The biology curriculum is designed to acquaint students with the broad scope of the biological sciences at several levels of functional organization. Its courses include molecular, cellular, organismal, ecological, and evolutionary aspects of biology. Departmental course offerings prepare biology majors for advanced study in graduate or professional schools and for other professional opportunities. The department believes that an informed understanding of biological principles is an important aspect of a liberal arts education, and it therefore offers diverse courses that introduce non-majors to basic biological concepts and explore the implications of modern biology for various social and ethical issues. Our curriculum also offers courses in geology to inform majors and non-majors about the history of the Earth, geologic materials, and the physical processes operating within the Earth and on its surface.

**Geosciences**

The Geosciences curriculum offers students an insight into the physical, chemical, and biological processes of the Earth and its multitude of interacting global systems. As we face increasing scientific, social, and economic challenges related to our changing environment, the tools and topics covered in this curriculum can help us make sense of how we affect and are affected by this environment. The Geosciences curriculum at Holy Cross highlights the wide range of processes that occur at and near the Earth’s surface, including how geologic forces create and modify landscapes; how water moves between the Earth, oceans, and atmosphere; and how life and climate have evolved and influence the Earth over its 4.5 to 4.6-billion-year history. Fieldwork outdoors is central to many of the courses, and many of the courses provide opportunities for hands-on exploration of the Earth, whether outdoors, in the lab, or through analyzing authentic data. Geosciences course offerings are listed below the Biology courses.

**Advanced Placement Credit**

Holy Cross awards credit for Advanced Placement exams taken through the College Board Advanced Placement Program and the International Baccalaureate Program and will accept some Advanced Level General Certificate of Education (A-Level) exams. One unit of credit is awarded for an Advanced Placement score of 4 or 5 in any discipline recognized by the College. One unit of credit is awarded for a score of 6 or 7 on a Higher Level International Baccalaureate Examination in a liberal arts subject. One unit of credit is awarded for a score of A/A* or B on an A-Level exam in a liberal arts subject. **The College does not award credit for the IB Standard Exam or the AS-Level Exam.** AP, IB, and A-Level credit may be used to satisfy deficiencies and common area requirements. Each academic department has its own policy regarding the use of AP or IB credit for placement in courses and progress in the major. The Department Chair must also review the A-Level score to determine placement in courses and progress in the major. See departmental descriptions for further information.

Robert M. Bellin, Ph.D., **Professor**

Robert I. Bertin, Ph.D., **Distinguished Professor of Science**

George R. Hoffmann, Ph.D., **Distinguished Professor of Science Emeritus**

Karen A. Ober, Ph.D., **Professor and Chair**

Kenneth N. Prestwich, Ph.D., **Professor**

Ann M. Sheehy, Ph.D., Professor

William V. Sobczak, Ph.D., **Professor**

Madeline Vargas, Ph.D., **Professor**

Geoffrey David Findlay, Ph.D., **Associate Professor**

Justin S. McAlister, Ph.D., **Associate Professor**

Sara G. Mitchell, Ph.D., **Associate Professor**

Michelle A. Mondoux, Ph.D., **Associate Professor**

Julia A. Paxson, Ph.D., **Associate Professor**

Alexis S. Hill, Ph.D., **Assistant Professor**

Alimatu Acheampong, Ph.D., **Laboratory Instructor**

Anna Doyle, M.L.A., **Lab Instructor**

James M. Doyle, M.A, **Lab Instructor and Manager**

Catherine M Dumas, M.S., **Laboratory Instructor**

Kirsten A. Hagstrom, Ph.D., **Lecturer**

Jodi M. Rymer, Ph.D., **Lecturer, Director of Biology Laboratories**

Kelly Wolfe-Bellin, Ph.D., **Lecturer, Director of Biology Laboratories**

Mary T. Pickering, Ph.D., **Visiting Assistant Professor**

Jessica Lucas Whitt, Ph.D., **Visiting Assistant Professor**

Sean M. Williams, Ph.D., **Visiting Assistant Professor**

**Academic Plans within Biology**

- Biochemistry Concentration (https://hccatalog.holycross.edu/academic-plans/biology/biochemistry-concentration)
- Biology Major (https://hccatalog.holycross.edu/academic-plans/biology/biology-major)
- Geosciences Minor (https://hccatalog.holycross.edu/academic-plans/biology/geosciences-minor)

**Other Academic Plans Accepting/Requiring Biology Coursework:**

- Environmental Studies Major (https://hccatalog.holycross.edu/academic-plans/environmental-studies/environmental-studies-major)
- Environmental Studies Minor (https://hccatalog.holycross.edu/academic-plans/environmental-studies/environmental-studies-minor)
- Neuroscience Student Designed Minor (https://hccatalog.holycross.edu/academic-plans/center-interdisciplinary-studies/student-designed-majors-minors/#text)
Biology (BIOL)

BIOL 114 — Biological Principles Course count: 1
These courses introduce non-science majors to principles and modes of inquiry underlying the study of living things. Each course examines a subset of subject matter, which may range from biological molecules and cells to the structure and function of organisms to interactions of organisms with their environments. All courses in this series share the common goal of providing a rigorous introduction both to the methods of scientific inquiry and to the content of the discipline. Recently taught subjects include evolution, microbiology, cancer, environmental biology, the molecular biology of the HIV pandemic, toxicants and radiation, biology of the brain, biology of aging, human anatomy and physiology, the unseen world, oceans and people, Mesozoic life and conservation biology.

GPA units: 1
Common Area: Natural Science
Typically Offered: Fall, Spring

BIOL 117 — Environmental Science Course count: 1
The goal of this course is to provide an understanding of major environmental problems by studying their biological bases. Applied and basic material will be integrated in most sections. Basic topics include ecosystem structure, energy flow, biogeochemical cycles, population growth and regulation and environmental policy. Applied topics include human population growth, agriculture and food production, pest control, conservation of forests and wildlife, preservation of biological diversity, energy use, water and air pollution and atmospheric climate change.

GPA units: 1
Common Area: Natural Science
Typically Offered: Fall, Spring

BIOL 159 — Biochemical Foundation of Life Course count: 1
This class provides an in-depth introduction to the chemical foundations of biology. The goal of the course is to explore the amazing world of cell and molecular biology, while solidifying a foundation in biochemistry and developing skills to approach problems in chemistry and biology. The course covers how atoms bond to form molecules and how molecules assemble into the macromolecules responsible for biological processes. These understandings are then used to examine the structure and functions of cells and their organelles and membranes. While no formal lab is associated with this course, we will consider the nature of science as a discipline and how experiments test hypotheses to generate new knowledge. We will have several days in a laboratory setting, dedicated to the active investigation of biochemical principles. Successful completion of BIOL 159 prepares students to continue to BIOL 161, Introduction to Cellular and Molecular Biology and to CHEM 181, Atoms and Molecules.

GPA units: 1
Common Area: Natural Science

BIOL 161 — Introduction to Cell & Molecular Biology Course count: 1
Fundamental principles of biology studied at the molecular and cellular levels of organization. Intended for all potential biology majors and pre-health students regardless of major. Includes laboratory.

GPA units: 1.25
Common Area: Natural Science
Typically Offered: Fall, Spring

BIOL 162 — Introduction to Mechanisms of Multicellular Life Course count: 1
Fundamental principles of mechanistic biology at the organ and system levels. Emphasis on vertebrates with some material on higher plants. Intended for all potential biology majors and pre-health students regardless of major. Includes laboratory.

Prerequisite: BIOL 161 or by permission from the Chair of the department.
GPA units: 1.25
Common Area: Natural Science
Typically Offered: Fall, Spring

BIOL 163 — Introduction to Biol Diversity and Ecology Course count: 1
An introduction to evolution, ecology and the diversity of life: plants, animals, fungi, protists and prokaryotes. Intended for all biology and environmental studies majors.

Prerequisite: BIOL 117 or BIOL 162 or by permission of Instructor.
GPA units: 1.25
Common Area: Natural Science
Typically Offered: Fall, Spring

BIOL 201 — Microbiology of a Hurricane Course count: 1
This course will introduce students to scientific thinking and give a brief introduction to the biology of bacteria, viruses and fungi. Emphasis will then shift to examining the role of microbes within hurricanes and environments affected by hurricanes through review of scientific literature. Topics will include, outbreaks of infectious diseases, spread of antibiotic resistance, bioremediation of contaminated sites and bioenergy.

GPA units: 1
Common Area: Natural Science

BIOL 210 — Microbiology for Allied Health Course count: 1
A comprehensive introduction to microbiology. This course provides an overview of microorganisms, including their structure and function, growth, ecology, genetics, taxonomy, and evolution. Emphasis is placed on prokaryotes and viruses of medical significance. The laboratory emphasizes pure culture methods, diagnostic microbiology, and physiology. Includes laboratory.

Prerequisite: BIOL 161 and CHEM 181 and permission of the Health Professions Advisors.
GPA units: 1.25
Typically Offered: Annually

BIOL 211 — Anatomy & Physiology I Course count: 1
This course studies the functional systems of the human body. It focuses heavily on their integrative nature and maintenance of homeostasis. Topics covered include cell and tissue structure, the nervous, skeletomuscular, endocrine systems. Permission for enrollment is controlled by the Health Professions Advisor and that office may waive the introductory biology requirement in some cases. This course is reserved for students planning to attend physician's assistant, nursing, physical therapy or other allied health programs after graduation. It may not be used as credit toward the biology major.

Prerequisite: BIOL 161 and permission of the Health Professions Advisors.
GPA units: 1.25
Common Area: Natural Science
Typically Offered: Annually
**BIOL 212 — Anatomy and Physiology 2** Course count: 1
This course is a continuation of Anatomy and Physiology 1. It may not be used as credit towards the biology major.

Prerequisite: BIOL 211 and permission of the Health Professions Advisors.
GPA units: 1.25
Typically Offered: Annually

**BIOL 213 — Comparative Vertebrate Morphology** Course count: 1
The structure, function, development and evolution of the skeletal, muscular, nervous, respiratory, circulatory, digestive and urogenital systems of the chordates, with special emphasis on vertebrates. Includes laboratory. Organismal biology.

Prerequisite: BIOL 162
GPA units: 1.25
Typically Offered: Annually

**BIOL 220 — Entomology** Course count: 1
An introduction to insects covering diversity, morphology, physiology, ecology and behavior, as well as considerations of the economic and medical importance of insects. Includes laboratory. Biological Diversity.

Prerequisite: BIOL 161 and BIOL 162 and BIOL 163
GPA units: 1.25
Typically Offered: Alternate Years

**BIOL 223 — Microbiology** Course count: 1
A comprehensive introduction to microbiology. This course provides an overview of microorganisms, including their structure and function, growth, ecology, genetics, taxonomy, and evolution. Emphasis is placed on prokaryotes and viruses. The laboratory emphasizes enrichment and pure culture methods, diagnostic microbiology, and physiology. Includes laboratory. Biological Diversity.

Prerequisite: BIOL 161; Prerequisite or Corequisite CHEM 222
GPA units: 1.25
Typically Offered: Annually

**BIOL 230 — Developmental Biology** Course count: 1
This course provides a comparative exploration of development from fertilization to adulthood using both organismal and molecular/cellular approaches. We will discuss and compare basic aspects of patterning and morphogenesis using the major model systems of nematodes, fruit flies, frogs, chicks and mice. Throughout the course, we will also examine how developmental processes affect aging, cancer, and regeneration/repair after disease. Organismal biology.

Prerequisite: BIOL 161 and BIOL 162. Students who have taken BIOL 230 may not enroll in BIOL 232.
GPA units: 1
Typically Offered: Annually

**BIOL 232 — Developmental Biology Lecture** Course count: 1
This course provides a comparative exploration of development from fertilization to adulthood using both organismal and molecular/cellular approaches. We will discuss and compare basic aspects of patterning and morphogenesis using the major model systems of nematodes, fruit flies, frogs, chicks and mice. Throughout the course, we will also examine how developmental processes affect aging, cancer, and regeneration/repair after disease. Organismal biology.

Prerequisite: BIOL 161 and BIOL 162. Students who have taken BIOL 230 may not enroll in BIOL 232.
GPA units: 1
Typically Offered: Annually

**BIOL 233 — Freshwater Ecology** Course count: 1
A comprehensive introduction to the hydrology, chemistry, and ecology of freshwater ecosystems. The laboratory component includes field work in several ecosystems (lake, stream, reservoir, river and wetland) and laboratory work characterizing the chemistry and biology of these diverse ecosystems. Includes laboratory and field work. Ecological and evolutionary biology.

Prerequisite: BIOL 163
GPA units: 1.25
Typically Offered: Annually

**BIOL 235 — Marine Biology** Course count: 1
This course presents a survey of the organisms that live in the sea and their adaptations to the marine environment. The course covers the major divisions of marine life and their diversity of form, as well as common ecological patterns, physiological processes and evolutionary strategies. The function and role of coastal, open-ocean, and deep sea ecosystems are also considered, as is the relevance of marine biology to current scientific, social, health, and economic affairs. Includes laboratory. Ecological and evolutionary biology.

Prerequisite: BIOL 163
GPA units: 1.25
Common Area: Natural Science
Typically Offered: Annually

**BIOL 241 — Virology** Course count: 1
This course is a general introduction to virology. Its primary focus is on human viruses that contribute to disease. We will explore different strategies viruses have adopted to replicate in the host cell, the battles viruses wage to outmaneuver the host immune system and the disease states that result from a viral infection. Molecular and cellular biology.

Prerequisite: BIOL 131
GPA units: 1
Typically Offered: Annually

**BIOL 250 — Field Botany** Course count: 1
An introduction to the local vascular flora, emphasizing identification of ferns, woody plants and plants flowering in the fall. The course will include training in use of field guides and technical keys and preparation of herbarium specimens. Includes field and laboratory work. Biological Diversity.

Prerequisite: BIOL 163 or by permission.
GPA units: 1
Typically Offered: Alternate Years
BIOL 255 — Vertebrate History Course count: 1
A survey of vertebrate history, with emphasis on the anatomical and physiological transformations that occurred at the evolutionary origins of the major vertebrate groups. Structure and function of both extant and extinct taxa are explored, as documented by modern fauna and the fossil record. Includes laboratory. Biological Diversity.

Prerequisite: BIOL 162
GPA units: 1
Typically Offered: Alternate Years

BIOL 257 — Paleontology Course count: 1
In this class, we will examine classic and emerging problems in paleontology as a gateway to concepts in evolution and the diversification of life over geologic time. The class will focus on the evolution of the vertebrate lineage, with occasional excursions into the evolution of other life forms. Topics that will receive attention in the course include the history and theory of evolutionary biology and paleontology, animal development, morphology and function, biological diversity, extinction and conservation. Ecological and evolutionary biology.

Prerequisite: BIOL 162 or permission of the instructor.
GPA units: 1
Typically Offered: Alternate Years

BIOL 261 — Genetics Course count: 1
An introduction to genetics that explores the molecular and cellular basis of heredity and physical traits. Topics include the central dogma, cell division, Mendelian inheritance, genetic analysis, chromosome structure and replication, gene expression, molecular biology techniques, genetic linkage, disease gene identification, and population genetics. Genomic approaches are interwoven throughout. The accompanying lab emphasizes model organism and human genetics and involves both genetic screens and molecular techniques. Molecular and cellular biology.

Prerequisite: BIOL 161 and BIOL 162 or BIOL 161 and permission of the instructor. Students who have taken BIOL 262 may not enroll in BIOL 261.
GPA units: 1.25
Typically Offered: Annually

BIOL 262 — Genetic Analysis Course count: 1
The mechanisms of heredity and genetic analysis. Topics include Mendelian inheritance, chromosome structure and function, genetic mapping, molecular genetics, mutation, genetic regulation, and population genetics. This course is a nonlaboratory equivalent of Biology 261. Molecular and cellular biology.

Prerequisite: BIOL 161 and BIOL 162 or BIOL 161 and permission of the instructor. Students who have taken BIOL 261 may not enroll in BIOL 262.
GPA units: 1
Typically Offered: Alternate Years

BIOL 266 — Cell Biology Course count: 1
The course explores the structure and function of eukaryotic cells and considers how cellular structure allows for biological activity. A range of topics will be discussed including membrane structure and function, homeostasis and metabolism, intracellular compartments and protein trafficking, signal transduction, the cytoskeleton, and the cell cycle. The cell biology of human disease will be considered throughout the course. The laboratory (Biology 268) is optional but recommended. Molecular and cellular biology.

Prerequisite: BIOL 161 and CHEM 181. CHEM 221 is recommended.
GPA units: 1
Typically Offered: Annually

BIOL 267 — Neurobiology Course count: 1
A study of the nervous system at multiple levels, from molecular to the systems level. Major topics include: structure of the nervous system and neurons, generation of electric signals, function of synapses, structure and function of sensory and motor circuits, and a discussion of higher order processing. Includes laboratory. Molecular and cellular biology.

Prerequisite: BIOL 161. BIOL 266 is recommended. Students who have taken BIOL 269 may not enroll in BIOL 267.
GPA units: 1.25
Typically Offered: Annually

BIOL 268 — Cell Biology Lab Course count: 0
This laboratory accompanies Biology 266. Students will learn the tools for solving problems in cell and molecular biology, as well as the appropriate approaches, controls, and analysis for experiments. The lab uses three model systems (the yeast S. cerevisiae, nematode C. elegans, and mammalian cell culture) to introduce students to a range of techniques including microscopy and staining, gel electrophoresis, genome databases and in silico analysis. Students will also design and carry out independent experiments. This laboratory is taken as a fifth course; while figured into the GPA, it does not count as one of the 32 courses required for graduation.

Corequisite BIOL 266 or by permission.
GPA units: 0.5
Typically Offered: Annually

BIOL 269 — Neurobiology Lecture Course count: 1
A study of the nervous system at multiple levels, from molecular to the systems level. Major topics include: structure of the nervous system and neurons, generation of electric signals, function of synapses, structure and function of sensory and motor circuits, and a discussion of higher order processing. Molecular and Cellular biology.

Prerequisite: BIOL 161. BIOL 266 is recommended. Students who have taken BIOL 267 may not enroll in BIOL 269.
GPA units: 1
Typically Offered: Alternate Years
BIOL 275 — Biological Statistics  
Course count: 1  
An introduction to the handling, analysis, and interpretation of biological data. Topics include descriptive statistics, probability distributions, goodness of fit tests, hypothesis testing, analysis of variance, regression, and correlation.  
Prerequisite: BIOL 161 or BIOL 162 or BIOL 163. Students who have taken ECON 249, MATH 220, PSYC 200 or SOCL 226 may not enroll in the class.  
GPA units: 1  
Typically Offered: Fall, Spring

BIOL 280 — Ecology  
Course count: 1  
A broad introduction to the study of relationships between organisms and their environments, with coverage of individual organisms, populations, communities and ecosystems, as well as natural history of New England. Includes laboratory and field work. Ecological and evolutionary biology.  
Prerequisite: BIOL 163.  
GPA units: 1.25  
Typically Offered: Annually

BIOL 283 — Evolution  
Course count: 1  
An inquiry-based approach to the study of evolutionary processes, including those that are adaptive and neutral with respect to natural selection. Evolution will be examined at a variety of scales, from molecular to ecological, and from changes in populations over a few generations to patterns over millennia. Most attention will be devoted to empirical work that addresses conceptual issues in evolutionary biology, including natural selection and fitness, speciation, population genetics, phylogenetics, and molecular evolution. Ecological and evolutionary biology.  
Prerequisite: BIOL 161, BIOL 162, and BIOL 163. BIOL 261 or BIOL 262 is recommended.  
GPA units: 1  
Typically Offered: Annually

BIOL 287 — Ethology & Behavioral Ecology  
Course count: 1  
A comparative look at animal behavior and the evolutionary forces that shape it. Topics include the history and approaches to studying animal behavior, behavioral genetics and heritability, development of behavior, communication, foraging, competition and cooperation, mating and parenting systems, and social behavior. The importance of good experimental design and the proper role of modeling in behavioral studies are emphasized. Field projects are included. Ecological and evolutionary biology.  
Prerequisite: BIOL 163 or permission of instructor.  
GPA units: 1  
Typically Offered: Alternate Years

BIOL 301 — Biochemistry  
Course count: 1  
A detailed study of the chemistry of biological molecules. Topics include the structural chemistry of the major classes of biological compounds, enzyme catalysis, bioenergetics, metabolic regulation, glycolysis, gluconeogenesis, beta-oxidation of fatty acids, tricarboxylic acid cycle, electron transport chain and oxidative phosphorylation. Molecular and cellular biology. Equivalent to CHEM 301.  
Prerequisite: CHEM 222  
GPA units: 1  
Typically Offered: Annually

BIOL 302 — Biochemistry 2  
Course count: 1  
A continuation of Biology 301. Topics include the chemistry, enzymology and regulation of lipid, protein and carbohydrate metabolism, photosynthesis, DNA replication, transcription, and translation. Molecular and cellular biology.  
Prerequisite: BIOL 301 or CHEM 301  
GPA units: 1  
Typically Offered: Annually

BIOL 303 — Biochemistry 1 Lab  
Course count: 0  
This optional laboratory course accompanies Biology 301 and introduces students to experimental methods used for the purification and characterization of biological molecules through a multi-week, full-semester procedure. While conducting the steps of this overall procedure, students gain experience with a wide range of biochemistry lab techniques including column chromatography, gel electrophoresis, Western blotting, and enzyme activity assays. This laboratory is taken as a fifth course; while figured into the GPA, it does not count as one of the 32 courses required for graduation.  
Prerequisite or Corequisite: BIOL 301 or CHEM 301  
GPA units: 0.5  
Typically Offered: Annually

BIOL 304 — Biochemistry 2 Lab  
Course count: 0  
This optional laboratory course accompanies Biology 302 and introduces students to the principles and methods of molecular biology as they relate to the modern practice of laboratory biochemistry. Through a multi-week, full-semester procedure, students are exposed to a wide-range of techniques including genomic DNA isolation, PCR, plasmid DNA construction, sequence analysis and recombinant protein expression. This laboratory is taken as a fifth course; while figured into the GPA, it does not count as one of the 32 courses required for graduation.  
Prerequisite or Corequisite: BIOL 302  
GPA units: 0.5  
Typically Offered: Annually

BIOL 331 — Ecosystem Ecology  
Course count: 1  
The course covers the history of ecosystem ecology, biogeochemical cycles and budgets, ecosystem energetics and trophic structure, and the response of ecosystems to disturbance and human-accelerated environmental change. The latter part of the course emphasizes discussion of recent primary literature that contributes to the conceptual framework underlying the management and conservation of diverse ecosystems. Ecological and evolutionary biology.  
Prerequisite: BIOL 163 and BIOL 233, or BIOL 235 or BIOL 280  
GPA units: 1  
Typically Offered: Alternate Years

BIOL 361 — Toxicology  
Course count: 1  
The study of adverse effects of chemicals on biological systems. Topics include measurements of toxicity; dose-response relationships; the absorption, distribution, metabolism and excretion of toxicants; targets of toxicity; genetic toxicity; carcinogenesis; developmental toxicity; clinical toxicology; environmental toxicology; and regulatory toxicology. Organismal biology.  
Prerequisite: BIOL 161 and 162, and CHEM 221  
GPA units: 1  
Typically Offered: Annually
BIOL 362 — Topics in Genomics Course count: 1
This seminar begins with an introduction to methods commonly used for genome sequencing and annotation. It then proceeds to consider selected topics in depth by using current primary literature. Examples of these topics include: the genomics of health and disease, the genomics of gene expression, genome evolution, and genomic conflict. Students also gain experience with various forms of scientific communication, including oral presentations, research proposal preparation, and peer review. Molecular and cellular biology.

Prerequisite: Biol 261 or Biol 262
GPA units: 1
Typically Offered: Alternate Years

BIOL 381 — Conservation Biology Course count: 1
A study of the effects of human activity on biological diversity at the population and system levels. Topics include the underlying philosophical approaches to conservation, techniques for measuring biological diversity, for assessing and predicting changes, the principles of management and restoration and the use of mathematical models in management. Classes will be a mix of lecture on general principles plus student-led discussion of case studies and of the recent conservation literature. Ecological and evolutionary biology.

Prerequisite: BIOL 233 or 261 or 262 or 280 or 331. BIOL 162 is recommended or by permission of instructor.
GPA units: 1
Typically Offered: Alternate Years

BIOL 383 — Applied Evolution Course count: 1
This seminar will explore in depth some examples of socially relevant evolutionary biology. Through text and primary literature readings we will examine how a strong understanding of evolutionary biology impacts medicine, human health and disease, conservation of biodiversity, agriculture, and biotechnology. Students will be able to describe and explain basic evolutionary principles and apply those principles to problems in our society. Students will interpret real-world data and results, construct experiments to test evolutionary hypotheses, and evaluate primary literature. Ecological and evolutionary biology.

Prerequisite: BIOL 261 or BIOL 262 or BIOL 283
GPA units: 1
Typically Offered: Alternate Years

BIOL 390 — Physiology Course count: 1
The functioning of cells, organs, and organisms with emphasis on mammals. Major themes are homeostasis, control mechanisms, and system integration. Topics include: excitable and contractile cell physiology, energy metabolism and temperature regulation, respiration and circulation, digestion, water balance, and coordination and control of these systems by neuroendocrine mechanisms. Includes laboratory. Organismal biology.

Prerequisite: CHEM 231 and BIOL 162. PHYS 111 or 115 suggested.
GPA units: 1.25
Typically Offered: Annually

BIOL 391 — Physiology Lecture Course count: 1
The functioning of cells, organs, and organisms with emphasis on mammals. Major themes are homeostasis, control mechanisms, and system integration. Topics include: excitable and contractile cell physiology, energy metabolism and temperature regulation, respiration and circulation, digestion, water balance, and coordination and control of these systems by neuroendocrine mechanisms. Organismal biology.

Prerequisite: CHEM 231 and BIOL 162. PHYS 111 or 115 suggested.
GPA units: 1
Typically Offered: Alternate Years

BIOL 392 — Molecular Immunology Course count: 1
The course emphasizes the molecular aspects of the human immune system. It spans the incredible breadth of the immune defenses ranging from the power of innate immunity, to the sophistication of the development and function of adaptive immunity. Integrative topics such as autoimmunity, immunodeficiency and transplantation are also covered. Molecular and cellular biology.

Prerequisite: BIOL 223 or BIOL 230 or BIOL 241 or BIOL 261 or BIOL 262 or BIOL 266 or BIOL 267 or BIOL 269 or permission of the Instructor.
GPA units: 1
Typically Offered: Alternate Years

BIOL 393 — Molecular Immunology Lab Course count: 0
This laboratory sequence focuses on exploring the molecular techniques employed to investigate an immunological question. The semester-long project is designed as two mini projects that explores a well characterized antiviral human protein. Students construct expression plasmids, ectopically express proteins in both bacteria and tissue culture cells and perform functional assays. We will also discuss the primary literature as it relates to the project and explore how the work fits into the broader context of the field. These projects are built as discovery projects where students may actively participate in the direction of the work. This laboratory is taken as a fifth course; while figured into the GPA, it does not count as one of the 32 courses required for graduation.

Prerequisite: BIOL 120 or 261 or 262 or 266
GPA units: 0.5
Typically Offered: Alternate Years

BIOL 401 — Undergraduate Research Course count: 1
Individual experimental investigation and associated study of the scientific literature under the direct supervision of a member of the faculty. The number of positions is limited; students contemplating research should make inquiries early in the year preceding the term in which research is to be initiated.

GPA units: 1.25
Typically Offered: Fall, Spring

BIOL 405 — Directed Readings Course count: 1
An in-depth literature study of a topic of interest to the student under the tutorial supervision of a member of the faculty.

GPA units: 1
Typically Offered: Fall, Spring
**Biol 407 — Honors Research** Course count: 1
Open only to students in the College Honors Program. Individual experimental investigation and associated study of the scientific literature under the direct supervision of a faculty member. Students contemplating research should make inquiries early in the year preceding the term in which research is to be initiated. One semester may be counted towards the biology major; additional semesters may be taken for college credit.

GPA units: 0
Typically Offered: Fall, Spring

**Biol 408 — Honors Research** Course count: 1
Open only to students in the College Honors Program. Individual experimental investigation and associated study of the scientific literature under the direct supervision of a faculty member. Students contemplating research should make inquiries early in the year preceding the term in which research is to be initiated. One semester may be counted towards the biology major; additional semesters may be taken for college credit.

GPA units: 2.5
Typically Offered: Fall, Spring

**Geosciences (GEOS)**

**Geos 150 — Introduction to Geology** Course count: 1
This course covers the physical processes and history of the Earth. Topics typically include the formation of the Earth, physical properties and identification of minerals and rocks, plate tectonics, earthquakes, volcanoes, geologic time, surface processes, the geology of energy resources, and global climate change. Field trips to local geologic sites provide hands-on experience using classic and modern approaches to investigating the Earth and its history. Students who have completed Geosciences 140 (Environmental Geology) may not enroll in this course. Includes laboratory.

GPA units: 1.25
Common Area: Natural Science
Typically Offered: Annually

**Geos 210 — Geomorphology** Course count: 1
Geomorphology is an introduction to landforms and the geological processes that modify Earth’s surface. Topics include tectonic, wind, soil, hillslope, glacial, and river processes; modern quantitative methods of investigating landscapes, including numerical modeling and GIS; and the influences of humans, climate, and biologic activity on surface processes and the physical environment. Includes computer and field work in the weekly laboratory.

GPA units: 1.25
Common Area: Natural Science
Typically Offered: Alternate Years

**Geos 270 — Watershed Hydrology** Course count: 1
Watershed Hydrology is an introduction to the movement and storage of atmospheric, surface, and ground water within a watershed. This class examines hydrologic processes and the geologic and topographic characteristics that control them, as well as how hydrologic data are collected and analyzed. Topics include the hydrologic cycle, water budgets, precipitation, evaporation, snow hydrology, infiltration, groundwater hydrology and contamination, runoff, stream flow, hydrographs, and flooding. Hydrology is a highly quantitative discipline and math at the pre-calculus level will be used extensively in this course. Prior college math or geoscience coursework is recommended but not required. Includes laboratory.

GPA units: 1.25
Typically Offered: Alternate Years

**Geos 310 — Paleoclimate** Course count: 1
This advanced-level lecture and discussion course examines the changes in Earth’s climate throughout geologic history from the Precambrian to the Anthropocene. Topics include an overview of Earth’s climate system, paleoclimate proxies and archives, distinctive intervals in Earth’s climate history, and how modern climate change is interpreted in a geological context. Paleoclimatology is highly interdisciplinary, drawing on methods and principles of geology, chemistry, physics, and biology. Students should have prior natural science coursework and be prepared to read and discuss primary scientific literature.

Prerequisite: GEOS 150 or GEOS 199-Geohazards or GEOS 210 or GEOS 270 or GEOS 350 or CHEM 181 or by permission.
GPA units: 1
Typically Offered: Alternate Years

**Geos 350 — Oceanography** Course count: 1
This course is an introduction to the inter-disciplinary study of the world’s oceans, and provides an overview of the main oceanographic sub-disciplines: biological, chemical, geological, and physical oceanography. The course will cover topics related to the science underlying global climate change, ocean acidification, ocean warming, sea level rise, marine pollution, resource extraction, and meteorology. A solid understanding of how the world ocean works and humanity’s association with it is fundamental to the appreciation, preservation, utilization, and protection of oceanic environments worldwide.

Prerequisite: CHEM 231
GPA units: 1
Typically Offered: Alternate Years

**Geos 401 — Undergraduate Research** Course count: 1
Individual investigation and associated study of the scientific literature under the direct supervision of a member of the faculty. The number of positions is limited; students contemplating research should make inquiries early in the year preceding the term in which research is to be initiated.

GPA units: 1.25
Typically Offered: Fall, Spring

**Geos 405 — Directed Reading** Course count: 1
An in-depth literature study of a topic of interest to the student under the tutorial supervision of a member of the faculty.

GPA units: 1
Typically Offered: Fall, Spring
GEOS 407 — Honors Research
Course count: 1
Open only to students in the College Honors Program. Individual investigation and associated study of the scientific literature under the direct supervision of a faculty member. Students contemplating research should make inquiries early in the year preceding the term in which research is to be initiated. Honors thesis credit can be counted toward the Environmental Studies major or minor, and toward the Geosciences minor.

GPA units: 0
Typically Offered: Annually

GEOS 408 — Honors Research
Course count: 1
Open only to students in the College Honors Program. Individual investigation and associated study of the scientific literature under the direct supervision of a faculty member. Students contemplating research should make inquiries early in the year preceding the term in which research is to be initiated. Honors thesis credit can be counted toward the Environmental Studies major or minor, and toward the Geosciences minor.

GPA units: 2.5
Typically Offered: Annually