

BIOLOGICAL SCIENCES

Overview and Contact Information

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.

Research interests of the faculty include animal behavior, anatomy, biomechanics, cell biology, development, ecology, evolution, gene regulation, history of biology, human physiology, invasion biology, invertebrates, microbiology, molecular ecology, neurobiology, plant diversity, plant genetics, and symbiosis.

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

See Also

- Biochemistry (<http://catalog.mtholyoke.edu/areas-study/biochemistry>)
- Bio-Mathematical Sciences (p. 1)
- Environmental Studies (<http://catalog.mtholyoke.edu/areas-study/environmental-studies>)
- Neuroscience and Behavior (<http://catalog.mtholyoke.edu/areas-study/neuroscience-behavior>)

Contact Information

Craig Woodard, Chair

Sue LaBarre, Academic Department Coordinator

106 Carr Laboratory

413-538-2149

<https://www.mtholyoke.edu/acad/biologicalsciences>

Faculty

This area of study is administered by the Department of Biological Sciences:

Rachel Fink, Professor of Biological Sciences

Amy Frary, Professor of Biological Sciences

Gary Gillis, Professor of Biological Sciences; Associate Dean of Faculty; Director of the Science Center

Martha Hoopes, Professor of Biological Sciences, Teaching Fall Only

Stan Rachootin, Professor of Biological Sciences

Craig Woodard, Christianna Smith Professor of Biological Sciences

Sarah Bacon, Associate Professor of Biological Sciences

Renae Brodie, Associate Professor of Biological Sciences

Jason Andras, Assistant Professor of Biological Sciences

Amy Camp, Assistant Professor of Biological Sciences

Patricia Brennan, Visiting Lecturer in Biological Sciences

Amanda Hamel, Visiting Lecturer in Biological Sciences

Katherine Schreiber, Visiting Lecturer in Biological Sciences

Andre White, Visiting Lecturer in Biological Sciences

Requirements for the Major

A minimum of 44 credits:

Biological Sciences:

BIOL-145	Introductory Biology ¹	4
or BIOL-160	Integrated Introduction to Biology and Chemistry	
or NEURO-100	Introduction to Neuroscience and Behavior	
BIOL-200	Introductory Biology II: How Organisms Develop	4
BIOL-230	Cell and Molecular Biology	4
BIOL-223	Ecology	4
or BIOL-226	Evolution	

Three additional courses at the 300-level in biology. ²

One additional course in Biological Sciences at any level

Required Courses Outside of Biological Sciences:

CHEM-101	General Chemistry I	4
CHEM-201	General Chemistry II	4
	One course in either calculus or statistics (e.g. MATH-101, MATH-102, MATH-203, STAT-140, STAT-240, etc.)	4

Total Credits 44

¹ BIOL-145 or any of its offerings; for example BIOL-145AB, BIOL-145GW, BIOL-145BN, or BIOL-145RG

² At least two (8 credits) of these 300-level courses must be taken at Mount Holyoke.

Additional Specifications

- A total of five courses at the 200 and 300 levels are required to be taken with labs.
- BIOL-295 and BIOL-395 do not count toward the minimum 32 credits in Biological Sciences, nor towards the five courses required to be taken with labs.

Requirements for the Minor

A minimum of 16 credits:

16 credits in Biological Sciences at the 200 and/or 300 level ¹	16
Total Credits	16

¹ BIOL-295 and BIOL-395 do not count toward the minimum 16 credits in the minor

Students interested in pursuing licensure in the field of biological sciences can combine their course work in biological sciences with a minor in education. The Massachusetts Department of Elementary and Secondary Education requires specific subject matter knowledge within the biological sciences. 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 Biology, please consult the Chair of the Biological Sciences department and your advisor. CHEM-212 is one of the recommended courses. For further information, also read the sections on the minor in education

(<http://catalog.mtholyoke.edu/areas-study/psychology-education/#minortext>) and Teacher Licensure (<http://catalog.mtholyoke.edu/areas-study/psychology-education/#teacherlicensuretextcontainer>).

Admission to the Licensure Program requires a formal application, as well as passing scores on the Massachusetts Test of Educator Licensure (MTEL) in both the literacy component and the subject matter component. Interested students should schedule an initial advising appointment with Sarah Frenette in the Department of Psychology and Education, preferably by the middle of the sophomore year, to review program requirements and assist in planning course work.

Additional information about the Licensure Program, including application materials, can be found on the Teacher Licensure Program website (<https://www.mtholyoke.edu/acad/teach>).

Course Advice

Credit in Biology towards the Science and Mathematics II Distribution Requirement

Departmental courses with laboratories satisfy the science and mathematics distribution requirement. Any off-campus biology course taken to satisfy the science and mathematics distribution 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 satisfy the science and mathematics distribution requirement.

Introductory Biology

The department offers introductory biology in two different forms. The BIOL-145 courses (e.g. BIOL-145AB, BIOL-145GW, etc.) are a liberal arts introduction to biology in a small-class atmosphere. Different sections emphasize different topics. BIOL-160, which must be taken concurrently with CHEM-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, or environmental studies. Completion of any of these courses will allow a student to enroll in BIOL-200. Students are welcome to email the instructors to find out more about any of the introductory courses.

Course Advice for Majors

Majors are strongly encouraged to complete the following course work outside of biological sciences: Organic Chemistry (CHEM-202 and CHEM-302), as well as additional coursework in Physics and Computer Science

It is not difficult to major in Biological Sciences and go off-campus for one or two semesters. For instance, other places are better situated to study tropical rain forests, deserts, or the ocean. Students have also received credit toward the biology major for course work done in French at partner universities in Montpellier. Mount Holyoke College has special relationships with several other programs abroad. It is not safe to assume, however, that biology courses taken through any program off-campus will count toward requirements of the Biology major. Before enrolling in study away from the College, it is essential to talk about your goals and specific plans with the Chair of Biology or a designated faculty member.

Course Offerings

BIOL-145 Introductory Biology

BIOL-145AB Introductory Biology: 'Animal Bodies, Animal Functions'

Fall. Credits: 4

How are animal bodies built to deal with living on earth? In this course we will study the function of cells, organs, and organ systems that have evolved to help animals make their way through the physical and chemical environment. In lecture and in lab, we will consider the common needs of animals – needs such as feeding, breathing, and reproducing – and the diverse solutions they have devised. A range of life, from unicellular organisms to animals with backbones (including mammals), will be considered.

Applies to requirement(s): Math Sciences

S. Bacon

Restrictions: This course is limited to first-year students.

Coreq: BIOL-145ABL.

BIOL-145BN Introductory Biology: 'Introduction to Biological Inquiry'

Fall. Credits: 4

This class will help students develop a basic understanding of how knowledge in biology is generated, and begin to acquire the skills necessary to conduct their own research and understand basic data analysis. Students will discuss socially relevant sciences issues with an emphasis in learning about evolution and organismal biology, as they gain experience formulating hypotheses and critically evaluating evidence.

Applies to requirement(s): Math Sciences

P. Brennan

Restrictions: This course is limited to first-year students.

Coreq: BIOL-145BNL.

BIOL-145GW Introductory Biology: 'A Green World'

Fall. Credits: 4

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.

Applies to requirement(s): Math Sciences

A. Frary

Restrictions: This course is limited to first-year students.

Coreq: BIOL-145GWL.

BIOL-145RG Introductory Biology: 'Organismal Biology'*Spring. Credits: 4*

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 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.

*Applies to requirement(s): Math Sciences**R. Brodie**Restrictions: This course is limited to first-year students.**Coreq: BIOL-145RGL.**Notes: Registration in one of the two corequisite labs is also required.***BIOL-160 Integrated Introduction to Biology and Chemistry***Fall. Credits: 4*

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 completing pre-health requirements or advanced study in biochemistry or neuroscience.

*Applies to requirement(s): Math Sciences**J. Andras, K. Broaders**Restrictions: This course is limited to first-year students.**Coreq: CHEM-160 and CHEM-160L.**Notes: 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.***BIOL-200 Introductory Biology II: How Organisms Develop***Spring. Credits: 4*

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.

*Applies to requirement(s): Math Sciences**R. Fink, A. Frary**Prereq: BIOL-145 or BIOL-160, or NEURO-100. Coreq: BIOL-200L.***BIOL-203 Teaching Children Science: College Students in the Elementary Classroom***Fall. Credits: 4*

This course is designed for science students with interests in teaching and learning with children. It will focus on research, theory and practice pertinent to science education, linking scientific information gained in college classes to children's learning of scientific phenomena. Weekly class meetings (from 1-3 hours) will include laboratory and off-site field investigations. Each student will also become a 'Science Buddy' at a local elementary school, assisting children with hands-on science experiences for at least 1 hour each week.

*Crosslisted as: EDUST-203**Applies to requirement(s): Meets No Distribution Requirement**Other Attribute(s): Community-Based Learning**R. Fink**Instructor permission required.**Prereq: One year of any college science (in any discipline), at least one lab course.***BIOL-206 Local Flora***Spring. Credits: 4*

This course offers plant identification and natural history, emphasizing native and introduced trees and wildflowers. On- and off-campus field trips.

*Applies to requirement(s): Meets No Distribution Requirement**A. Frary**Prereq: 4 credits in the department.***BIOL-220 Cell Biology***Spring. Credits: 4*

The aim of this course is to understand the fundamental unit of life—the cell—at the molecular level. We will consider the assembly and structure of cellular membranes, proteins, organelles, and the cytoskeleton, as well as their roles in cellular processes including the capture and transformation of energy, catalysis, protein sorting, motility, signal transduction, and cell-cell communication. Emphasis will be placed upon the diversity of cellular form and function and the cell biological basis for disease. The laboratory portion of this course will illustrate and analyze these phenomena through selected biochemical, genetic, and microscopy-based approaches.

*Applies to requirement(s): Math Sciences**The department**Prereq: BIOL-200 or BIOL-210, and CHEM-201. Contact the instructor for permission if you've taken BIOL-200 or BIOL-210 and want to take CHEM-201 in the same semester as BIOL-220. Coreq: BIOL-220L.**Advisory: Chemistry 201 can be taken concurrently***BIOL-223 Ecology***Fall. Credits: 4*

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.

*Applies to requirement(s): Math Sciences**M. Hoopes**Prereq: BIOL-145 or BIOL-160 and at least one semester of Calculus or Statistics. Coreq: BIOL-223L.**Notes: Biology 223 and/or Biology 226 must be taken for the Biology major.*

BIOL-226 Evolution*Spring. Credits: 4*

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.

*Applies to requirement(s): Math Sciences**S. Rachootin**Prereq: BIOL-210 or BIOL-223 or BIOL-230. Coreq: BIOL-226L.***BIOL-230 Cell and Molecular Biology***Fall. Credits: 4*

Cells are the smallest common denominator of life: the simplest organisms are single cells, while others like ourselves are composed of vast communities of cells. In this course, we will learn how cellular structure and function is orchestrated by biological molecules, most notably the genome and the proteins it encodes. Topics will include genetic inheritance, gene and protein regulation, cellular processes including transport, energy capture, and signaling, the cellular and molecular basis for disease, and modern techniques including genomics, bioinformatics, and microscopy. The laboratory component will illustrate and analyze these topics through selected experimental approaches.

*Applies to requirement(s): Math Sciences**A. Camp, C. Woodard**Prereq: BIOL-200 and CHEM-201. Coreq: BIOL-230L.**Advisory: Students who have completed BIOL-210 or BIOL-220 should not take BIOL-230.***BIOL-234 Biostatistics***Not Scheduled for This Year. Credits: 4*

The statistics sections of biology articles have become so technical and jargon-filled that many biologists feel intimidated into skipping them or blindly accepting the stated results. But how can we ask relevant questions or push the boundaries of knowledge if we skip these sections? Using lectures, data collection, and hands-on analysis in R, this course will connect statistics to biology to help students develop a gut instinct for experimental design and analysis. We will explore sampling bias and data visualization and review methods and assumptions for the most common approaches with examples from current biological literature and our own data.

*Applies to requirement(s): Math Sciences**S. Cox, M. Hoopes**Prereq: 8 credits in biological sciences or ENVST-200.***BIOL-236 Topics in Biological Sciences****BIOL-236TA Topics in Biological Sciences: 'Biology of Terrestrial Arthropods'***Not Scheduled for This Year. Credits: 4*

Evolutionary history of the terrestrial arthropods (body plans, relationships, fossil history); physiology (the implications of cuticle, thermoregulation, flight); reproduction (life cycles, metamorphosis, mating systems); behavior (communication, sociality); ecology (parasitism, mutualism, predator-prey and plant-insect interactions). Each student will collect, mount, and identify specimens for her own collection.

*Applies to requirement(s): Math Sciences**S. Rachootin**Instructor permission required.**Coreq: BIOL-236TAL.***BIOL-295 Independent Study***Fall and Spring. Credits: 1 - 4**The department**Instructor permission required.*

Notes: 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.

BIOL-301 Regenerative Medicine: Biology and Bioethics*Spring. Credits: 4*

What is regenerative medicine? What is the science that drives new medical therapies using stem cells? We will study the biology of adult, embryonic, and induced pluripotent stem cells, as well as the legal, ethical, and moral implications of using these cells in medical therapies. 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.

*Applies to requirement(s): Math Sciences**Other Attribute(s): Speaking-Intensive**R. Fink**Instructor permission required.**Prereq: BIOL-220 and instructor permission.***BIOL-302 Molecular Evolution***Fall. Credits: 4*

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.

*Applies to requirement(s): Math Sciences**A. Frary**Prereq: BIOL-210 and BIOL-226. Coreq: BIOL-302L.***BIOL-305 Cellular and Molecular Aspects of Development***Not Scheduled for This Year. Credits: 4*

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.

*Applies to requirement(s): Math Sciences**Other Attribute(s): Speaking-Intensive**R. Fink**Prereq: BIOL-200 and either BIOL-210, BIOL-220, or BIOL-230. Coreq: BIOL-305L.*

BIOL-307 Vertebrate Anatomy*Spring. Credits: 4*

We will study the structure, function and evolution of the diversity of structures that allow vertebrates to perform basic functions such as locomotion. We will connect the functions with day-to-day challenges for vertebrates, and we will discuss functional disruption such as disease and trauma. In lab we will dissect fresh-frozen and formaline-preserved vertebrates. A willingness to work with such preserved material is critical to success in class. Students are expected to work in groups during class time, as well as read the required chapters before class. This class requires you to memorize the names of several structures in a functional context.

*Applies to requirement(s): Math Sciences**P. Brennan**Prereq: BIOL-220, BIOL-230, or BIOL-226. Coreq: BIOL-307L.***BIOL-308 Darwin***Spring. Credits: 4*

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.

*Crosslisted as: HIST-361DA**Applies to requirement(s): Humanities**Other Attribute(s): Writing-Intensive**S. Rachootin**Prereq: BIOL-226 or HIST-248.***BIOL-310 Invertebrate Zoology***Fall. Credits: 4*

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.

*Applies to requirement(s): Math Sciences**S. Rachootin**Prereq: BIOL-226. Coreq: BIOL-310L.***BIOL-311 Protein Biochemistry and Cellular Metabolism***Fall. Credits: 4*

This course is a rigorous introduction to the study of protein molecules and their role as catalysts in the cell. Topics include general principles of protein folding, protein structure-function correlation, enzyme kinetics and mechanism, carbohydrate and lipid biochemistry, and metabolic pathways (catabolic and anabolic) and their interaction and cross-regulation. Biological transformation of energy is considered in light of the principles of thermodynamics.

*Crosslisted as: BIOCH-311, CHEM-311**Applies to requirement(s): Math Sciences**K. Berry**Restrictions: This course is limited to Biochemistry majors only.**Prereq: BIOL-230 (or BIOL-210) and CHEM-302. Coreq: BIOL-311L.***BIOL-315 Behavioral Ecology***Fall. Credits: 4*

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.

*Applies to requirement(s): Math Sciences**Other Attribute(s): Writing-Intensive**R. Brodie**Prereq: 8 credits of 200-level work from Biological Sciences Coreq: BIOL-315L.**Advisory: Biological Sciences 223 or Biological Sciences 226 strongly recommended***BIOL-316 Scanning Electron Microscopy***Fall. Credits: 2*

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.

*Crosslisted as: GEOL-316**Applies to requirement(s): Meets No Distribution Requirement**B. Carbajal-Gonzalez**Prereq: 4 credits at the 200 level from Biological Sciences or Geology.***BIOL-320 Introduction to Transmission Electron Microscopy***Not Scheduled for This Year. Credits: 2*

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 portfolio.

*Applies to requirement(s): Meets No Distribution Requirement**B. Carbajal-Gonzalez**Prereq: BIOL-220.***BIOL-321 Conference Course**

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

BIOL-321AD Conference Course: 'Addiction, Superior Memory, and Diseases of the Brain'*Spring. Credits: 4*

In this course, we will explore diseases of memory as well as extreme instances of phenomenal memory. We will review primary research literature and case studies to explore the changes that underlie addiction and memory. After reviewing the scientific literature, we will manipulate memory-related pathways in the brain of mice then evaluate the resulting changes in memory formation and behavior. This course will enable students to relate behavioral changes to changes in brain function.

*Applies to requirement(s): Math Sciences**A. White**Prereq: BIOL-200 and BIOL-220. Coreq: BIOL-321ADL.*

BIOL-321BA Conference Course: 'Biology of Aging'*Fall. Credits: 4*

Biology of Aging explores the molecular mechanisms regulating human aging. Topics include general biology of aging, genetics of longevity, cellular aging, human longevity, and potential interventions to modulate human aging. Emphasis will be placed on age-related diseases as well, including cancer, diabetes, and Alzheimer's disease. In the laboratory component, we will examine genetic and pharmacological ways to regulate lifespan of the model organism, *c. elegans*.

*Applies to requirement(s): Math Sciences**K. Schreiber**Prereq: BIOL-210 and BIOL-220. Coreq: BIOL-321BAL.***BIOL-321BC Conference Course: 'Biology of Cetaceans'***Spring. Credits: 2*

This course provides an introduction to the evolution, life history, adaptations, ecology, social structure, behavior, and conservation of cetaceans (whales, dolphins, and porpoises). Seminars are discussion-based and will consist of student presentations of pertinent scientific journal articles followed by group discussions of reading materials. Evaluation will be based on group presentations, participation in discussions, and quiz grades (on reading materials). Additionally, students will write a final literature review paper on a topic related to cetaceans of their choosing.

*Applies to requirement(s): Meets No Distribution Requirement**Other Attribute(s): Speaking-Intensive, Writing-Intensive, Community-Based Learning**D. Orbach**Prereq: BIOL-223, BIOL-226, or BIOL-335.***BIOL-321CS Conference Course: 'Cell Signaling and Disease'***Not Scheduled for This Year. Credits: 4*

In this course we will explore the nature of degenerative diseases and review current literature aimed at understanding the molecular mechanisms driving their development. We will study how cellular communication breaks down with age leading to degenerative diseases, such as cardiovascular disease, diabetes, macular degeneration, and cancer.

*Applies to requirement(s): Math Sciences**K. Schreiber**Prereq: BIOL-220 or BIOL-230.***BIOL-321EL Conference Course: 'Extreme Life'***Not Scheduled for This Year. Credits: 4*

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 Celsius. Through readings and discussions we will explore the diverse mechanisms that underlie how organisms reach extreme levels of performance and survive in extreme environments.

*Applies to requirement(s): Math Sciences**G. Gillis**Prereq: BBIOL-220 and plus one additional Biological Sciences course above 200.***BIOL-321EV Conference Course: 'Evo-Devo of Human Anatomy'***Spring. Credits: 4*

This course will explore how evolution and developmental biology illuminate our understanding of human anatomy. Combining lecture and discussion of the current literature, we will examine how major gene signaling pathways pattern the body and particular organs. These investigations into genetic analysis and comparative embryology will guide our discussions about the origin of some of the unusual aspects of our anatomy, including the evolutionary trade-offs that may lead to features that are prone to difficulties.

*Applies to requirement(s): Math Sciences**Other Attribute(s): Speaking-Intensive**A. Price**Prereq: BIOL-220 or BIOL-230.***BIOL-321ME Conference Course: 'Molecular Ecology'***Spring. Credits: 4*

Over the past quarter century, molecular genetic methods have become increasingly important in ecological research. In this course, we will examine contemporary molecular genetic tools and learn how they can be used to answer ecological questions. Topics will include: reconstruction of ancestral relationships; measuring the size, diversity, and spatial structure of populations; characterization of migration and dispersal patterns; and identification of sensitive or threatened species and populations. We will explore these themes through foundational texts and current scientific literature, and we will analyze molecular genetic datasets in class to gain familiarity with available techniques.

*Applies to requirement(s): Math Sciences**Other Attribute(s): Speaking-Intensive, Writing-Intensive**J. Andras**Prereq: BIOL-210 or BIOL-223 or BIOL-226.***BIOL-321NE Conference Course: 'The Neurobiology of Stress'***Fall. Credits: 4*

In this seminar, students will gain a thorough understanding of the stress response system, referred to as the hypothalamic-pituitary-adrenal (HPA) axis. Using primary literature, the course will cover various facets of the HPA axis, including the cellular and anatomical neuroscience behind the stress response. Students will gain an understanding of the techniques commonly used to assess acute and chronic HPA axis activity and behavioral reactivity in humans and in a variety of non-human animals. We will explore how genes and the environment interact to determine how an individual will respond to a stressor and examine irregular activity of the HPA axis in neuropsychiatric disorders, including Anxiety, Depression, and Post-Traumatic Stress Disorder.

*Applies to requirement(s): Meets No Distribution Requirement**Other Attribute(s): Speaking-Intensive**A. Hamel**Prereq: BIOL-220.**Advisory: Psychology 200 or Biological Sciences 220 preferred.*

BIOL-321RB Conference Course: 'Race and Biology'

Not Scheduled for This Year. Credits: 4

In this student-centered, discussion-based seminar, we will explore hypotheses about the evolution of human variation and how our ideas about race intersect with new information from the human genome. We will focus on three main themes: genes, geography, and human variation; the misuse of evolutionary biology in the construction of race; and race in the age of the human genome.

Applies to requirement(s): Math Sciences

Other Attribute(s): Writing-Intensive

R. Brodie

Prereq: Any 200-level Biological Sciences course.

Notes: Class materials will be drawn from primary scientific literature, books by evolutionary biologists and film. Student learning will be evaluated through writing assignments, presentations, and participation in online and face-to-face discussions.

BIOL-322 Comparative Biomechanics

Not Scheduled for This Year. Credits: 4

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.

Crosslisted as: PHYS-222

Applies to requirement(s): Math Sciences

G. Gillis

Prereq: 8 credits from Biological Sciences except BIOL-200. Coreq: BIOL-322L.

BIOL-325 Plant Diversity and Evolution

Not Scheduled for This Year. Credits: 4

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.

Applies to requirement(s): Math Sciences

A. Frary

Prereq: 2 courses from BIOL-200, BIOL-210, BIOL-223, or BIOL-226. Coreq: BIOL-325L.

Notes: offered alternate years

BIOL-326 Ocean Blues: State of the World's Oceans

Fall. Credits: 4

This seminar explores the science behind pressing issues facing our oceans, such as coastal eutrophication, ocean acidification and overfishing. Professors from the Five College Coastal and Marine Sciences (FCCMS) certificate program, representing different science disciplines, will engage with students in this discussion-based course. Students will gain a greater understanding of the scientific approaches being used to investigate ocean ecosystem health. They will also learn to analyze scientific literature and engage constructively in scholarly discussions.

Applies to requirement(s): Math Sciences

Other Attribute(s): Speaking-Intensive, Writing-Intensive

J. Andras

Instructor permission required.

Prereq: Any 200-level science.

Advisory: Any 200 level science, preference will be given to juniors and seniors who are participating in the Coastal and Marine Sciences certificate program

Notes: Ocean Blues can be applied to any of the course categories required for the certificate.

BIOL-327 Microbiology

Spring. Credits: 4

We share planet Earth with an unimaginable number of "invisible" microbial life forms. In this course we will explore the structure, metabolism, genetics, and ecology of microbes, most prominently bacteria. Other microbes, including archaea, eukaryotic microbes, and viruses will also be considered. Whenever possible, the relationship between microbes and humans will be highlighted. Other goals will be for students to become comfortable with scientific primary literature and to hone their communication skills through discussions and written assignments. Finally, the laboratory portion of this course will highlight classic and modern techniques in microbiology.

Applies to requirement(s): Math Sciences

A. Camp

Prereq: BIOL-230 or both BIOL-210 and BIOL-220. Coreq: BIOL-327L.

BIOL-328 Human Physiology

Spring. Credits: 4

A consideration of the physiological processes involved in the control of human body functions. We will study the mechanisms for regulating individual organ systems and how these mechanisms respond to changing needs of the individual. Our examination of the physiological controls will include an analysis of the underlying cellular and molecular processes that drive the mechanisms and integrate the activities of the different systems.

Applies to requirement(s): Math Sciences

S. Bacon

Prereq: BIOL-220 or BIOL-230 or BIOCH-311. Coreq: BIOL-328L.

BIOL-331 Theory and Application of Conservation Biology

Not Scheduled for This Year. Credits: 4

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.

Applies to requirement(s): Math Sciences

M. Hoopes

Prereq: BIOL-223, BIOL-226, BIOL-315, or ENVST-200. Coreq: BIOL-331L.

BIOL-332 Macroevolution

Not Scheduled for This Year. Credits: 4

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, and the emerging field of evolutionary developmental biology.

Applies to requirement(s): Math Sciences

S. Rachootin

Prereq: BIOL-226.

Notes: Biology majors who arrange a lab project in this class can count this course as a lab course.

BIOL-333 Neurobiology

Fall. Credits: 4

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.

Applies to requirement(s): Math Sciences

A. White

Prereq: BIOL-200, BIOL-220, and 4 credits from Chemistry or Physics. Coreq: BIOL-333L.

Notes: preference given to seniors

BIOL-335 Mammalian Anatomy

Not Scheduled for This Year. Credits: 4

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.

Applies to requirement(s): Math Sciences

G. Gillis

Restrictions: This course is open to Juniors and Seniors.

Prereq: 8 credits at the 200-level from Biological Sciences, except BIOL-200.

Coreq: BIOL-335L.

Notes: Course open to 12 juniors and 12 seniors.

BIOL-336 Bacterial Cell Biology

Not Scheduled for This Year. Credits: 4

Long considered to be simple 'bags of enzymes,' bacteria are now appreciated to be highly ordered and dynamic cells. Bacterial cells organize their genetic material, assemble cytoskeletons, localize proteins, construct organelle-like compartments, differentiate, and communicate with one another to coordinate multicellular behaviors. This course will explore the exciting new field of bacterial cell biology via the primary scientific literature. Substantial student participation in the form of group work and discussions will be expected.

Applies to requirement(s): Math Sciences

A. Camp

Prereq: BIOL-220.

BIOL-337 Symbiotic Interactions

Spring. Credits: 4

From mutualism to parasitism, symbiotic interactions are a universal feature of life. In this seminar we will study the mechanisms underlying symbiotic interactions and consider their significance for the ecology and evolution of organisms. Through foundational texts and current scientific literature, we will explore some of the most spectacular and important examples of contemporary symbioses - from coral reefs, to infectious diseases, to the vast communities of microbes that live on and in our bodies - and we will learn how symbiosis is responsible for major milestones in the history of life, such as the origin of the eukaryotic cell, the emergence of land plants, and the evolution of sex.

Applies to requirement(s): Math Sciences

Other Attribute(s): Speaking-Intensive, Writing-Intensive

J. Andras

Prereq: BIOL-223 or BIOL-226.

BIOL-338 Evolution and Human Sexual Behavior

Fall. Credits: 4

This seminar will discuss patterns and variations of human sexual behavior and the likely role that evolution has played in shaping some of these patterns. We will discuss the evolution of sex, gender differences, principles of sexual selection, physiology, cultural differences in sexual behavior, mating systems, etc. We will follow a recently published book on this topic, and add readings from the primary literature. Students are expected to write one major research paper on any aspect of human sexual behavior of their choosing and to be ready to present their findings to the class towards the end of the semester.

Applies to requirement(s): Math Sciences

P. Brennan

Prereq: BIOL-226.

BIOL-339 Mechanisms of Hormone Action

Spring. Credits: 4

What are the molecular mechanisms by which hormones direct cellular processes? In this course, we will examine the nature of chemical communication between and within cells. We will study hormones, receptors, and signal transduction pathways, and the ways in which these signaling systems regulate development, programmed cell death, inflammatory responses, and other biological processes.

Applies to requirement(s): Math Sciences

C. Woodard

Prereq: BIOL-230 or both BIOL-210 and BIOL-220. Coreq: BIOL-339L.

Advisory: Note: Biological Sciences 230 will replace Biological Sciences 210 and 220 in 2016/2017.

BIOL-340 Eukaryotic Molecular Genetics

Fall. Credits: 4

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 discuss new techniques for genomic analysis, including the science as well as the health, legal, ethical and moral issues involved. There will be group discussions of original research articles and review articles.

Applies to requirement(s): Math Sciences

C. Woodard

Prereq: BIOL-200 and BIOL-210.

BIOL-395 Independent Study

Fall and Spring. Credits: 1 - 8

The department

Instructor permission required.

Notes: NOTE: See safety training restrictions in description of Biological Sciences 295

BIOL-399 Journal Club / Data Hub

Spring. Credits: 1

Reading and understanding research reports from the primary scientific literature is an essential skill for any scientist. Likewise, critiquing experimental proposals and freshly-minted data is one of the core components of the pursuit of science. Using the Biology Department Seminar series as a springboard, this course seeks to familiarize students with the process of understanding, appreciating, and critiquing scientific manuscripts. Additionally, drawing on projects being proposed and executed under the auspices of Biology 395, this course seeks to help students develop comfort discussing 'fresh' scientific data. This course will provide a valuable way to connect with active scientists, both developing and experienced, from within and beyond Mount Holyoke.

Applies to requirement(s): Meets No Distribution Requirement

R. Brodie, A. White

Prereq: 8 credits in Biological Sciences.

Notes: Credit/No Credit grading only. Reading materials will be drawn primarily from research and review articles in the primary scientific literature. Data will be presented by students actively engaged in research projects. We will discuss data and readings as a group in class meetings.