

# 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

Stan Rachootin, Chair (Fall 2017)

Rachel Fink, Chair (Spring 2018)

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, Ida and Marion Van Natta Professor of Biological Sciences, Teaching Spring Only

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, David and Lucy Stewart Professor of Biological Sciences

Craig Woodard, Christianna Smith Professor of Biological Sciences, Teaching Spring Only

Sarah Bacon, Associate Professor of Biological Sciences

Renae Brodie, Associate Professor of Biological Sciences, Teaching Fall Only

Jason Andras, Assistant Professor of Biological Sciences

Amy Camp, Assistant Professor of Biological Sciences

Rebecca Lijek, Assistant Professor of Biological Sciences

Andre White, Assistant Professor of Biological Sciences

Patricia Brennan, Visiting Lecturer in Biological Sciences

Shannon Compton, Visiting Lecturer in Biological Sciences

Shawn Massoni, Visiting Lecturer in Biological Sciences

Elizabeth Mearls, Visiting Lecturer in Biological Sciences

## Requirements for the Major

A minimum of 44 credits<sup>1</sup>:

### Biological Sciences:

|   |  |           |
|---|--|-----------|
| BIOL-145  | Introductory Biology <sup>2</sup>                | 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  |           |
| 12 additional credits at the 300-level in biology. <sup>3</sup>   |  | 12        |
| One additional course in Biological Sciences at any level   |  | 4         |
| <b>Required Courses Outside of Biological Sciences:</b>   |  |           |
| 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         |
| <b>Total Credits</b>  |  | <b>44</b> |

<sup>1</sup> 32 credits in biology, 8 credits in chemistry, and 4 credits in statistics or calculus

<sup>2</sup> BIOL-145 or any of its offerings; for example BIOL-145AB, BIOL-145BN, BIOL-145GW, BIOL-145HG, or BIOL-145RG

<sup>3</sup> At least two of these 300-level courses (8 credits) 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 <sup>1</sup> | 16        |
| <b>Total Credits</b>   | <b>16</b> |

<sup>1</sup> 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-145HG Introductory Biology: 'Biology in the Genomic Era'***Spring. Credits: 4*

Genome projects are leading to great advances in our understanding of biology and in our ability to manipulate the genetic information of organisms, including humans. We will focus on the science behind genome projects, and the ways in which the resulting knowledge and technology affect our lives. This course will also serve as a general introductory biology course for biology majors as well as non-majors. We will read articles and books, and make use of the World Wide Web.

*Applies to requirement(s): Math Sciences**C. Woodard**Restrictions: This course is limited to first-year students.**Coreq: BIOL-145HGL.***BIOL-145RG Introductory Biology: 'Organismal Biology'***Not Scheduled for This Year. 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-145UW -Introductory Biology: 'the Unseen World'***Fall. Credits: 4*

This course examines the diversity of unseen life that surrounds us all, from our bodies to the air we breathe to the corridors, fields, forests and waterways around us. We will study the sometimes unique and always surprising biology and lifestyles of the very small, including bacteria, yeast, fungi, protists and arthropods. Labs will explore the unseen diversity around us via field work around campus as well as laboratory experiments, will introduce students to data collection, manipulation and analysis, and will give students an appreciation that what we can't see is all around us.

*Applies to requirement(s): Math Sciences**S. Massoni**Restrictions: This course is limited to first-year students.**Coreq: BIOL-145UWL.***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, A. van Giessen**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***Not Scheduled for This Year. 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-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, R. Lijek**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'***Fall. 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 or BIOL-230 and instructor permission.***BIOL-302 Molecular Evolution***Not Scheduled for This Year. 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-230 (or BIOL-210) and BIOL-226. Coreq: BIOL-302L.*

**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 including humans, 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***Not Scheduled for This Year. 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-314 Nucleic Acids Biochemistry and Molecular Biology***Spring. Credits: 4*

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.

*Crosslisted as: BIOCH-314, CHEM-314**Applies to requirement(s): Math Sciences**K. Berry**Restrictions: This course is limited to Biochemistry majors only.**Prereq: BIOCH-311, BIOL-311, or CHEM-311. Coreq: BIOL-314L.**Advisory: Chemistry 302 can be taken concurrently**Notes: Please sign up for this course as Biochemistry 314***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: BIOL-223 or BIOL-226 strongly recommended.***BIOL-316 Scanning Electron Microscopy***Not Scheduled for This Year. 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-319 Immunology with Laboratory***Spring. Credits: 4*

The immune system protects the sterile interior of our bodies from the vast diversity of microbes in the outside world, adapting and improving from each encounter. How does it achieve this remarkable feat? This course will investigate the cells, organs, and biochemical signals that comprise innate and adaptive immune systems, as well as how they interact to identify and remove foreign pathogens. Emphasis will be placed on the human immune response to infectious diseases, with examples from clinical case studies and experimental models. The laboratory portion will provide hands-on experience with the foundational techniques of immunology research. Additional topics may include: autoimmunity, allergy, vaccination, transplantation, cancer, immune deficiency, and pathogen evasion strategies.

*Applies to requirement(s): Math Sciences**R. Lijek**Prereq: BIOL-210 and BIOL-220, or BIOL-230. Coreq: BIOL-319L.**Notes: The lecture for this course meets at the same time as Biology 317, but this course includes a laboratory.***BIOL-320 Introduction to Transmission Electron Microscopy***Fall. 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**Instructor permission required.**Prereq: BIOL-220 or BIOL-230.**Notes: There will be an additional self-scheduled, weekly 1-2 hour lab during which students will receive microscope training.***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 or BIOL-220 or BIOL-230. Coreq: BIOL-321ADL.***BIOL-321BC Conference Course: 'Biology of Cetaceans'***Spring. Credits: 4*

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): Math Sciences**Other Attribute(s): Speaking-Intensive, Writing-Intensive**D. Orbach**Prereq: BIOL-223, BIOL-226, or BIOL-335.***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: BIOL-230 and plus one additional Biological Sciences course above 200.***BIOL-321GB Conference Course: 'Molecular Genetics of Bacteria'***Fall. Credits: 4*

This course is an in-depth examination of studies at the molecular level of various aspects of genetics, as expressed in bacterial and viral systems. Topics include patterns and mechanisms of DNA replication, recombination, repair and mutation; regulation of gene activity; gene-protein relationships; and genetic engineering. Both classic and modern experimental approaches are emphasized. Coursework involves both lectures and a "journal club" format with student presentations.

*Applies to requirement(s): Math Sciences**S. Massoni**Prereq: BIOL-230, or BIOL-210 and BIOL-220.***BIOL-321GD Conference Course: 'Genetics of Disease'***Fall. Credits: 4*

In this course we will explore the genetic basis for disease susceptibility using HIV and breast cancer as models. Discussion will focus on how the environment and genetics interact on an individual level, which leads to a "susceptibility profile" for each person. We will also delve into the primary literature to evaluate strategies aimed at preventing disease, treatments, and future therapeutic possibilities.

*Applies to requirement(s): Math Sciences**S. Compton**Prereq: BIOL-230 (or BIOL-210 and BIOL-220).*

**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-230 (or BIOL-210), and BIOL-223 or BIOL-226.***BIOL-321MY Conference Course: 'Mycology: A Fungus Among Us'***Spring. Credits: 4*

In this course, we will cover the biology, ecology, classification and identification of fungi and fungal-like organisms. We will consider fungi as causes of diseases in animals, humans, and plants, and their uses in biotechnology applications. We will additionally have in-class discussions and engage with the primary literature.

*Applies to requirement(s): Math Sciences**S. Massoni**Prereq: BIOL-230 (or BIOL-210 and BIOL-220).***BIOL-321RB Conference Course: 'Race and Biology'***Fall. 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-321TC Conference Course: 'Biotechnology'***Fall. Credits: 4*

Biotechnology aims to improve the quality of human life by selectively modifying biological systems to meet a specific need. We will examine topics in medicine, ecology, sustainable energy, and food technology at the molecular level to learn how biotechnology can be developed and applied to overcome a variety of challenges. Discussions will incorporate recent advances in the fields of microbiology, metabolic engineering, and synthetic biology through evaluation of the primary literature.

*Applies to requirement(s): Math Sciences**Other Attribute(s): Speaking-Intensive**E. Mearls**Prereq: BIOL-230 (or BIOL-210 and BIOL-220).***BIOL-321TD Conference Course: 'Parasitology and Neglected Tropical Diseases'***Spring. Credits: 4*

Neglected tropical diseases are a set of infectious diseases arising from a diverse group of parasites that affect an estimated 1.4 billion people worldwide. These diseases affect the world's most vulnerable populations, almost exclusively poor and powerless people living in rural areas and urban slums of low-income countries. In this course, we will cover the diversity of parasitic organisms, the historical significance of parasitic diseases, and the often-complicated relationships involving parasites. We will also discuss the economic and social impacts of parasitic diseases, as well as reinforcing our understanding of vector biology as key to disease control. This class will also make extensive use of discussions and engagement with the primary literature.

*Applies to requirement(s): Math Sciences**S. Massoni**Prereq: BIOL-230 (or BIOL-210 and BIOL-220).***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***Fall. 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, BIOL-226, or BIOL-230.**Coreq: BIOL-325L.**Notes: offered alternate years*

**BIOL-326 Ocean Blues: State of the World's Oceans***Fall. Credits: 4*

Ocean ecosystems are of tremendous ecological importance and provide many billions of dollars worth of services annually, yet our marine systems face serious threats due to overfishing, climate change, ocean acidification, pollution, and the spread of invasive species. Conservation and management strategies aim to protect our remaining marine resources and restore those that have been lost or damaged. In this course, we will study the scientific evidence documenting the most pressing threats to marine ecosystems and examine available strategies for mitigating these threats. We will also explore cultural, economic, and political issues relevant to marine conservation and management.

*Applies to requirement(s): Math Sciences**Other Attribute(s): Speaking-Intensive, Writing-Intensive**J. Andras**Instructor permission required.**Prereq: Any 200-level science.**Advisory: 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 Coastal and Marine Sciences 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***Spring. 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**The department**Prereq: BIOL-223, BIOL-226, BIOL-315, or ENVST-200. Coreq: BIOL-331L.***BIOL-332 Macroevolution***Fall. 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**Restrictions: This course is limited to seniors.**Prereq: BIOL-200 and BIOL-220, or BIOL-230. Also take 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-337 Symbiotic Interactions***Not Scheduled for This Year. 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*

We 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***Not Scheduled for This Year. 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.***BIOL-340 Eukaryotic Molecular Genetics***Not Scheduled for This Year. 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-230 (or 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***Fall and 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. Lijek, The department**Prereq: 8 credits in Biological Sciences.*

*Notes: Repeatable for credit. 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.*