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

Marth Hoopes, Chair
Sue LaBarre, Academic Department Coordinator

106 Carr Laboratory
413-538-2149
https://www.mtholyoke.edu/acad/biologicalsciences

Learning Goals

Our goal in the Department of Biological Sciences is to stimulate students' curiosity about the natural world and help them see themselves as scientists, whether they become biology majors or not.

Our learning goals for the major are for students to develop fluency with four core concepts of biology:

- Evolution by natural selection.
- The relationship between structure and function.
- Information flow, exchange, and storage.
- The interconnections between living things and between living things and their environment.

Students develop the abilities to closely observe natural phenomena, use evidence in scientific reasoning, and test their own hypotheses about the natural world. They develop biological literacy, following the trains of scientific discovery (and conflict) in the primary literature, and use quantitative methods — including statistics and modeling — to better understand natural phenomena.

Faculty

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

Renae Brodie, Professor of Biological Sciences
Rachel Fink, Ida and Marion Van Natta Professor of Biological Sciences, Teaching Spring Only
Amy Fray, David and Lucy Stewart Professor of Biological Sciences
Gary Gillis, Norman Wait Harris and Emma Gale Harris Foundation Professor of Biological Sciences; Associate Dean of Faculty; Director of the Science
Martha Hoopes, Professor of Biological Sciences
Craig Woodard, Christianna Smith Professor of Biological Sciences, Teaching Fall Only
Jason Andras, Associate Professor of Biological Sciences
Sarah Bacon, Associate Professor of Biological Sciences
Amy Camp, Associate Professor of Biological Sciences
Patricia Brennan, Assistant Professor of Biological Sciences, On Leave 2021-2022
Rebeccah Lijek, Assistant Professor of Biological Sciences, Teaching Spring Only
André White, Assistant Professor of Biological Sciences, Teaching Spring Only
Jennifer Van Wyk, Visiting Lecturer in Biological Sciences

Requirements for the Major

A minimum of 40 credits:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BIOL-145</td>
<td>Introductory Biology ²</td>
<td>4</td>
</tr>
<tr>
<td>or BIOL-160</td>
<td>Integrated Introduction to Biology and Chemistry</td>
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<tr>
<td>or NEURO-100</td>
<td>Introduction to Neuroscience and Behavior</td>
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<tr>
<td>BIOL-200</td>
<td>Introductory Biology II: How Organisms Develop</td>
<td>4</td>
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<tr>
<td>BIOL-230</td>
<td>Molecular Genetics and Cell Biology</td>
<td>4</td>
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<tr>
<td>BIOL-223</td>
<td>Ecology</td>
<td>4</td>
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<tr>
<td>or BIOL-226</td>
<td>Evolution: Making Sense of Life</td>
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12 additional credits at the 300-level in biology.³ 12

One additional course in Biological Sciences at any level 4

Required Courses Outside of Biological Sciences:

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<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CHEM-150</td>
<td>General Chemistry: Foundations of Structure and Reactivity</td>
<td>4</td>
</tr>
<tr>
<td>or CHEM-160</td>
<td>Integrated Introduction to Biology and Chemistry</td>
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Biology majors will explore the full range of the discipline and gain ample research and laboratory experience. Ultimately, they are provided with the foundations for success in diverse careers, including medicine, biotechnology, environmental conservation, and public policy.
One course in either calculus or statistics (e.g. MATH-101, MATH-102, MATH-203, STAT-140, STAT-240, etc.)  

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<tr>
<th>Code</th>
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<tr>
<td></td>
<td>16 credits in Biological Sciences at the 200 and/or 300 level</td>
<td>16</td>
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<tr>
<td>Total Credits</td>
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<td>16</td>
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1 BIOL-295 and BIOL-395 do not count toward the minimum 16 credits in the minor

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 France 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’
Not Scheduled for This Year. 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-years and sophomores.
Coreq: BIOL-145ABL.
**BIOL-145BN Introductory Biology: 'Introduction to Biological Inquiry'**

*Not Scheduled for This Year. Credits: 4*

In this course students will explore the biological world from evolution to physiology to cellular dynamics, developing a basic understanding of how knowledge is generated. Laboratory experiences will help students acquire the skills necessary to conduct their own research and understand basic data analysis. Socially relevant science issues will generate discussion on the intersection of science and current events.

*Applies to requirement(s): Math Sciences*

The department

*Restrictions: This course is limited to first-years and sophomores.*

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 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'**

*Not Scheduled for This Year. 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. In lab we will examine and analyze a variety of organisms such as microbes, plants and humans. This class will also serve as a general introductory biology course for biology majors as well as non-majors.

*Applies to requirement(s): Math Sciences*

C. Woodard

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

Coreq: BIOL-145HGL.

**BIOL-145NH Introductory Biology: 'Nature Harmoniously Confused'**

*Fall. Credits: 4*

Most organisms are notably unlike ourselves–a tapestry of bacteria, protozoans, algae, and, off by themselves, the plants, fungi, and 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.

*Applies to requirement(s): Math Sciences*

S. Rachootin

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

Coreq: BIOL-145NHL.

**BIOL-145PA Introductory Biology: 'Plant-Animal Interactions'**

*Fall. Credits: 4*

Plants as basal resources shape ecological interactions across terrestrial communities. The plant kingdom is diverse, and this diversity structures ecosystem function and interactions within communities. In labs, students will learn about plant taxonomy, structure, function, and adaptation. In lecture, we will build on this botanical understanding to discover how these diverse traits shape ecological interactions. Our goal is to find wonder in the natural world, develop tools for observing natural history, and create a foundation for understanding ecology.

*Applies to requirement(s): Math Sciences*

J. Van Wyk

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

Coreq: BIOL-145PAL.

**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, W. Chen

*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*

Developmental biology is a topic full of fantastic questions: how does a single egg transform into an organism with many cells and tissue types? What controls gene expression? What is the interplay between environmental signal and plant hormones? In this course plant and animal development will be studied at the level of genes, cells and tissues, in model organisms such as sea urchins, ferns, chicks and lilies. The laboratory is at the heart of the course, and classwork is designed around the live material students will meet each week.  
*Applies to requirement(s): Math Sciences*  
R. 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: EDUCT-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 ecology 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.*  
*Advisory: Because the course uses quantitative methods, students must have experience with calculus or statistics; high school level courses are sufficient.*  
*Notes: Biology 223 and/or Biology 226 must be taken for the Biology major.*

BIOL-226 Evolution: Making Sense of Life  
*Spring. Credits: 4*

Evolution is central to our understanding of Biology; it helps us explain both the diversity and commonality in organismal form, function and behavior that have been generated over 3 billion years of Earth. We will discuss the mechanisms of evolution within populations and between species, examine some branches of the tree of life and learn how the tree is generated, discuss how phenotypes arise from genotypes and interactions with the environment, and how development is central to understanding evolution. Some themes include the evolution of symbiosis, sex, and human evolution, as well as the crucial role that evolutionary principles play in society including agriculture, medicine, and even the judicial system.  
*Applies to requirement(s): Math Sciences*  
J. Andras  
*Prereq: BIOL-200 or BIOL-223 or BIOL-230. Coreq: BIOL-226L.  
Notes: BIOL-223 and/or BIOL-226 must be taken for the Biology major.*

BIOL-230 Molecular Genetics and Cell 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-150 or CHEM-160 Coreq: BIOL-230L.*

BIOL-234 Biostatistics  
*Spring. 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*  
J. Baumann  
*Prereq: 8 credits in biological sciences or ENVST-200. Coreq: BIOL-234L.*
BIOL-295 Independent Study
Fall and Spring. Credits: 1 - 4
In this class, students will acquire hands-on experience in diverse aspects of the research process in any field of Biology, from familiarizing themselves with a research topic, generating interesting questions, designing experiments, acquiring technical skills, collecting and analyzing data, to writing and/or presenting their results. To inquire about enrollment, students should approach a Biological Sciences faculty member to identify mutual areas of interest. Typically, these conversations should occur well before registration, and the decision by the faculty member will depend on lab capacity. A single credit requires an average of 3 hrs of work per week. (Note: Some faculty may require a set weekly meeting time for a portion of this class.)
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.
Applies to requirement(s): Math Sciences
Other Attribute(s): Speaking-Intensive
R. Fink
Instructor permission required.
Prereq: BIOL-230 and instructor permission.
Advisory: To obtain permission for BIOL-301 please email Professor Fink a list of courses you have taken in biology, ethics, medicine and/or reproductive technologies, and include your reasons for wanting to take this course.

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 recording, 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 BIOL-230. Coreq: BIOL-305L.

BIOL-307 Vertebrate Anatomy
Not Scheduled for This Year. Credits: 4
We will study the structure, function and evolution of the diversity of structures that allow vertebrates, including humans, to perform basic functions. We will connect these functions with day-to-day challenges for vertebrates, and we will discuss functional disruption such as disease and trauma. Students are expected to work in groups, as well as view the lectures before class. Class time will be used for active discussion and occasional guest lectures. During lab time, we will use virtual software to examine the morphology of all organ systems in humans and compare this anatomy to that of other vertebrates, and we will get together virtually to clarify points of confusion. Please note that we will not be dissecting cats this semester, but we may be able to do some practicums with smaller animals depending on health and safety. This class requires memorization of many structures in a functional context.
Applies to requirement(s): Math Sciences
P. Brennan

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, and CHEM-302 and CHEM-231.

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. Coreq: BIOL-314L.
Advisory: CHEM-302 can be taken concurrently.
Notes: Please sign up for this course as BIOCH-314
BIOL-315 Behavioral Ecology
Not Scheduled for This Year. 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-319 Immunology with Laboratory
Not Scheduled for This Year. 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 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-230. Coreq: BIOL-319L.

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 phenotypic 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 examine memory-related pathways in the brain. This course will enable students to relate behavioral changes to changes in brain function.
Applies to requirement(s): Math Sciences
A. White
Prereq: 8 credits in Biological Sciences. Coreq: BIOL-321ADL.

BIOL-321BE Conference Course: 'Inquiries in Behavioral Ecology'
Fall. Credits: 4
In this student-centered project-based course, students will design their own animal behavior investigation and prepare a web-based presentation, teaching module, or manuscript. At the end of the course, students will improve their understanding of basic concepts in behavioral biology and develop a deep understanding of the scientific literature in their area of inquiry. We will work on skills that promote supportive research environments, and explore inclusive approaches to science communication.
Applies to requirement(s): Math Sciences
Other Attribute(s): Writing-Intensive
R. Brodie
Prereq: 8 credits of 200-level work from Biological Sciences.
Advisory: BIOL-223 or BIOL-226 strongly recommended.

BIOL-321BG Conference Course: 'Bacterial Molecular Genetics'
Spring. Credits: 4
Bacteria existed long before humans arrived on the planet and will rule the Earth long after we have gone. These tiny organisms are experts in adapting to stressful environments and evolving to survive. In this class, we'll examine the molecular mechanisms that bacteria use to evolve. Topics will include gene and genome organization, the central dogma, the DNA damage response and mechanisms of mutagenesis, and methods of genetic exchange between bacteria. We will analyze primary literature and actual biological data to explore how bacteria are able to evolve so well
Applies to requirement(s): Math Sciences
T. Tashjian
Prereq: BIOL-230.

BIOL-321CE Conference Course: 'Local Community Ecology'
Spring. Credits: 4
This field-based lab course will explore local community ecology and biodiversity using our own Mount Holyoke campus in winter as a "living lab." We will explore local community patterns in study sites, identify plant and animal species, and develop research projects that investigate ecological processes and community interactions. Students will learn basic statistical programming using the R environment to analyze collected and available data for independent or group research papers/presentations. Lecture topics will include species/sign identification in winter, study design, niche and neutral theory, eco-evolutionary processes, predator-prey and host-pathogen dynamics, and human impacts on biodiversity. We will discuss the value of biodiversity and threat of climate change from different global perspectives.
Applies to requirement(s): Math Sciences
A. Teffer
Prereq: Ecology (BIOL-223) or Evolution (BIOL-226).
Notes: Outdoor lab during winter – please dress appropriately.
BIOL-321CR Conference Course: 'Coral Reefs in a Changing Climate'

Spring. Credits: 4
Coral reefs are among the most diverse and important ecosystems in the world's oceans. Yet they face a multitude of stressors leading to their decline in both structure and function – including ocean warming, acidification, coastal development, and land-use change. This course provides a detailed exploration of coral reef ecology, physiology, and biogeochemistry including reading, interpreting, and analyzing of primary literature. Building upon previous research we will work to understand the state of the world's reefs and evaluate possible solutions to the interacting stressors that imperil coral reefs in the modern world.

Applications to requirement(s): Math Sciences
J. Baumann
Prereq: 8 credits in Biology and BIOL-145 or BIOL-160.

BIOL-321DE Conference Course: 'Disease Ecology'

Spring. Credits: 4
The effects of emerging wildlife diseases are global and profound. They can result in economic and agricultural impacts, declines in wildlife populations, ecological disturbance and even the loss of human lives. Disease dynamics are governed by species interactions and the abiotic environment. We will consider the synergistic effects of globalization, climate change, and agriculture on the spread of pathogens. This course will focus on both wildlife diseases and the ecological context of vector-borne human pathogens, including but not limited to the Sylvatic plague, West Nile Virus, Lyme disease and the newly emergent Rabbit Hemorrhagic Disease Virus.

Applications to requirement(s): Math Sciences
J. Van Wyk
Prereq: 8 credits at the 200-level in Biological Sciences.

BIOL-321EC Conference Course: 'Topics in Invasion Ecology'

Spring. Credits: 4
Invasive species have become a common focus for land managers and gardeners around the world because some invasive species have decimated local biodiversity. What can we learn about these species, their interactions with local communities, and the dynamics of invasions that will help us manage diversity in a changing world? We will discuss the science and politics behind invasive species and explore the secrets of their success and impacts. This course will include a whole class project or group research projects based on current issues in the literature or local invasive species.

Applications to requirement(s): Math Sciences
Other Attribute(s): Speaking-Intensive, Writing-Intensive
M. Hoopes
Prereq: 8 credits above BIOL-200 with BIOL223 or BIOL-226 or ENVST-200.

BIOL-321EN Conference Course: 'Entomology'

Spring. Credits: 4
Insects are cold-blooded arthropods that represent 90% of all life forms on earth. Humans are quick to categorize insect species as beneficial or pests as they relate to agriculture, yet insects are fascinating beyond that dichotomy. This course employs insect models to address the study of diversity, behavior, and ecology. We will highlight the beneficial and detrimental roles of insects in human society, as vectors of disease, the ecological and agricultural impact of introduced species, and climate change. Insect populations have declined by 75% in the past fifty years – and the consequences may soon be catastrophic. Is the insect apocalypse here?

Applications to requirement(s): Math Sciences
J. Van Wyk
Prereq: 8 credits at the 200-level in Biological Sciences and Ecology or Evolution. Coreq: BIOL-321ENL.

BIOL-321HG Conference Course: 'Molecular Genetics and Human Genetic Disorders'

Spring. Credits: 4
Mendel's principles of genetic inheritance underpin all the inheritance patterns that we observe and the traits they govern. However, in nature, not all is as it first appears. Many traits seem to diverge from Mendelian genetics until we understand those inheritance patterns more deeply. In this course, we will explore the depths of genetic inheritance by first understanding the mechanisms of these seeming "exceptions of Mendelian inheritance". We will then understand how the molecule of DNA behaves in the nucleus to allow for gene expression and how we study DNA in the lab. Finally, we will discuss human genetic disorders that occur because of deviations in gene expression or DNA behavior but are rooted in Mendelian genetic principles. The capstone experience of the course is a student-group project exploring experimental approaches for diagnosing or treating a human genetic disorder.

Applications to requirement(s): Math Sciences
T. Mennella
Prereq: BIOL-200 and BIOL-230.

BIOL-321ME Conference Course: 'Molecular Ecology'

Not Scheduled for This Year. Credits: 4
Over the past quarter century, molecular genetic tools 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 mutation 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.

Applications 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-321PE Conference Course: 'Pollination Ecology'

Fall. Credits: 4
Pollination is the transfer of pollen from an anther to the stigma in angiosperms. Flowers and their pollinators are delightfully beautiful and evolutionarily complex. This course will explore the diversity and intricacies of pollination interactions from both animal and plant perspectives. We will cover an array of topics centered on pollination ecology: the politics and economics of global pollinator declines, evolution and ecology, and pollination in the context of global change.

Applications to requirement(s): Math Sciences
J. Van Wyk
Prereq: BIOL-223 or BIOL-226 and 8 credits at the 200-level. Coreq: BIOL-321PEL.
**BIOL-321PR Conference Course: 'Pregnancy and the Placenta'**

_Fall. Credits: 4_

Pregnancy is a stunning feat of physiology. It is a conversation between two bodies – maternal and fetal – whose collective action blurs the very boundaries of the individual. In this course we will explore such questions as: what is pregnancy, and how does the ephemeral, essential organ known as the placenta call pregnancy into being? How is pregnancy sustained? How does it end? We will consider the anatomy of reproductive systems and the hormonal language of reproduction. We will investigate the nature of “sex” hormones, consider racial disparities in pregnancy outcome, and weigh the evidence that the intrauterine environment influences disease susceptibility long after birth.

Crosslisted as: GNDST-333PC

 Applies to requirement(s): Math Sciences

Other Attribute(s): Speaking-Intensive

_S. Bacon_

Prereq: 8 credits at the 200 level in Biological Sciences.

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

_Fall. Credits: 4_

In this student-centered, discussion-based seminar, we will explore current hypotheses about the evolution of human variation, trace the history of how biology has been used in the construction of racial ideologies, and delve into the impacts of racial categorization on human health. We will investigate these themes through readings, videos, class discussions, student expert panels, and research papers. Students taking this course will improve their ability to: engage constructively in scholarly discussions; use verbal and written discourse to explore themes in science; use new knowledge to understand current issues; critically evaluate media information using evidence from scientific studies; and communicate new knowledge.

Applies to requirement(s): Math Sciences

_R. Brodie_

Prereq: 4 credits of Biological Sciences at the 200 level.

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**BIOL-321TH Conference Course: 'Ornithology'**

_Fall. Credits: 4_

In this course, we will explore the evolutionary history and defining characteristics of living dinosaurs, also known as birds. Students will learn how anatomy and physiology influence natural history and spectacular behaviors such as mating displays and long- and short-distance migrations. By the end of this course, students will: develop a greater appreciation for avian biodiversity and the primary threats to avian conservation across the full annual cycle, be able to identify local bird species by sight and sound, and understand the primary methods used in avian field studies. Students will also learn how to: work together in a group of their peers, synthesize scientific literature, and create a science communication product for a target public audience.

Applies to requirement(s): Math Sciences

_K. Straley_

Prereq: BIOL-223 or BIOL-226. Coreq: BIOL-321THL.

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**BIOL-321VX Conference Course: 'Outsmarting Pathogens'**

_Spring. Credits: 4_

Smallpox, a disfiguring infection called "one of the most devastating diseases known to humanity" by the World Health Organization, was eradicated from the planet through immunization. Polio paralyzed 350,000 children a year until immunization reduced infection by 99%. Why have we succeeded in immunizing against these pathogens but not HIV or the common cold? Students in this seminar will discuss primary literature in immunology, microbiology, and epidemiology to learn how vaccines outsmart pathogens. Study of biological mechanisms will be complemented with exploration of the socioeconomic factors that influence vaccine development and usage. Students’ independent research will connect their interests and current events to course concepts.

Applies to requirement(s): Math Sciences

_R. Lijek_

Prereq: BIOL-230.

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**BIOL-323 Plant Growth and Development**

_Not Scheduled for This Year. Credits: 4_

This course is a study of the higher plant, its structure, organization, and development. We will examine the endogenous and environmental factors influencing plant growth and reproduction. Topics include anatomy, hormones and their mode of action, tropisms, photomorphogenesis, and flowering.

Applies to requirement(s): Math Sciences

_A. Frary_

Prereq: Two courses from BIOL-200, BIOL-223, BIOL-226, or BIOL-230.

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**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-223, BIOL-226, or BIOL-230.

 Notes: offered alternate years

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

_Not Scheduled for This Year. 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 relationships 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. Coreq: BIOL-327L.

BIOL-328 Human Physiology
Spring. Credits: 4
A course on the function of human organ systems, at both the cellular and whole tissue level. We will study the mechanisms that regulate a variety of organ systems and learn how these mechanisms respond to the changing needs of the individual. We will discuss how we used animal models to determine the normal function of these systems, practice the math used to model their function, and analyze how the activities of these systems are integrated.

Applies to requirement(s): Math Sciences
S. Bacon
Prereq: 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-333 Neurobiology
Not Scheduled for This Year. Credits: 4
Description: We will study the electrical and chemical signals underlying the generation of the nerve impulse and synaptic transmission. We will then explore neuroanatomy, diseases of the brain and the neuronal circuits underlying learning and memory and sensory perception.

Applies to requirement(s): Math Sciences
A. White
Restrictions: This course is open to juniors and seniors
Prereq: BIOL-230 and 4 credits from Chemistry or Physics. Coreq: BIOL-333L.
Notes: Preference given to seniors

BIOL-337 Symbiotic Interactions
Fall. 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 infectious diseases to 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-230 or BIOL-226.

BIOL-338 Evolution and Human Sexual Behavior
Not Scheduled for This Year. 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-223.

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., 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.

BIOL-351 Research Methods: Peer Review
Spring. Credits: 4
Peer review is the process by which scientists evaluate the integrity of each other’s work. It is the backbone of science that justifies public confidence in our work and drives decisions about which research gets published and funded. Just as peer review is integral to science, teaching students how to peer review is integral to their education. This seminar will demystify the review process and give students hands-on experience reviewing manuscripts related to their interests. By critiquing other scientists’ work, students will improve their own ability to design experiments, analyze and present data, communicate and see themselves as scientists.

Applies to requirement(s): Math Sciences
Other Attribute(s): Speaking-Intensive, Writing-Intensive
R. Lijek
Restrictions: This course is open to juniors and seniors
Prereq: BIOL-230.
Advisory: Students may not take BIOL-321VX concurrently with this course.
BIOL-395 Independent Study

Fall and Spring. Credits: 1 - 8

In this class, students will acquire hands-on experience in diverse aspects of the research process in any field of Biology, from familiarizing themselves with a research topic, generating interesting questions, designing experiments, acquiring technical skills, collecting and analyzing data, to writing and/or presenting their results. To inquire about enrollment, students should approach a Biological Sciences faculty member to identify mutual areas of interest. Typically, these conversations should occur well before registration, and the decision by the faculty member will depend on lab capacity. A single credit requires an average of 3 hrs of work per week. (Note: Some faculty may require a set weekly meeting time for a portion of this class.)

The department

Instructor permission required.

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

BIOL-399 Biology Journal Club/Data Hub

Not Scheduled for This Year. 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

M. Hoopes, R. Lijek

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.