Biological Sciences

The major and minor in biological sciences are administered by the Department of Biological Sciences: Professors Barry, Fink, Knight, Rachootin, Woodard; Associate Professors Bacon (*chair*), Brodie, Frary, Gillis, Hoopes, Stranford; Visiting Assistant Professors Pope, Rounds, Sacchetti.

Contact Persons

Nancy Lech, *senior administrative assistant*
Ellie Perrier, *administrative assistant*
Sarah Bacon, *chair*

Our major provides many ways of looking at living things. Core courses introduce complementary perspectives on life. Advanced courses bring students to the edge of what we know, and provide a foundation for original work.

Requirements for the Major

Credits

- A minimum of 32 credits in biological sciences

Courses

Required courses in biological sciences:

- Biology:
- 145, Introductory Biology (various types) or
- 160, Integrated Introduction to Biology and Chemistry
- 200, Introductory Biology II (prereq. Biology 145 or 160)
- 210, Genetics and Molecular Biology (prereq. Biology 200; Chemistry 101; Chemistry 101 may be taken concurrently with Biology 210)
- 220, Cell Biology (prereq. Biology 200, Chemistry 201; Chemistry 201 may be taken concurrently with Biology 220)
- 223, Ecology (prereq. Biology 145 or Environmental Studies 100, one semester of college or high school calculus or statistics) or
- 226, Evolution (prereq. Biology 210 or 223)
- Three additional courses (12 credits) at the 300-level in biology. At least two of these (8 credits) must be taken at Mount Holyoke, and at least two must have labs.
- Biology 295 or 395 does not count toward the minimum 32 credits in the major.

Required courses outside of biological sciences:

- General Chemistry 101 and 201
- Calculus or Statistics

Recommended courses outside of biological sciences:

- Organic Chemistry 202 and 302
- Physics
- Computer Science

Requirements for the Minor

Credits

- A minimum of 16 credits at the 200- and/or 300-level
- Biology 295 or 395 do not count toward the minimum 16 credits in the minor.

Teacher Licensure

Students interested in pursuing licensure in the field of biological sciences can combine their course work in biological sciences with a minor in education. In some instances course work in the major coincides with course work required for licensure; in other cases, it does not. For specific course requirements for licensure within the major of biological sciences, please consult your advisor or the chair of the biological sciences department. For information about the requirements for the minor in education, please consult "Teacher Licensure" in the Other Degree and Certificate Programs chapter and Ms. Lawrence in the psychology and education department. Licensure also requires a formal application as well as passing scores on the Massachusetts Test of Educator Licen-

sure (MTEL) in both the literacy component and the subject matter component. Copies of the test objectives for the MTEL are available in the biological sciences department and in the Department of Psychology and Education. Licensure application information and materials are available in the Department of Psychology and Education.

Facilities

The department's facilities include transmission, scanning electron, fluorescence, and confocal microscopes, image capture and processing equipment, a tissue culture room, a greenhouse, controlled environment chambers, molecular biology equipment, and several computer-equipped teaching laboratories.

Research interests of the faculty include animal behavior, anatomy, human physiology, biochemistry, biomechanics, development, ecology, evolution, immunology, microbial genetics, microbiology, neurobiology, invertebrates, plant diversity, and plant genetics.

Math and Science II-B Distribution Credit in Biology

Departmental courses with laboratories satisfy the Group II-B distribution requirement. Any off-campus biology course taken to satisfy the Group II-B requirement must have a laboratory component; courses that are introductions to professional specialties dependent on biology (e.g., nutrition or horticulture), or are addressed to technical certification (e.g., emergency medical technician), do not carry Group II-B credit.

Course Offerings

The department offers introductory biology in two different forms. The Biology 145 courses are a liberal arts introduction to biology in a small-class atmosphere. Different sections emphasize different topics. Biology 160, which must be taken concurrently with Chemistry 160, offers an integrated introduction to biology and chemistry. Either one is an appropriate choice for students who are considering a major in biology, biochemistry, environmental studies, or neuroscience and behavior. Completion of any of these courses will allow a student to enroll in Biology 200. Students are welcome to email the instructors to find out more about any of the introductory courses.

145fs Introductory Biology

Fall 2011

145f(1) Nature Harmoniously Confused
(First-year seminar) Most organisms are notably unlike ourselves—a tapestry of bacteria, protozoans, algae, and, off by themselves, the plants, fungi, and other animals. We will survey the whole range of organisms, especially those in the ponds and forests of our campus. Labs will start in the field, offering many opportunities for wet or muddy work. The class is addressed to students intrigued by natural history; it might be useful for students interested in further study of the environment.
Meets Science and Math II-B requirement
S. Rachootin
Prereq. fy; 4 credits

145f(2) Comparative Vertebrate Physiology
This course will explore the structure and function of major physiological systems in vertebrate animals. Of particular interest will be identifying the solutions that different animals have evolved to deal with similar problems (e.g., how do fish gills and bird lungs function in gas exchange?).
Meets Science and Math II-B requirement
G. Gillis
4 credits

145f(3) A Green World
(First-year seminar) This course examines the plant life in the woods and fields around us, the exotic plants in our greenhouses, and the plants we depend on for food. We will study plants living in surprising circumstances, settling into winter, escaping from gardens, reclaiming farmland, cooperating with fungi and insects, and fighting for their lives. We will find that plants challenge some conventional, animal-based assumptions about what matters to living things. In labs, students will seek to answer their questions about how plants grow in nature, by studying plant structure and function, ecology, and evolution.

Meets Science and Math II-B requirement
A. Frary
Prereq. fy; 4 credits

145f(4) Diversity of Life
We will survey the great diversity of life on earth from the archae-bacteria that live in hot sulfur springs to giant sequoia trees to singing birds. Labs will explore biological diversity via collecting trips around campus as well as laboratory experiments and will introduce students to data collection, manipulation, and analysis.
Meets Science and Math II-B requirement
S. Barry
24 first years and 12 sophomores; 4 credits

145f(5) Complexity of Life
Planet Earth is inhabited by a variety of organisms, ranging from simple viruses to complex organisms, humans, and plants. We will examine the vast diversity of life forms surrounding us and how these organisms have evolved. We will also examine the essential biological processes and systems that sustain life. Using all resources available, such as laboratory experiments, articles, books, and the World Wide Web, students will gain practical experience and understand how scientific results are collected, analyzed, and presented.
Meets Science and Math II-B requirement
P. Sacchetti
4 credits

**145f(7) Complexity and Diversity of Life On Earth*
Planet Earth is inhabited by a variety of organisms, ranging from simple viruses to complex organisms, humans, and plants. We will examine the vast diversity of life forms surrounding us and how these organisms have evolved. We will also examine the essential biological processes and systems that sustain life. Using all resources available, such as laboratory experiments, articles, books, and the World Wide Web, students will gain practical experience and understand how scientific results are collected, analyzed, and presented.
Meets Science and Math II-B requirement
P. Sacchetti
4 credits

**145f(8) Organismal Biology*
This course encompasses a broad range of concepts central to our understanding of how organisms function and evolve. We will investigate important biological processes, such as photosynthesis and metabolism, and of systems, such as the cardiovascular and immune systems. We will also take a holistic view of biology and use our newly acquired knowledge to explore such diverse topics as: the evolution of infectious diseases, the consequences of development and design on the evolution of organisms, and how the physiology and behavior of animals might affect their responses to global climate change.
Meets Science and Math II-B requirement
R. Brodie
Prereq. fy; 4 credits

Spring 2012

**145s(14) Biology in the Age of the Human Genome Project*
(First-year seminar; writing-intensive course)
The Human Genome Project is leading to great advances in our understanding of the human body and in our ability to manipulate our own genetic information. We will focus on the science behind the Human Genome Project, and the ways in which it will change our lives. This course will also serve as a general introductory biology course for biology majors as well as nonmajors. We will read articles and books, and make use of the World Wide Web.
Meets Science and Math II-B requirement
C. Woodard
4 credits

160f Integrated Introduction to Biology and Chemistry
This 8-credit course serves as a gateway to both the biology and chemistry core curricula. The course introduces and develops fundamental concepts in chemistry while also exploring the diverse range of strategies adopted by living systems to survive in different environments. This course prepares students for further study in chemistry (Chemistry 201) and/or biology (Biology 200). Students must register for both Biology 160 and Chemistry 160 as well as a single lab section (listed under Chemistry 160L). Recommended for students interested in com-

pleting pre-health requirements or advanced study in biochemistry or neuroscience.
Meets Science and Math II-B requirement
R. Brodie, M. Nunez
Prereq. fy; Students must co-enroll in Biology 160 and Chemistry 160 for a total of 8 credits; three 50 minute lectures, three 75 minute lectures, and one three-hour laboratory per week.; 4 credits

200s Introductory Biology II: How Organisms Develop
An overview of cells to tissues to organisms. Cellular components, the role of the nucleus, cell reproduction, and meiosis will be examined as part of our study of gamete production, fertilization, embryology, and development in an invertebrate (sea urchins), a vertebrate (chick), a fern, and a flowering plant. The basic molecular biology of DNA, RNA, and protein synthesis will be presented and examined in the context of building a fly embryo and a flower.
Meets Science and Math II-B requirement
R. Fink, A. Frary
Prereq. Biological Sciences 145, 146, or 160; 4 credits

206s Local Flora
Offers plant identification and natural history, emphasizing native and introduced trees, and wildflowers. On- and off-campus field trips.
Does not meet a distribution requirement
A. Frary
Prereq. 4 credits in department; 2 credits

210f Genetics and Molecular Biology
A comprehensive study of the fundamental principles of classical and molecular genetics. Major topics include transmission genetics, gene linkage and mapping, molecular approaches to genetic analysis, genetic engineering, gene therapy, developmental genetics, quantitative inheritance.
Meets Science and Math II-B requirement
J. Knight, C. Woodard
Prereq. Biological Sciences 200, Chemistry 101 must also be taken prior to or as a co-requisite to this course; 4 credits

220s Cell Biology
This course undertakes an integrated study of the processes and structures that define life at the cellular level. We will consider the molecular and supramolecular organization of membranes, cytoskeleton, and organelles in the context of the physical and chemical principles governing their assembly, and their participation in phenomena such as the capture and transformation of energy, catalysis, transport, motility, signal transduction, and maintenance of cytoplasmic organization. The laboratory portion of this course illustrates and analyzes these phenomena through selected optical and biochemical approaches.
Meets Science and Math II-B requirement
P. Sacchetti
Prereq. Biological Sciences 200, Chemistry 201 (can be taken concurrently); 4 credits

223f Ecology
This course will cover the fundamental factors controlling the distribution and abundance of organisms, including interactions with the abiotic environment, fitness and natural selection, population growth and dynamics, species interactions, community dynamics, and diversity. We will address variation across space and time. The course will combine observational, experimental, and mathematical approaches to some of the applications of ecological theory, including conservation, disease dynamics, and biological control.
Meets Science and Math II-B requirement
The department
Prereq. An MHC Biology class or Environmental Studies 200 and a minimum of one semester of high school or college calculus or statistics; Biology 223 and/or Biology 226 must be taken for the Biology major; 4 credits

226s Evolution
The mechanisms of evolutionary change within populations and between species; patterns of change in space, time and form; and the origin of adaptations. These approaches make sense of the diversity of life. Then we turn to the evolution of developmental pathways, as a way of approaching the unity of life.
Meets Science and Math II-B requirement
S. Rachootin
Prereq. Biological Sciences 210 or 223; 4 credits

295fs Independent Study
Does not meet a distribution requirement

The department
Prereq. soph, permission of instructor; Note: Any student conducting an independent laboratory research project for course credit in a department, program, or laboratory covered by the College's chemical hygiene plan must participate in a safety training session before beginning research. Course credit will not be granted to students who do not receive safety training. See department for requirements.; 1-4 credits

301s Stem Cells and Regenerative Medicine: Past, Present, and Future
(Speaking-intensive course) This course will look at the current state of mammalian cloning and the debates about human stem cell research, reading from primary literature. We will study adult, embryonic, and induced pluripotent stem cells. We will discuss the legal, ethical, and moral implications of using these cells in medical therapies, and each member of the class will participate in a staged debate on these issues for an introductory biology class. Pending funding, we may travel to Washington, D.C.
Does not meet a distribution requirement
R. Fink
Prereq. permission of instructor; 2 credits

302f Molecular Evolution
This course examines the dynamics of evolutionary change at the molecular level, the effects of various molecular mechanisms on the structure and function of genes and genomes, and the methodology involved in dealing with molecular data from an evolutionary perspective. Lab work will be devoted to learning ways to analyze DNA sequence data and to create and evaluate trees that use molecular data.
Meets Science and Math II-B requirement
A. Frary
Prereq. Biological Sciences 210 and 226; 4 credits

303f Microbial Genetics
(Speaking-intensive course) Studies at the molecular level of various aspects of genetics, as expressed in bacterial and viral systems. Topics include patterns and mechanisms of replication, recombination, repair, and mutation of DNA; regulation of gene activity; gene-protein relationships; and genetic engineering. The fourth hour will follow a "journal club" format with student presentations.
Does not meet a distribution requirement
J. Knight
Prereq. Biological Sciences 210, and either 220 or 311; 4 credits

305f Cellular and Molecular Aspects of Development
(Speaking-intensive course) Examines the roles of cellular movement and cellular interaction in the development of multicellular organisms. Topics include cell recognition and adhesion during morphogenesis, the importance of extracellular matrices, and current theories of embryonic pattern formation. Self-designed laboratories include techniques such as microsurgery and time-lapse video microscopy using a wide variety of embryos and cell types.
Meets Science and Math II-B requirement
R. Fink
Prereq. Biological Sciences 200, 210, and 220; 4 credits

308s Darwin
(Writing-intensive course; Same as History 361s(01)) This course looks at the scientific content and intellectual context of Darwin's theory of evolution - his facts, metaphors, hypotheses, and philosophical assumptions. Readings from Darwin and his sources, and examination of the organisms he studied. A background in eighteenth- and nineteenth-century history or whole organism biology is recommended.
Meets Humanities I-B requirement
S. Rachootin
Prereq. Biological Sciences 226 or 4 credits in history; 4 credits

310f Invertebrate Zoology
This course looks at the evolutionary relations of the profoundly different groups of animals in light of their structure, development, and fossil history. Emphasizes exceptional organisms that prove - and disprove - biological rules. Themes include coloniality, asexual reproduction, metamorphosis, and making skeletons.
Meets Science and Math II-B requirement
S. Rachootin
Prereq. Biological Sciences 226; 4 credits

311f Protein Biochemistry and Cellular Metabolism
(See Biochemistry 311; also Chemistry 311)
Meets Science and Math II-B requirement
L. Hsu
Prereq. Biological Sciences 210, Chemistry 302; 4 credits

314s Nucleic Acids Biochemistry and Molecular Biology
(Same as Biochemistry 314, Chemistry 314) This course is an in-depth examination of DNA and RNA structures and how these structures support their respective functions during replication, transcription, and translation of the genetic material. Emphasis is on the detailed mechanisms associated with each step of gene expression. Discussions incorporate many recent advances brought about by recombinant DNA technology.
Meets Science and Math II-B requirement
L. Hsu
Prereq. Biological Sciences 210, Chemistry 302, Biochemistry 311; Please sign up for this course as Biochemistry 314; 4 credits

315s Behavioral Ecology
(Writing-intensive course) In this course, students learn to view and understand animal behavior within an evolutionary context. The mechanistic side of behavior is investigated and students explore how behavioral traits originate and evolve over time. Students will integrate their knowledge of how organisms work with an appreciation of why they work the way they do. At the end of the course, students will understand basic concepts in behavioral biology and know many of the experiments that have facilitated our understanding of this field. They will be able to construct hypotheses and design experiments that address behavioral phenomena. The laboratory portion of this course is based on individual projects.
Meets Science and Math II-B requirement
R. Brodie
Prereq. 8 credits of biology at the 200 level with 223 or 226 strongly recommended; 4 credits

316f Scanning Electron Microscopy
(Same as Geology 316) Includes theory and operation of the scanning electron microscope and preparation of biological and geological materials for observation. The versatile use of the microscope will be emphasized and will include low magnification, high resolution, and back scattered (reflected) electron modes of operation as well as operation at different pressures. Energy dispersive X-ray microanalysis will be introduced.
Does not meet a distribution requirement
M. Rice
Prereq. 4 credits of biological sciences or geology course at the 200 level.; 2 credits

***318s Aquatic Biology**
(Writing-intensive course) In this course, we will focus on marine coastal and open ocean habitats as well as freshwater systems, including lakes, ponds, rivers, creeks, and wetlands. For oceans, we will explore such topics as currents, the interaction of climate and oceans, nutrient cycling and ecosystems. Our study of freshwater systems will focus on cycles, water chemistry and flora and fauna of local freshwater habitats.
Does not meet a distribution requirement
R. Brodie
Prereq. Biological Sciences 223 or 226; 4 credits

***319s Immunology**
This course will cover the cells, organs, and biochemical signals that constitute the immune system, as well as immune mechanisms for the identification and removal of foreign pathogens. Additional topics may include: autoimmunity, allergy, vaccination, transplantation, immune deficiency, and pathogen evasion strategies. Special emphasis will be placed on the human immune response, with the addition of clinical case studies and independent projects to reinforce these ideas.
Meets Science and Math II-B requirement
S. Stranford
Prereq. Biological Sciences 210 and 220; 4 credits

320f Introduction to Transmission Electron Microscopy
Basic principles of transmission electron microscopy (TEM) and potential uses in biological studies. Each student selects a project and learns the fundamentals of specimen preparation, operation of the TEM, and image acquisition. Preparation, assessment and interpretation of the resulting electron micrographs culminate in an individual portfo-

lio. Students wishing to extend their experience in other courses, including Biological Sciences 295 and 395, may enroll in this course concurrently.
Does not meet a distribution requirement
S. Lancelle, M. Rice
Prereq. Biological Sciences 220; 2 credits

321fs Conference Course
Selected topics from areas emphasized in the department according to needs of particular students. Study in small groups or by individuals.

Fall 2011

321f(A) Extreme Life
This course will focus on biological systems that push the limits of structural and physiological possibility. For example, midges flap their wings at up to 1000 Hz; bar-headed geese migrate over Mount Everest; deep-sea fish withstand pressures near 300 atmospheres; certain frogs can allow their body temperatures to drop below 0 degrees C. Through readings and discussions we will explore the diverse mechanisms that underlie how organisms reach extreme levels of performance and survive in extreme environments.
G. Gillis
Prereq. any two courses above Biological Sciences 200; 2 credits

321f(B) Advanced Topics in Vertebrate Structure and Function
This course will take a comparative approach to examine the diverse structure and function found within vertebrates. Why can an eagle fly, but not an ostrich or a dog? Focus will be placed on understanding the specializations in skeletal, muscular, and sensory systems within the context of the ecology and behavior of the organism. These topics will be approached with the ultimate goal of understanding the evolutionary significance of vertebrate diversity. The course will include discussions of examples from the primary literature, comparative dissections, and observation of prepared specimens.
L. Macesic
Prereq. two courses above Biological Sciences 200; 4 credits

321f(C) Art, Music, and the Brain
Art and music are a part of all human cultures. Is there something about the human brain that drives us to paint and sing? We will examine how the brain simultaneously processes different aspects of a visual object, such as shape, color, and depth, and ask how this processing may affect the way we draw and paint. We will ask whether musical dissonance and consonance are biologically or culturally determined and whether or not different parts of the brain process different aspects of music such as pitch, melody, harmony, rhythm, and the emotional content of a musical piece.
S. Barry
Prereq. seniors with at least 8 credits at the 200 level in biology, neuroscience and behavior, studio art, art history, or music; students studying art and music are encouraged to enroll; 2 credits

321f(D) Response to Environmental Contaminants and Evolution: Communicating the Science to the Public
(Speaking- and writing-intensive course; Same as Environmental Studies 321) It is essential for scientists to communicate their findings to the public. Students will learn the basic concepts of toxicology-the study of chemical contaminants—and they will consider how toxicity is both a product and a selective force in the evolution of particular groups of organisms. They will research particular toxicants—their chemistry, physiological effects in different kinds of organisms, and the environmental and evolutionary contexts for varying susceptibilities and responses. Their findings will be the basis of articles written for online publication in the Encyclopedia of Earth, a freely available, expert-reviewed collection of articles written in non-technical language.
E. Monosson
Prereq. 8 credits from environmental studies, chemistry, biochemistry, biological sciences, or geology; or permission of instructor; 4 credits

321f(F) Molecular Physiology of the Cell
DNA and protein are just part of what makes a cell alive; without the compartments, membranes and chemical gradients of the cell they could do nothing. In this course we will ex-

plore the ways molecular biology informs our understanding of cell physiology. The course will include in-depth discussions of protein trafficking, membrane transport, cell motility, membrane potential, and respiration. We will also cover cell structure and the implications of the endosymbiotic events that have led to the eukaryotic cell's form. The laboratory section of the course will include the use of molecular techniques and fluorescence microscopy in several different cell types.
C. Rounds
Prereq. Biological Sciences 220; 4 credits

Spring 2012

321s(E) The Biology of Neurological Disorders
(Speaking-intensive course) The course will present an overview of basic anatomical, biochemical, cellular, and physiological concepts behind the organization of the nervous system. After defining how neural cells perform complex motor, sensory, and cognitive processes, we will examine the impact of developmental abnormality, chemical imbalance or injury on behavior and cognition. Students will analyze primary literature and present current data on possible causes and mechanisms underlying major neurological and degenerative disorders affecting the human population. Trauma, cell death, alterations in neurotransmission, and regeneration and other potential cures will be some of the topics covered.
P. Sacchetti
Prereq. Biological Sciences 220 and instructor permission; 2 credits

**321s(F) Emerging Infectious Diseases*
(Speaking-intensive course) What is the current state of infectious disease in the world? What are the important factors that favor the emergence or re-emergence of specific infectious agents? In this course the primary literature will be used as a foundation for discussing global emerging and re-emerging infectious diseases. As a group we will discuss the science behind these diseases and their therapies as well as some of the social aspects relevant to the present-day spread of infectious disease. Students will be expected to work in collaborative groups to present background material and original research findings relevant to these pathogens and the diseases they cause.
S. Stranford
Prereq. Biological Sciences 319; 4 credits

321s(G) Marine Conservation Biology
(Speaking- and writing-intensive course) This seminar course is based entirely on published research related to issues in marine conservation biology. It will introduce students to the latest research by leading scientists in ocean science and is highly relevant to current pressing concerns about global environmental change. The focus on primary literature and student-led discussions will help students improve their abilities to read, analyze and discuss primary literature. Those progressing to graduate school in the next year or two will feel more confident in delving into the literature surrounding their research interests and in discussing published findings and current ideas with colleagues.
R. Brodie
Prereq. Biological Sciences 223 or 226; 2 credits

**321s(H) Topics in Invasion Ecology*
(Speaking- and writing-intensive course) Invasive species have become a common focus for land managers and gardeners around the world, but is there anything fundamentally new, different, or threatening about these organisms? These new arrivals potentially increase local biodiversity and offer excellent examples of evolution and ecological interactions, but they also incite scientists to uncharacteristic value judgments. We will discuss the science and politics behind invasive species and explore the secrets of their success and the realities of their impacts. This course uses local examples, some field trips, and current literature to examine invasion ecology and other local issues in conservation biology.
M. Hoopes
Prereq. 8 credits above Biological Sciences 200 with Biological Sciences 223 or 226 or ES200; 4 credits

**321s(I) Acquired Immune Deficiency Syndrome Seminar*
(Speaking-intensive course) What is our current understanding of HIV-induced AIDS? What factors favor disease progression or re-

sistance? Are there new therapies or vaccines in the pipeline? In this course, the primary literature will be used as a foundation for discussing the global picture on AIDS and current research. As a group we will discuss the science behind this immune deficiency causing virus, therapies, research priorities and new vaccine strategies. We will also touch on the social, economic and political situations that influence rates of HIV infection and disease progression. Students will be expected to work in small groups to present background material and original research.
S. Stranford
Prereq. Biological Sciences 319 and permission of instructor; one biweekly meeting, 2 hours; 2 credits

***322s Comparative Biomechanics**
(Same as Physics 222) The main objective of this course is to explore organismal structure and function via an examination of the basic physical principles that guide how living things are constructed and how organisms interact with their environment. We will use the combined approaches of the biologist and engineer to study the impact of size on biological systems, address the implications of solid and fluid mechanics for animal design, survey different modes of animal locomotion, and learn how biologists working in diverse areas (e.g., ecology, development, evolution, and physiology) gain insight through biomechanical analyses.
Meets Science and Math II-B requirement
G. Gillis
Prereq. any two courses above Biological Sciences 200.; 4 credits

***325f Plant Diversity and Evolution**
This course explores the tremendous diversity of the plant kingdom, emphasizing the local flora. Evolutionary relationships are discussed on the basis of comparisons of reproductive biology, morphology, anatomy, cell structure, and molecular biology.
Meets Science and Math II-B requirement
A. Frary
Prereq. two of Biological Sciences 200, 210, 223 or 226, or permission of instructor; offered alternate years; 4 credits

327s Microbiology
This course is a general study of microorganisms and their activities, including form and structure; biochemical processes of growth, metabolism, and energy storage; distribution in nature and relationships to other organisms; cycles of matter; beneficial and detrimental effects on humans; and physical and chemical effects microorganisms make in their environment.
Meets Science and Math II-B requirement
J. Knight
Prereq. Biological Sciences 220 or 311 and either 210 or 223; 4 credits

***331s Theory and Application of Conservation Biology**
This course focuses on advanced ecological theory applied to conservation. Class will combine lectures and discussions of primary scientific literature. Labs will include field trips to collect observational and experimental data and indoor exercises to explore the concepts of rarity, coexistence, and population viability with mathematical models. A community-based learning aspect is possible for the final project in this class.
Meets Science and Math II-B requirement
M. Hoopes
Prereq. Biological Sciences 223 or 315; or Biological Sciences 226 with permission of instructor; or Environmental Studies 200 with permission of instructor; 4 credits

***332f Macroevolution**
This course presents the science of biological form and its relation to adaptation, development, and the modes of evolutionary change. Emphases include primary theoretical literature, whole organisms, the emerging field of evolutionary developmental biology, and major transitions in vertebrate evolution.
Meets Science and Math II-C requirement
S. Rachootin
Prereq. Biological Sciences 226; 4 credits

333s Neurobiology
We will study the electrical and chemical signals underlying the generation of the nerve impulse and synaptic transmission. We will then explore neuronal circuits underlying learning and memory, movement, and sensory perception.
Meets Science and Math II-B requirement

S. Barry
Prereq. Biological Sciences 200, 220 and 4 credits in chemistry or physics; preference given to seniors; 4 credits

334f Chemical Communication in Vertebrates
(Speaking-intensive course) How is information about physiological states coded in chemical information passed between animals? How is this information passed between organs in the body? In this course we'll read and discuss the primary literature in biology to look in depth at the nature of chemical communication in vertebrates. We will study hormones, pheromones, and neurotransmitters, the neuroendocrine mechanisms which mediate their functions in the body, and the social and physical contexts in which these signalling mechanisms operate.
Does not meet a distribution requirement
S. Bacon
Prereq. Biological Sciences 220, 223 or 226; 4 credits

335s Mammalian Anatomy
This course will examine the fundamental structural organization of the mammalian body. The lecture portion of the class will focus largely on humans, and students will gain practical insight into other mammalian systems in the laboratory.
Meets Science and Math II-B requirement
G. Gillis
Prereq. any two courses above Biological Sciences 200; course open to 12 juniors and 12 seniors; 4 credits

340s Eukaryotic Molecular Genetics
In this course we will examine the role of molecular genetic analysis in the study of phenomena such as human disease (e.g., breast cancer), animal development, and gene regulation. We will also study genetic engineering of plants and animals. There will be group discussions of original research articles and review articles.
Meets Science and Math II-B requirement
C. Woodard
Prereq. Biological Sciences 200 and 210; 4 credits

395fs Independent Study
Does not meet a distribution requirement
The department
Prereq. jr, sr, and permission of department; submit application in biological sciences office or via the department's Web site; NOTE: See safety training restrictions in description of Biological Sciences 295; 1-8 credits

Biological Sciences/Postbaccalaureate Studies Program

146f Postbaccalaureate Introductory Biology
This course is designed for students beginning the Postbaccalaureate Studies Program in preparation for pursuing graduate-level study in the health professions. Topics include basic principles of biodiversity and taxonomy, genetics, basic biochemical principles, cell structure and function, and organ systems. Laboratory exercises complement lecture material and are intended to help students develop strong skills in microscopy, familiarity with using a variety of lab equipment, experimental design and data collection and analysis, and scientific writing.
Does not meet a distribution requirement
D. Gardner
Prereq. Postbaccalaureate students only; 4 credits