**  **Advanced Genomics**  Designed to enable students to become familiar with the various types of genomic data used to examine biological phenomena. Students will become proficient at critically examining the application and interpretation of genomic data, including closely and distantly related genomes, populations of genomes, and metagenomes from environmental samples.  *Prerequisite:*  Biology 278.  *Three credit hours.*  ANGELINI

**[BI348s]**  **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, and Chemistry 131, 145, 147, or 141 and 142 (may be taken concurrently).  *Three credit hours.*  FEKETE

**[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. Optional fourth credit for laboratory.  *Prerequisite:*  Junior standing, a W1 course, Biology 164, and either Biology 263 or Environmental Studies 271.  *Three or four credit hours.*  W3.

**[BI356s]**  **Aquatic Ecology**  Listed as Environmental Studies 356.  *Four credit hours.*  BRUESEWITZ

**[BI358]**  **Ecological Field Study in Moorea**  Listed as Environmental Studies 358.  *Three credit hours.*  BRUESEWITZ

**[BI362f]**  **Medical Biochemistry**  Listed as Biochemistry 362.  *Four credit hours.*  MOLOONEY

**[BI367]**  **Biochemistry of the Cell I**  Listed as Biochemistry 367.  *Four or five credit hours.*  BRUESEWITZ

**[BI368s]**  **Biochemistry of the Cell II**  Listed as Biochemistry 368.  *Prerequisite:*  Biochemistry 367. Biochemistry 367 laboratory is prerequisite to Biology 368 laboratory.  *Four or five credit hours.*  RICE

**[BI371]**  **Applied Biomedical Genomics**  A computation-intensive course designed to familiarize students with modern molecular, genomic, and bioinformatic approaches to biomedical research. Students will use next-generation sequencing platforms to investigate mammalian or cancer genomes, and will be exposed to clinically relevant research. One to two weeks spent at an off-campus facility (Jackson Laboratory, Mount Desert Island Biological Laboratory), with the rest of the time spent on campus. No prior computation required.  *Prerequisite:*  Junior standing.  *Four or five credit hours.*  RICE
experience necessary. Nongraded. Previously offered as BI397 (Jan Plan 2015). No extra student cost. Prerequisite: A 200-level biology course. Three credit hours. TILDEN

BI373s Animal Behavior An examination of animal behavior from a biological perspective. Topics include the control, development, function, and evolution of behavior. Prerequisite: Biology 164 and junior standing. Three credit hours. BEVIER

BI374fs 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. Prerequisite: Biology 274. Four or four credit hours. AHMAD, MARTIN

BI375 Animal Physiology: Environment and Adaptation A study of the diversity of animal function, from organisms to molecules, with an emphasis on adaptations to the environment. Physical and chemical principles and their application to physiological processes will be emphasized. The optional laboratory, when offered, earns a fourth credit and is an in silico exploration of quantitative concepts, genomics, proteomics, and bioinformatics. Prerequisite: A 200-level biology course. Three credit hours.

BI376s Development, Genes, and Evolution Evolutionary developmental biology investigates the intersections of development, genetics, and evolution. We will present an overview of these subjects, followed by ideas and methodologies that emerge from their synthesis. Topics include plasticity, polyphenism, gene networks, constraint, parallel evolution, evolvability, among others. Students will (1) become familiar with the history and evidence of these concepts, (2) understand the arguments for and criticisms of their roles in evolution, (3) practice discussion, peer review, and presentation of these and related topics. Prerequisite: Biology 279. Three credit hours. ANGELINI

BI378s Molecular Biology Listed as Biochemistry 378. Four credit hours. VAN OERS

BI382s 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: Biology 263 or 271 or Environmental Studies 271, and Mathematics 212 or Statistics 212. Four credit hours. MOORE

BI397j Synthetic Biology Introduces students to the latest advances in synthetic biology, genome editing, and genetic engineering. We will explore these technical advances, study practical examples, and use a marine protozoan parasite as a model system. We will also discuss and debate the role that genetic engineering is playing and ought to be playing to benefit society. Prerequisite: Biology 279. Three credit hours. FERNANDEZ-ROBLEDO

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

BI451s Applied and Environmental Microbiology Students will develop and conduct an independent research project to explore microbes and how they affect, and are affected by, their environments. A particular focus will be learning about and employing modern biochemical and genetic techniques to analyze microbes in extreme environments. Students will analyze scientific literature, conduct experiments, and interpret data. Results and data analysis will be disseminated in the form of oral and written reports. Prerequisite: Biology 248 or 279. Four credit hours. PECK

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

BI483Jj Honors Research in Biology Noncredit. ANGELINI

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

BI494f Problems in Environmental Science Listed as Environmental Studies 494. Five credit hours. BRUESEWITZ