

PROFESSOR: Renee Godard

ASSOCIATE PROFESSORS: Rebecca Beach, C. Morgan Wilson (chair)

ASSISTANT PROFESSOR: Ryan Huish

ADJUNCT LECTURER: Amy Fenster

LABORATORY TECHNICIAN: TBA

The biology major seeks to develop in its students a sense of independent inquiry into the processes of life. Core courses in the major provide all students with a solid foundation in the biological sciences (from cells to ecosystems), while upper-level courses and seminars as well as research opportunities give students the chance for specific areas of interest in biology. As well as exploring biological concepts, classes in the biology department promote the development of oral and written communication skills as well as critical thinking. Graduating seniors will have the skills to critique the primary biological literature, utilize biological instrumentation, and design and carry out biological research in several disciplines. Hollins graduates go on to graduate school, medical school, veterinary school, or other advanced training in allied health professions. Other graduates pursue a variety of careers in the biological sciences, becoming research assistants, environmental consultants, and teachers at both the elementary and secondary levels. Biology majors also occupy various technical positions in private firms and governmental agencies.

REQUIREMENTS FOR A MAJOR IN BIOLOGY (B.A.):

8 courses and associated laboratories, if applicable; two semesters of senior seminar and allied courses (54–70 credits)

REQUIRED COURSES IN BIOLOGY:

- Four core courses in biology and accompanying laboratories:
 - BIOL 207: Ecology (6)
 - BIOL 220: Human Physiology (6)
 - BIOL 236: Molecular and Cell Biology (6)
 - BIOL 241: Plant Biology (6)
- Four elective courses in biology at or above the 200 level (including labs, if applicable). A student may substitute one semester of BIOL 390: Independent Study, BIOL 391: Independent Research in Biology, **or** BIOL 480: Senior Thesis for one of the elective courses. (A student may petition the department to include one course at the 100 level among the four elective courses, if the course is taken before the student decides to major in biology.)
- BIOL 471, BIOL 472: Senior Seminar (2, 2) (Those seniors engaged in student teaching are exempt from BIOL 472.)

REQUIRED ALLIED COURSES:

- CHEM 101 and CHEM 102: General Chemistry (including laboratories) (4, 2) (4, 2) **or** CHEM 105: Principles of Chemistry (including laboratory) (4, 2)
- One course in mathematics **or** statistics (140 or above) **or** PSY 208: Analysis of Behavioral Data (4)

RECOMMENDED ADDITIONAL COURSE WORK:

For students interested in medical school, veterinary school, or graduate programs in health sciences or biology:

- CHEM 221 and CHEM 222: Organic Chemistry (including laboratories) (4, 2) (4, 2)
- PHYS 151 and PHYS 152: Physical Principles **or** PHYS 201 and PHYS 202: Analytical Physics (including laboratories) (4, 2) (4, 2)
- STAT 140: Introduction to Statistics (4) **or** MATH 241: Calculus I (6)

FOR STUDENTS INTERESTED IN TEACHING IN SECONDARY SCHOOLS:

- CHEM 221 and CHEM 222: Organic Chemistry (including laboratories) (4, 2) (4, 2)
- PHYS 151 and PHYS 152: Physical Principles (including laboratories) (4, 2), (4, 2)

REQUIREMENTS FOR A MAJOR IN BIOLOGY (B.S.):

8 courses and associated laboratories, if applicable; two semesters of senior seminar and allied courses (74–86 credits)

REQUIRED COURSES IN BIOLOGY:

- Four core courses in biology and accompanying laboratories:
 - BIOL 207: Ecology (6)
 - BIOL 220: Human Physiology (6)
 - BIOL 236: Molecular and Cell Biology (6)
 - BIOL 241: Plant Biology (6)
- Three elective courses in biology (including labs, if applicable). At least two courses must be at the 300 level.
- One semester of independent research:
 - BIOL 391: Independent Research in Biology (4) **or** BIOL 480: Senior Thesis (4)
- BIOL 471, BIOL 472: Senior Seminar (2, 2)

REQUIRED ALLIED COURSES:

- CHEM 101 and CHEM 102: General Chemistry (including laboratories) (4, 2) (4, 2) **or** CHEM 105: Principles of Chemistry (including laboratory) (4, 2)
- Two additional chemistry courses (with labs), at or above the 200 level (8–12)
- One course in mathematics, either MATH 152: Intuitive Calculus **or** MATH 241: Calculus I **or** STAT 140: Introduction to Statistics **or** STAT 251: Statistical Methods I **or** PSY 208: Analysis of Behavioral Data (4–6)
- PHYS 151/151L **and** PHYS 152/152L: Physical Principles I, II **or** PHYS 201/201L **and** PHYS 202/202L: Analytic Physics I, II (12)

REQUIREMENTS FOR A MINOR IN BIOLOGY:

6 courses and associated laboratories, if applicable (32–36 credits)

- Three core courses in biology and accompanying laboratories chosen from the following:
 - BIOL 207: Ecology (6)
 - BIOL 220: Human Physiology (6)

BIOLOGY continued

BIOL 236: Molecular and Cell Biology (6)

BIOL 241: Plant Biology (6)

- Three elective courses in biology at or above the 200 level (including laboratories, if applicable).

COURSES IN BIOLOGY:

BIOL 117: ENVIRONMENTAL SCIENCE (4)

Godard

In this lecture/laboratory course students explore how organisms, communities, and ecosystems function under natural conditions, as well as how they function under human influence. We will cover a variety of current environmental concerns in both the classroom and laboratory, including the patterns of human population growth, the extinction crisis, global warming, acid rain, water pollution, solid waste management, sustainable agriculture, and renewable energy. Also listed as ES 117. Not intended for students majoring in biology. Open to first-year students. No prerequisite. Offered Term 2. (SCI)

BIOL 121: PLANTS AND PEOPLE - AN INTRODUCTION TO ETHNOBOTANY (4)

Huish

This interdisciplinary course draws from the natural and social sciences to investigate plant-human interactions. We'll examine modern and historical uses of plants in a variety of cultures. Topics explored include plants as food, medicine, and in ritual and everyday life. The combined lecture/laboratory format allows students to experience the science of ethnobotany firsthand through experimentation and observation. At least one weekend field trip will be required. Not intended for students majoring in biology. Also listed as INTL 121. No prerequisite. Offered both terms. (GLO, SCI)

BIOL 130: BIOLOGICAL SELF DEFENSE (4)

Fenster

This lecture/laboratory course explores how the human immune system protects us from disease and the microbial pathogens that try to breach our defenses. The outcome of this constant interaction dictates the state of human health. Topics covered will include sexually transmitted diseases, biological agents, AIDS, malaria, and other diseases of public health interest. Laboratory experiments will investigate different facets of the immune system, the ubiquity of microorganisms and antibiotic sensitivity/resistance. Not intended for students majoring in biology. Open to first-year students. No prerequisite. Not offered in 2009–10. (SCI)

BIOL 132: HUMAN BIOLOGY - HOW DOES MY BODY WORK? (4)

Wilson

This lecture/laboratory course explores the basic principles and functions of the human body (such as digesting a meal, taking a breath, or fighting an infection) and puts them in the context of total body function. The aims of this course are to provide students with hands-on experience gathering physiological data, as well as with a basic knowledge of human health, which will provide them with a foundation from which they can ask informed questions of a physician about their own health and/or the health of their family members. Not intended for students majoring in biology. Open to first-year students. No prerequisite. Offered Term 1. (SCI)

BIOL 140: HUMAN GENETICS (4)

Beach

In this combined lecture/laboratory course we explore the science behind such issues as human cloning, genetic testing, gene therapy, forensic DNA evidence, and genetically modified foods. Students gain an understanding of how the Human Genome Project may impact their lives and get a hands-on introduction

to the laboratory analyses used in these studies. Not intended for students majoring in biology. Open to first-year students. No prerequisite. Offered Term 2. (SCI)

BIOL 197F: FIRST-YEAR SEMINAR - YOU ARE WHAT YOU EAT: MAKING GOOD FOOD CHOICES FOR YOUR HEALTH AND THE ENVIRONMENT (4) **Beach**

Why do we make the food choices we make? Do we choose food mainly out of habit, or do we consider what is in it and how it was grown? How does the media and advertising influence our diet? In this course students learn to critically evaluate the foods they eat and the messages the food choices send to their bodies and the environment. We will examine where our foods come from, how food production and transportation impact the environment, why excessive use of pesticides has become problematic, and why *trans* fats and genetically modified foods (GMOs) may pose health risks. We will also investigate the energy footprints of processed foods and whole foods, and learn why some scholars advocate locally produced food and plant-based diets as the solution to the many environmental and health issues that surround food. Laboratory investigations will include testing for GMOs in foods, producing cultured and fermented foods, and analyzing our diets for nutritional content. Also listed as ES 197F. No prerequisite. Placement to be determined during the summer. Offered Term 1. (SCI, r)

BIOL 207: ECOLOGY (4) **Godard**

As one of the core courses for the biology major, students explore the structure and function of the natural world. We examine the relationships between organisms and their physical and biological environment, global patterns of climate and biological life, patterns in population dynamics, as well as structure and change in communities of organisms. Also listed as ES 207. Open to first-year students. No prerequisite. Offered Term 1. (SCI: must take lab to fulfill SCI)

BIOL 207L: LABORATORY FOR ECOLOGY (2) **Godard**

Students explore local aquatic and terrestrial ecosystems as well as gain hands-on experience carrying out ecological research in this field laboratory course. Students will also have several opportunities to carry out their own independent research. Also listed as ES 207L. Corequisite: BIOL 207. Offered Term 1. (SCI)

BIOL 220: HUMAN PHYSIOLOGY (4) **Wilson**

As one of the four core courses for the biology major, students explore physiological mechanisms of the human body on the cellular, tissue, organ, organ system, and whole-organism levels, with emphasis on the way in which the human body responds to various external and internal stimuli to maintain homeostasis. Open to first-year students. Prerequisite: CHEM 101 or CHEM 105 or permission. Offered Term 2. (SCI: must take lab to fulfill SCI)

BIOL 220L: LABORATORY FOR HUMAN PHYSIOLOGY (2) **Wilson**

In this inquiry-based laboratory course, we explore many of the tools and techniques used in the study of physiological mechanisms. Students will employ hypothesis testing to explore these mechanisms and learn the essentials of scientific research and writing. Corequisite: BIOL 220. Offered Term 2. (SCI)

BIOLOGY continued

BIOL 236: MOLECULAR AND CELL BIOLOGY (4) **Beach**

The diversity and complexity of different cell types found in multicellular organisms is extensive, yet all eukaryotic cells have the same basic molecular components. One of the four core courses for the biology major, this course provides an overview of cell structure, biological macromolecules, cellular reproduction, and gene structure and function. Open to first-year students. Prerequisite: CHEM 101 or CHEM 105, BIOL 220, or permission. Offered Term 2. (SCI: must take lab to fulfill SCI)

BIOL 236L: LABORATORY FOR MOLECULAR AND CELL BIOLOGY (2) **Beach**

This project-oriented laboratory provides students with the opportunity to analyze and characterize DNA and other cellular molecules. The course is designed to give students experience with an array of molecular biological techniques. In addition, students are exposed to elements of research and experimental design in a directed framework. Corequisite: BIOL 236. Offered Term 2. (SCI)

BIOL 241: PLANT BIOLOGY (4) **Huish**

This course provides a comprehensive understanding of the nature of plants and the practice of plant science. We'll cover the structure, function, and diversity of plants, including discussions of practical/applied plant biology (conservation, biotechnology, etc.). Students will be challenged to build an integrated understanding of plants, from an awareness of their biochemistry to their roles in an ecosystem, enabling future studies of plants and plant-mediated processes. Prerequisite/corequisite: CHEM 101 or CHEM 105. Offered Term 1.

BIOL 241L: LABORATORY FOR PLANT BIOLOGY (2) **Huish**

Laboratory sessions provide a hands-on introduction to plant biology in laboratory and field settings. Investigations of plant structure, diversity, ecology, and physiology will introduce students to experimental design, data collection, and subsequent written and oral presentations of results. At least one weekend field trip will be required. Corequisite: BIOL 241. Offered Term 1. (o)

BIOL 250: SPECIAL TOPIC - ORNITHOLOGY (4) **Wilson**

With nearly 10,000 recognized species, the Class Aves is one of the most diverse groups of animals on Earth. In this combined lecture/laboratory course, students explore the anatomy, physiology, behavior, taxonomy, evolution, and life history of birds, as well as the history of the study of these organisms. During weekly trips into the field, students will explore a variety of habitats and observe birds in their natural environments at several key points of their annual cycle (over-wintering, spring migration, and breeding). During these field experiences, students will learn to identify avian species by both sight and sound. Open to first-year students. No prerequisite. Offered Term 2.

BIOL 260: HUMAN ANATOMY (4) **Godard, Wilson**

In this course, students have the opportunity to investigate the structure of the human body through independent exploration of texts and computer-based models of human anatomy. Students will be evaluated for their understanding of each anatomical system through written tests, lab practicals, and oral exams. This self-directed course is only for students who need human anatomy as a prerequisite for professional schools. Prerequisite/corequisite: BIOL 220 and BIOL 220L. Permission of instructor is required. Offered Term 2.

- BIOL 290: INDEPENDENT STUDY (2 or 4)** **Department**
Tutorials based on standard primary and secondary sources or may contain an experiential component. These studies, below the advanced level, must be planned and approved in consultation with a member of the department prior to registration. Maximum of 8 credits permissible. Offered any term.
- BIOL 310: EVOLUTION AND THE HUMAN CONDITION (4)** **Godard**
In this seminar students explore basic evolutionary concepts, such as natural selection, sexual selection, and population genetics and relate them to issues in human health and disease, the extinction crisis, and other impacts associated with human activity in the world. Our investigations will include an exploration of a variety of issues from the costs and benefits of aging, to the host-pathogen arms race, to the long-term viability of conservation programs for endangered species. Prerequisite: one of the four biology core courses (BIOL 207, BIOL 220, BIOL 236, or BIOL 241) or permission. Offered Term 1. (*o, r*)
- BIOL 312: MICROBIOLOGY (4)** **Fenster**
The term *microorganism* brings to mind the thought of disease and infection, yet plants and animals cannot exist without the many microbes in our world. This course provides a survey of microorganisms, focusing largely on the bacterial organisms and viruses that have the greatest impact on our existence. Prerequisites: BIOL 220 and BIOL 236; CHEM 102 or CHEM 105. Offered Term 2.
- BIOL 312L: LABORATORY FOR MICROBIOLOGY (2)** **Fenster**
This lab concentrates on techniques for culturing, handling, and identifying microorganisms. Students also carry out independent laboratory projects during the final weeks of the semester. Corequisite: BIOL 312. Offered Term 2.
- BIOL 313: INVERTEBRATE ZOOLOGY (4)** **Wilson**
Invertebrates, members of the animal kingdom lacking a backbone, comprise 95 percent of the animals on Earth today. In this course students explore the anatomy, physiology, behavior, ecology, and taxonomy of this incredibly diverse group of animals. Prerequisite: BIOL 220. Not offered in 2009–10.
- BIOL 313L: LABORATORY FOR INVERTEBRATE ZOOLOGY (2)** **Wilson**
This laboratory provides students the opportunity to explore the anatomy of invertebrate organisms, the environments in which they live, and the techniques used to classify them. Exercises are conducted in both the laboratory and the field. Corequisite: BIOL 313. Not offered in 2009–10.
- BIOL 314: GENETICS (4)** **Beach**
This course covers aspects of inheritance, including classical Mendelian and modern molecular genetics. Population genetics and variation will also be explored. Prerequisite: Two of the four biology core courses (BIOL 207, BIOL 220, BIOL 236, or BIOL 241 and CHEM 101 or CHEM 105). Offered Term 1.
- BIOL 314L: LABORATORY FOR GENETICS (2)** **Beach**
In this laboratory students gain practical experience in the techniques of both classical geneticists and molecular biologists. Laboratory investigations include breeding experiments with plants and fruit flies, as well as molecular genetic experiments using recombinant DNA methodology. Corequisite: BIOL 314. Offered Term 1.

BIOLOGY continued

BIOL 315: COMPARATIVE VERTEBRATE ANATOMY (4) Wilson

Why are there no flying elephants? In this course we will compare the design and structure of vertebrate animals in relationship to the environments in which they evolve. We will emphasize the functional morphology of anatomical systems and major adaptive changes in the evolution of vertebrate structure. Prerequisite: BIOL 220. Offered Term 1.

BIOL 315L: LABORATORY FOR COMPARATIVE VERTEBRATE ANATOMY (2) Wilson

This laboratory involves detailed dissections and comparisons of organ systems in the lamprey, shark, and cat. Corequisite: BIOL 315. Offered Term 1.

BIOL 317: BIOLOGICAL PSYCHOLOGY (4) Bowers

Also listed and described as PSY 317. Prerequisites: PSY 141 (or permission) and BIOL 220. Offered Term 1. (SCI)

BIOL 322: DEVELOPMENTAL BIOLOGY (4) Beach

Development from the fertilized egg to a complete adult organism requires a precisely coordinated series of events involving molecular, cellular, and organismal mechanisms. This course provides an integrative survey of animal development, with a focus on those unifying mechanisms that are common to all developing embryos. Prerequisite: BIOL 236. Not offered in 2009–10.

BIOL 322L: LABORATORY FOR DEVELOPMENTAL BIOLOGY (2) Beach

This laboratory is designed to give the student hands-on experience in experimental embryology. The first part of the course is devoted to techniques for handling, culturing, and manipulating invertebrate and vertebrate embryos. Students then apply these techniques in self-designed independent projects during the remaining half of the semester. Corequisite: BIOL 322. Not offered in 2009–10.

BIOL 323: ANIMAL BEHAVIOR (4) Godard

Analyses of animal behavior incorporating ethological, ecological, and evolutionary perspectives. This interdisciplinary course covers the development, underlying mechanisms, adaptive value, and evolution of behavior. Also listed as PSY 323. Prerequisite: BIOL 207 or BIOL 220. Not offered in 2009–10.

BIOL 323L: LABORATORY FOR ANIMAL BEHAVIOR (2) Godard

Observational and experimental techniques in field and laboratory settings. The lab culminates in independent research projects. Also listed as PSY 323L. Corequisite: BIOL 323. Not offered in 2009–10.

BIOL 332: IMMUNOLOGY (4) Fenster

This course provides an overview of the cell and molecular biology of the mammalian immune response, focusing on antibody structure and function, cells and tissues of the immune system, and the genetic basis for antibody diversity. Advances in studies of immune deficiencies, autoimmune diseases, the allergic response, transplant rejection, and cancer are also covered. Prerequisites: BIOL 220 and BIOL 236 and CHEM 101 or CHEM 105. Not offered in 2009–10.

BIOL 332L: LABORATORY FOR IMMUNOLOGY (2) Fenster

This laboratory provides students with hands-on experience in experimental techniques used in immunology research. Laboratory methods focus on cellular, molecular, and biochemical aspects of immunology. Corequisite: BIOL 332. Not offered in 2009–10.

- BIOL 351: BIOCHEMISTRY (4)** **Boatman**
Also listed and described as CHEM 351. Prerequisites: CHEM 222 and CHEM 222L or equivalent. Offered Term 1.
- BIOL 351L: LABORATORY FOR BIOCHEMISTRY (2)** **Boatman**
Also listed and described as CHEM 351L. Corequisite: BIOL 351. Offered Term 1.
- BIOL 352: ADVANCED BIOCHEMISTRY (4)** **Boatman**
Also listed and described as CHEM 352. Prerequisite: BIOL 351. Offered Term 2.
- BIOL 352L: LABORATORY FOR ADVANCED BIOCHEMISTRY (2)** **Boatman**
Also listed and described as CHEM 352L. Corequisite: BIOL 352. Not offered in 2009–10.
- BIOL 357: CONSERVATION BIOLOGY (4)** **Huish**
This seminar examines the impact of current environmental problems (global warming, introduced species, degradation of water resources, land use practices, etc.) on the life-sustaining properties of natural ecosystems, as well as current theories and practices in conservation biology. We not only try to understand the nature, cause, and implications of various environmental issues, but we also explore possible solutions to the problems. Each student has the opportunity to explore a particular environmental problem of interest (from local to global) and present her research. Also listed as ES 357. Prerequisites: BIOL 207 and 207L or BIOL 117 and permission. Offered Term 2.
- BIOL 357L: LABORATORY FOR CONSERVATION BIOLOGY (2)** **Huish**
Laboratory activities will cultivate an understanding of real-world, hands-on conservation biology through fieldtrips, active discussions, and training on the use of professional tools used by conservation biologists, such as GIS (Geographic Information Systems), which significantly aid in the decision-making process for the management and preservation of biodiversity. Offered Term 2.
- BIOL 361: PHYSIOLOGICAL ECOLOGY (4)** **Wilson**
Living organisms must overcome the challenges imposed by their natural surroundings to survive. This course explores the physiological mechanisms that animals (both vertebrate and invertebrate) employ to flourish in a variety of environments, both aquatic and terrestrial. Using a comparative approach in the context of evolution, students explore topics such as osmoregulation and excretion, metabolism, respiration and circulation, thermoregulation, and the neuroendocrine control of physiology and behavior. Prerequisite: BIOL 207 or BIOL 220. Not offered in 2009–10.
- BIOL 361L: PHYSIOLOGICAL ECOLOGY LAB (2)** **Wilson**
This laboratory provides students with hands-on experience documenting and experimentally manipulating the physiological mechanisms employed by organisms in response to a variety of environmental conditions. Following introductory laboratory experiences, students design and carry out their own experiments to test questions involving a variety of physiological processes. Corequisite: BIOL 361. Not offered in 2009–10.
- BIOL 390: INDEPENDENT STUDY (2 or 4)** **Department**
Independent study conducted at the advanced level. Application must be made with faculty prior to registration. Offered any term.

BIOLOGY continued

BIOL 391: INDEPENDENT RESEARCH IN BIOLOGY (4) **Department**

This course is intended for students conducting independent scientific research. At the beginning of the semester in which the student enrolls in this course, a proposal for the research project will be developed in consultation with the faculty supervisor. The project must involve laboratory and/or field research with significant data collection and analysis. The student will be expected to produce a formal scientific report at the conclusion of the project, which should include a review of the scientific literature relevant to the study. Prerequisites: two of the four biology core courses (BIOL 207, BIOL 220, BIOL 236, or BIOL 241). Offered any term.

BIOL 399: INTERNSHIP (4) **Department**

Application must be made with faculty prior to registration. May be proposed any term.

BIOL 471, 472: SENIOR SEMINAR (2, 2) **Beach, Godard**

All majors are required to take this course during both terms of their senior year. During the first term, each student will prepare a portfolio summarizing her academic experiences. Additionally, during the first term students will explore and develop presentations about the primary literature. In the second term, students will choose from a number of major topics of importance and controversy and develop group presentations and lead discussions exploring these topics. Offered both terms.

BIOL 480: SENIOR THESIS (4, 4) **Department**

Students are expected to carry out a yearlong research project (includes Short Term). The research project will be summarized in a paper of publication quality. If a student's status and thesis meet the requirements for honors, then BIOL 480 will be converted to BIOL 490. Application must be made with faculty prior to registration.

BIOL 490: SENIOR HONORS THESIS (4, 4) **Department**

Students should not register for BIOL 490. Research is initially conducted as BIOL 480: Senior Thesis. Honors status will be determined in the spring.