Department of Biological Sciences

Professor: Berger-Sweeney, *Buchholtz, Cameron (Chair), Harris, Peterman[A] , Rodenhouse, Webb*

Associate Professor: *Moore, Sequeira*

Assistant Professor: *Ellerby, Hood-DeGrenier, Mattila, Newton, Suzuki*

Adjunct Assistant Professor: *Jones, Königer[A2]*

Senior Lecturer: *O'Donnell*

Lecturer: *Hughes*

Visiting Lecturer: *LaBonte, Sommers Smith*

Senior Instructor in Biological Sciences Laboratory: *Crum, Helluy, Thomas*

Instructor in Biological Sciences Laboratory: *Beers, Dolce, Hacopian, McDonough, Skow*

Botany Fellow: *Griffith*

Biology is the study of life. Biologists examine life at all levels of organization: chemical, molecular, cellular, organismal, and community. Biology is an extraordinarily dynamic science that interfaces with many other disciplines, continually advancing our understanding of life's complexities. The patterns and processes of evolution provide a unifying theme for our knowledge of the astounding variety of living organisms, past and present.

Unless otherwise noted, all courses meet for two periods of lecture each week. If indicated, there will also be one three-and-one-half hour laboratory session weekly. Seminars normally meet for one double period each week.

Note: For any course that stipulates 110/112 as a prerequisite, the following courses may be used: 110, [110DL], 112. For any course that stipulates 111/113 as a prerequisite, the following courses may be used: 111, [111DL], 111T, 113.

Goals for the Major

An understanding of the fundamental principles and concepts of biology at all levels of organization, from molecules to ecosystems

Strong problem-solving abilities; the ability to think in a broad context about new biological problems and to evaluate data and arrive at defensible conclusions within the framework of current knowledge

Strong quantitative skills and critical thinking abilities; the ability to frame focused biological questions that are approachable experimentally, to formulate and test hypotheses, to analyze and interpret data, and to apply statistical tests

Strong laboratory skills; experience with the operation of complex instrumentation and computers, and an understanding of general lab protocols and safety issues

The ability to read and interpret the primary biological literature and to use literature databases

Strong communication skills; the ability to speak and write about biological topics and the ability to work effectively as a member of a team

An appreciation of the relevance of biology in our lives and the biological literacy required to address ethical and public policy issues of biological significance

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BISC 103 Human Biology

Sommers Smith

The anatomy and physiology of human tissues, organs, and organ systems will be the focus of this course, intended for non-majors or those students seeking to fulfill natural/physical science requirements. The course will be structured around four week-long units. Each unit will consist of four lecture/discussions and one computer laboratory module (Weblab). Weblabs will consist of medical case studies focused on the lecture and discussion material for that week.

Prerequisite: None. Not open to students who have taken BISC 109.
Distribution: Natural and Physical Sciences
Semester: Summer Unit: 1.0

BISC 104 Science or Science Fiction?

Königer

NOT OFFERED IN 2010-11. This course will examine the scientific facts behind phenomena portrayed in a variety of Hollywood and foreign movies. We will cover topics ranging from the definition and recreation of life, genetics, behavior to evolution and environmental issues. The course will include weekly screenings of movies outside of class time as well as lectures, assigned readings and discussions. While obtaining an introduction to key concepts in biology, students will also explore misconceptions about science and scientists that are perpetuated by these movies.

Prerequisite: Fulfillment of the basic skills component of the Quantitative Reasoning requirement.
Distribution: Natural and Physical Science
Semester: N/O Unit: 1.0

BISC 105 Stem Cells: A New Frontier in Biomedicine

O'Donnell

The exciting area of stem cell research has led to many recent discoveries. As researchers have learned more about the properties of these amazing cells, many potential biomedical applications have been envisioned. In this course, we will focus on understanding the unique biological properties of stem cells, and how these cells might lead to novel patient therapies. Questions to be addressed include: How were stem cells discovered? Where do stem cells come from, and what are stem cell lines? What are the similarities and differences between embryonic stem cells, adult stem cells, and recently discovered "induced pluripotent stem cells"? We will also discuss the bioethical issues and scientific controversies associated with recent stem cell discoveries. Promising areas of current research will be described.

Prerequisite: Fulfillment of the basic skills component of the Quantitative Reasoning requirement.
Distribution: Natural and Physical Science
Semester: Fall Unit: 1.0

BISC 106 Environmental Biology with Laboratory

Rodenhouse

In this course we will take a "Google Earth" approach to understanding humanity's role on our blue-green planet. We will zoom in from the Earth's energy budget to the evolutionary effects of choices made by individual water striders on a New England stream; and, we will explore the theoretical and practical implications of our findings. Labs will be conducted primarily out-of-doors: in the snow, at the seashore, on rivers, in lakes, under the forest canopy and over a mountaintop. Emphases will be on keen observation, creative thinking, synthesis and extrapolation of ideas, exploration and discoveries large and small, intellectual and physical.

Prerequisite: Open to first-year students only. Fulfillment of the basic skills component of the Quantitative Reasoning requirement
Distribution: Natural and Physical Science
Semester: Spring Unit: 1.25

BISC 107 Biotechnology

LaBonte

This course focuses on applications of recently developed biological techniques, including recombinant DNA, antibody techniques and reproductive technology. The social and ethical issues surrounding these techniques are also discussed. No prior knowledge of biology is expected, as all necessary background information will be discussed.

Prerequisite: Fulfillment of the basic skills component of the Quantitative Reasoning requirement.
Distribution: Natural and Physical Science
Semester: Fall Unit: 1.0

BISC 108 Environmental Horticulture with Laboratory

Jones, McDonough, Thomas

This course will examine how plants function, both as individual organisms and as critical members of ecological communities, with special emphasis on human uses of plants. Topics will include plant adaptations, reproduction, environmentally sound landscape practices, urban horticulture, and the use of medicinal plants. The laboratory involves extensive use of the greenhouses, experimental design, data collection and analysis, and field trips.

Prerequisite: Fulfillment of the basic skills component of the Quantitative Reasoning requirement.
Distribution: Natural and Physical Science
Semester: Spring Unit: 1.25

BISC 109 Human Biology with Laboratory

Ellerby, McDonough, Skow

In this class, we will explore human biology through case studies, lectures, and laboratories. Lecture topics will include: the structure and function of the major physiological systems; recent developments in health care; human genetics; and the impacts of human activity on the environment. Laboratories involve data collection using computers, physiological test equipment, limited animal dissection, a personal nutrition study and field trips.

Prerequisite: Fulfillment of the basic skills component of the Quantitative Reasoning requirement. Not open to students who have taken 103.
Distribution: Natural and Physical Science. Fulfills the Quantitative Reasoning overlay course requirement.
Semester: Fall Unit: 1.25

BISC 110 Introductory Cellular and Molecular Biology with Laboratory

Staff

A gateway course that focuses on the study of life at the cellular and molecular level, including eukaryotic and prokaryotic cell structure, function of biological macromolecules, cellular metabolism, molecular genetics, and mechanisms of growth and differentiation. This course will provide the fundamental tools for exploration of this field with the aim of enhancing conceptual understanding. Laboratories focus on experimental approaches to these topics and are shared with 112. *Either 110/112 or 111/113 may be taken first.*

Prerequisite: Fulfillment of the basic skills component of the Quantitative Reasoning requirement. Not open to students who have taken 112.
Distribution: Natural and Physical Science
Semester: Fall, Spring Unit: 1.25

BISC 111 Introductory Organismal Biology with Laboratory

Staff

A gateway course that focuses on the study of life at the organismal level. The main themes of this course are the evolution and diversification of life, the form and function of plants and animals, and ecological interactions among organisms. This course will provide the fundamental tools for exploration of this field with the aim of enhancing conceptual understanding. Laboratories focus on experimental approaches to these topics and are shared with 113. *Either 110/112 or 111/113 may be taken first.*

Prerequisite: Fulfillment of the basic skills component of the Quantitative Reasoning requirement. Not open to students who have taken 113.
Distribution: Natural and Physical Science. Fulfills the Quantitative Reasoning overlay course requirement.
Semester: Fall, Spring Unit: 1.25

BISC 111T Introductory Organismal Biology with Laboratory (Tropical Island)

Königer

Introduction to the central questions, concepts, and methods of experimental analysis in selected areas of organismal biology with a focus on tropical island biology. Topics include: evolution, ecology, and plant and animal structure and physiology. Lectures and discussions during the first two weeks will prepare students for the field laboratory and lectures taught at the Central Caribbean Marine Institute in Little Cayman. Laboratory work will be carried out primarily in the field and includes introductions to the flora and fauna of the island and the coral reefs, as well as group projects. *Normally offered every summer session I. Subject to Dean's Office Approval.*

Prerequisite: Fulfillment of the basic skills component of the Quantitative Reasoning requirement. Not open to students who have taken 113.
Distribution: Natural and Physical Science. Fulfills the Quantitative Reasoning overlay course requirement.

Semester: Summer Unit: 1.25

BISC 112 Exploration of Cellular and Molecular Biology with Laboratory

Staff

Seminar-style introduction to life at the cellular and molecular level, designed as an alternative to 110 for students with strong high school preparation (such as AP, IB, or other). The course will include eukaryotic and prokaryotic cell structure, function of biological macromolecules, cellular metabolism, molecular genetics, and mechanisms of growth and differentiation, with an emphasis on experimental approaches to investigating these topics. This course will aim to develop students' skills in data analysis and scientific writing along with building foundational knowledge in the field. Lab sections are shared with 110. 112 differs from 110 in its small class size and discussion-based format. 112 meets for one discussion and one lab session per week. *Either 110/112 or 111/113 may be taken first.*

Prerequisite: A score of 4 or 5 on the Biology AP exam or equivalent experience or permission of instructor. Fulfillment of the basic skills component of the Quantitative Reasoning requirement. One section in the fall will be open to first-year students only. Not open to students who have taken 110.
Distribution: Natural and Physical Science
Semester: Fall, Spring Unit: 1.0

BISC 113 Exploration of Organismal Biology with Laboratory

Staff

An exploration of the central questions, concepts, and methods of experimental analysis in selected areas of organismal biology, designed as an alternative to 111 for students with strong high school preparation (such as AP, IB, or other). Topics include: the evolution and diversification of life, the form and function of plants and animals, and ecological interactions among organisms, with an emphasis on laboratory methods, data analysis, and science writing. Lab sections are shared with 111. 113 differs from 111 in its smaller class size, a seminar-style format, and a focus on discussion of landmark scientific studies that shape this field. 113 meets for one discussion and one lab session per week. *Either 110/112 or 111/113 may be taken first.*

Prerequisite: A score of 4 or 5 on the Biology AP exam or equivalent experience or permission of instructor. Fulfillment of the basic skills component of the Quantitative Reasoning requirement. One section in the fall will be open to first-year students only. Not open to students who have taken 111.
Semester: Fall, Spring Unit: 1.0

BISC 198 Statistics in the Biosciences

Hughes

This course combines statistical theory and practical application, the latter using examples from ecology and experimental biology to illustrate some of the more common techniques of experimental design and data analysis. Students will learn how to plan an experiment and consider the observations, measurements, and potential statistical tests before data are collected and analyzed. Other topics include graphical representation of data, probability distributions and their applications, one- and two-way ANOVA and t-tests, regression and correlation, goodness-of-fit tests, and nonparametric alternatives. Students also learn to use statistical computer software.

Prerequisite: Fulfillment of the basic skills component of the Quantitative Reasoning requirement and one course in biology, chemistry, or environmental science. Fulfills the Quantitative Reasoning overlay course requirement.
Distribution: Natural and Physical Science
Semester: Spring Unit: 1.0

BISC 201 Ecology with Laboratory

Rodenhouse

An introduction to the scientific study of interactions between organisms and their environments. Topics include evolutionary adaptation in dynamic environments, behavioral ecology and life-history strategies, population growth and regulation, species interactions (competition, parasitism, mutualism, predation) and their consequences, and the structure and function of biological communities and ecosystems. Emphasis is placed on experimental ecology and its uses in addressing environmental issues such as biological control of pests, conservation of endangered species and global climate change. Laboratories occur primarily in the field where students explore and study local habitats, including meadows, forests, alpine tundra, bogs, dunes, marshes, lakes, and streams.

Prerequisite: 108 or 111/113 or ES 101 or by permission of the instructor.
Distribution: Natural and Physical Science. Fulfills the Quantitative Reasoning overlay course requirement.
Semester: Fall Unit: 1.25

BISC 202 Evolution with Laboratory

Buchholtz

NOT OFFERED IN 2010-11. Examination of evolution, the central paradigm of biology, at the level of populations, species, and lineages. Topics include the genetics of populations, the definition of species, the roles of natural selection and chance in evolution, the reconstruction of phylogeny using molecular and morphological evidence, and patterns in the origination, diversity, and extinction of species over time.

Prerequisites: 110/112 and 111/113
Distribution: Natural and Physical Science
Semester: N/O Unit: 1.25

BISC 203 Comparative Physiology and Anatomy of Vertebrates with Laboratory

Cameron, Buchholtz, Dolce, Helluy

The physiology and functional anatomy of vertebrate animals, with an emphasis on comparisons among representative groups. The course covers topics in thermoregulatory, osmoregulatory, reproductive, cardiovascular, respiratory, digestive, neural and ecological physiology. The laboratories incorporate the study of preserved materials and physiological experiments.

Prerequisite: 109 or 111/113, or permission of the instructor.
Distribution: Natural and Physical Science
Semester: Fall Unit: 1.25

BISC 206 Histology I: Human Microscopic Anatomy with Laboratory

Sommers Smith, Hacopian

NOT OFFERED IN 2010-11. The structure and function of human tissues, and their cells, using light microscopic, histochemical and electron microscopic techniques. Topics covered include the connective tissues, epithelia, nervous tissue, blood, lymphoid tissue and immunology, as well as others. Laboratory study includes direct experience with selected techniques.

Prerequisite: 110/112
Distribution: Natural and Physical Science
Semester: N/O Unit: 1.25

BISC 207 The Biology of Plants with Laboratory

Peterman, Königer

NOT OFFERED IN 2010-11. An introduction to experimental plant biology. Topics will include growth and development, stress physiology, plant defense, applications of genetic engineering to the study and improvement of plants and the properties of medicinal plants. The project-oriented laboratory sessions will provide an introduction to some of the techniques currently employed in answering research questions ranging from the organismal to the cellular level.

Prerequisite: 110/112 or 111/113
Distribution: Natural and Physical Science
Semester: N/O Unit: 1.25

BISC 209 Microbiology with Laboratory

Newton, Crum, McDonough

Overview of the microbial world including a survey of the structure, functioning, and diversity of microorganisms, Introduction to the fundamental concepts of microbial evolution, genomics, metabolism, ecology, genetics, and pathogenesis. The student will gain extensive experience in microbiological laboratory procedures including sterile technique, microscopy, enrichment, isolation, and methods of identification and preservation.

Prerequisite: 110/112 and one unit of college chemistry
Distribution: Natural and Physical Science
Semester: Spring Unit: 1.25

BISC 210 Marine Biology with Laboratory

Moore, Hughes

Oceans cover more than 70 percent of the earth's surface and are our planet's primary life support system. This course examines adaptations and interactions of plants, animals and their environments in marine habitats. Focal habitats include the photic zone of the open ocean, the deep-sea, subtidal and intertidal zones, estuaries, and coral reefs. Emphasis is placed on the dominant organisms, food webs, and experimental studies conducted within each habitat. Laboratories will emphasize primarily fieldwork outdoors in marine habitats where students will gather data for the testing of student-originated hypotheses.

Prerequisite: 111/113 or ES 101, or by permission of the instructor.
Distribution: Natural and Physical Science
Semester: Fall Unit: 1.25

BISC 214 Animal Behavior with Laboratory

Ellerby, Mattila

In meeting the challenges of survival and reproduction, animals have evolved behaviors that can be spectacular and sometimes unpleasant. With an eye to how behaviors ultimately shape an animal's fitness, we will explore the aspects of life that makes each animal's strategy unique, including communication, orientation, foraging, conflict and aggression, mating, parental care, and social life. Laboratories will expose students to the challenges of collecting, analyzing, interpreting, and presenting data on animal behavior.

Prerequisite: 109 or 111/113, or permission of the instructor.
Distribution: Natural and Physical Science
Semester: Spring Unit: 1.25

BISC 216 Mechanisms of Animal Development with Laboratory

O'Donnell, Suzuki, Skow

In this course, we will explore animal development beginning with the process of fertilization. We will consider how a single cell gives rise to the many specialized cell types of the adult and how the development of tissues and the whole body is coordinated. The mechanisms that determine cell fate during embryonic and postembryonic maturation of animals will be discussed. Topics will include: embryonic induction, pattern formation, organ development, regeneration, stem cells, growth, developmental plasticity and aging. Laboratory sessions will focus on experimental approaches to development.

Prerequisite: 110/112 and 111/113, or permission of the instructor.
Distribution: Natural and Physical Science
Semester: Spring Unit: 1.25

BISC 217/ES 217 Field Botany with Laboratory

Griffith

Field Botany is a combination of "What's that wildflower?" and "Why does it grow over there and not here?" The course merges aspects of plant systematics and identification (with an emphasis on learning the local flora and important plant families) and plant ecology (with an emphasis on ecological interactions and phenomena unique to plants). Laboratories will primarily be taught in the field and greenhouses and will include using dichotomous and web-based keys to identify plants, observational and experimental studies, and long-term study of forest patches on the Wellesley campus. Laboratories will also include experimental design and data analysis. The goal of Field Botany is not only to train students in botany and plant ecology, but to engage them in botany every time they step outside. *Students may register for either BISC 217 or ES 217 and credit will be granted accordingly.*

Prerequisite: 108 or 111/113 or ES 101 or permission of instructor.
Distribution: Natural and Physical Science
Semester: Fall Unit: 1.25

BISC 219 Genetics with Laboratory

Webb, Königer, Beers, Crum

The goal of the course is to develop an understanding of the fundamental principles of genetics at the molecular, cellular, and organismal levels. The mechanisms that regulate the control of gene expression leading to alteration in phenotype during cellular differential will be studied. A link will be established between the generation of genetic variants through mutation and recombination, their patterns of inheritance, interactions between genes to produce complex phenotypes and the maintenance of such genetic variation in natural populations. Topics will include: organization of the eukaryotic genome, gene structure and function, multi-level gene control, genetics of pattern formation, inheritance of gene differences, gene and allele interactions and aspects of population and evolutionary genetics. Laboratory experiments will expose students to the fundamentals of genetics including modern molecular techniques for genetic analysis.

Prerequisite: 110/112 and one unit of college chemistry. Not open to first-year students.
Distribution: Natural and Physical Science
Semester: Fall Unit: 1.25

BISC 220 Cellular Physiology with Laboratory

Harris, Hood-DeGrenier, Beers

This course will focus on structure/function relationships in eukaryotic cells. Topics include: protein structure and introductory enzyme kinetics, membrane and membrane-bound organelle structure and function, cytoskeleton, transport mechanisms, cell communication, cell cycle, apoptosis, and cancer cell biology with an emphasis on experimental methods for investigating these topics. The laboratory consists of three projects: enzyme purification and characterization, investigation of cellular transport pathways in yeast, and an analysis of the cytoskeleton in cultured mammalian cells using fluorescence microscopy.

Prerequisite: 110/112 and two units of college chemistry. One semester of organic chemistry is recommended. Not open to first-year students.
Distribution: Natural and Physical Science
Semester: Spring Unit: 1.25

BISC 250 Research or Individual Study

Prerequisite: By permission of the instructor.
Distribution: None
Semester: Fall, Spring Unit: 1.0

BISC 250H Research or Individual Study

Prerequisite: By permission of the instructor.
Distribution: None
Semester: Fall, Spring Unit: 0.5

BISC 302 Human Physiology with Laboratory

Cameron, Paul (Neuroscience)

This course takes an integrated approach to the study of organ system function in humans. We will examine control mechanisms that allow the body to maintain a constant balance in the face of environmental challenges, such as exercise, temperature change, and high altitude. Our particular focus will be recent findings in the areas of neural, cardiovascular, respiratory, renal, and muscle physiology. In the laboratory, students gain experience with the tools of modern physiological research at both the cellular and organismal levels.

Prerequisite: 111/113 or NEUR 100, and one of the following: 203, 206, NEUR 200
Distribution: Natural and Physical Science
Semester: Spring Unit: 1.25

BISC 303/CS 303 Bioinformatics

Tjaden (Computer Science)

NOT OFFERED IN 2010-11. A multidisciplinary seminar exploring the origins, present and future applications, and challenges of the intersection of biological and computer sciences. The field of bioinformatics, generated in response to the era of genomics, encompasses all aspects of biological data acquisition, storage, processing, analysis and interpretation with a view to generating in silico models of cellular function. *Students may register for either BISC 303 or CS 303 and credit will be granted accordingly.*

Prerequisites: 219 or 220 or CS 231. Not open to students who have taken CS 313.
Distribution: Natural and Physical Science
Semester: N/O Unit: 1.0

BISC 305 Seminar. Evolution

Buchholtz

A brief history of life. Origin of life from nonlife, evolution of replicatory molecules, origin of eukaryotic cellular structure, diversification of organic domains, kingdoms and animal phyla, development of strategies for life in terrestrial environments, patterns of extinction. The course will emphasize student participation and make extensive use of the primary literature.

Prerequisite: Two units in Biological Sciences at the 200 level or permission of the instructor.
Distribution: Natural and Physical Science
Semester: Fall Unit: 1.0

BISC 306/NEUR 306 Principles of Neural Development with Laboratory

Beltz (Neuroscience), Paul (Neuroscience)

This course will discuss aspects of nervous system development and how they relate to the development of the organism as a whole. Topics such as neural induction, neurogenesis, programmed cell death, axon guidance, synaptogenesis and the development of behavior will be discussed, with an emphasis on the primary literature and critical reading skills. Laboratory sessions focus on a variety of methods used to define developing neural systems. *Students may register for either BISC 306 or NEUR 306 and credit will be granted accordingly.*

Prerequisite: BISC 216 or NEUR 200, or permission of the instructor
Distribution: Epistemology and Cognition or Natural and Physical Science
Semester: Spring Unit: 1.25

BISC 307/ES 307 Advanced Topics in Ecology with Laboratory

NOT OFFERED IN 2010-11.

Prerequisite: Two units in Biological Sciences at the 200-level or above, or permission of the instructor
Distribution: Natural and Physical Science
Semester: N/O Unit: 1.25

BISC 308 Tropical Ecology with Wintersession Laboratory

Königer, Helluy

Tropical rain forests and coral reefs seem to invite superlatives. They are among the most fascinating, diverse, productive, but also most endangered ecosystems on earth. These topics are addressed during the fall lectures in preparation for the laboratory part of the course which takes place in Central America during wintersession. We first travel to a small island part of an atoll bordering the world's second longest barrier reef off the coast of Belize. In the second half of the field course we explore an intact lowland rain forest in Costa Rica. Laboratory work is carried out primarily outdoors and includes introductions to flora and fauna, and implementation of research projects designed during the fall. *Normally offered in alternate years. Subject to Dean's Office approval.*

Prerequisite: 201, 207, or 210, and permission of the instructor. Application required.
Distribution: Natural and Physical Science
Semester: Fall Unit: 1.25

BISC 310 Advanced Topics in Cellular Regulation with Laboratory

Hood-DeGrenier

Eukaryotic cells possess a diverse array of molecular circuits that regulate their normal activities and respond to external signals. Common modes of regulation include modulation of protein expression or localization, covalent protein modifications, and protein-protein interactions. This course will examine this diverse range of molecular regulatory mechanisms in the context of eukaryotic cell cycle control. The course format will combine minimal lecturing by the instructor with student presentations and discussion of articles from the scientific literature. The laboratory component will involve a semester-long investigative laboratory project related to the instructor's research.

Prerequisite: 219 or 220 (both recommended)
Distribution: Natural and Physical Science
Semester: Fall Unit: 1.25

BISC 311 Evolutionary Developmental Biology with Laboratory

Suzuki

The diversity of organismal forms has fascinated human beings for centuries. How did butterflies get eyespots? What is the evolutionary origin of bird feathers? How did snakes get to be so long? The field of evolutionary developmental biology or evo-devo integrates the long separate fields of evolutionary biology and developmental biology to answer these questions. In this course, we will explore topics such as the evolution of novelties, body plan evolution, developmental constraints, convergent evolution and the role of environmental changes in evolution. Through reading of original papers, we will examine recent advances made in evo-devo and critically analyze the role of evo-devo in biology and the implications beyond biology. Students will have the opportunity to design and conduct an independent research project using arthropods.

Prerequisite: 202 or 216 or by permission of instructor. Not open to students who have taken [309].
Distribution: Natural and Physical Science
Semester: Fall Unit: 1.25

BISC 313 Seminar. Microbial Physiology and Biochemistry

NOT OFFERED IN 2010-11.

Prerequisite: 209, 219 or 220, and CHEM 211, or permission of the instructor
Distribution: Natural and Physical Science
Semester: N/O Unit: 1.0

BISC 314 Environmental Microbiology with Lab

Newton

A field-based exploration of the microbial world centered on distinct microbial habitats visited locally. Short lectures and readings from primary literature will be combined with trips to visit a diverse set of microbial environments where students will collect samples for microbial isolation as well as culture-independent community assessment. In the laboratory, students will learn how to identify and design media for selective isolation of microbes involved in processes such as: methanotrophy, sulfur oxidation, nitrogen fixation, syntrophism and symbiosis, fermentation of ethanol and aging of cheese. Student participation and discussion of original scientific literature will be emphasized.

Prerequisite: CHEM 211 plus any of the following: 201, 202, 209, 210, 219 or 220 or permission of the instructor
Distribution: Natural and Physical Science
Semester: Fall Unit: 1.25

BISC 315/NEUR 315 Neuroendocrinology with Laboratory

Tetel (Neuroscience)

Hormones act throughout the body to coordinate basic biological functions such as development, differentiation and reproduction. This course will investigate how hormones act in the brain to regulate physiology and behavior. We will study how the major neuroendocrine axes regulate a variety of functions, including brain development, reproductive physiology and behavior, homeostasis and stress. The regulation of these functions by hormones will be investigated at the molecular, cellular and systems levels. Laboratory experiments will explore various approaches to neuroendocrine research, including the detection of hormone receptors in the brain and analysis of behavior. *Students may register for either BISC 315 or NEUR 315 and credit will be granted accordingly.*

Prerequisite: NEUR 200, or both BISC 110/112 and BISC 203, or permission of the instructor
Distribution: Epistemology and Cognition or Natural and Physical Science
Semester: Fall Unit: 1.25

BISC 319 Population Genetics and Systematics: Evolution on Islands with Laboratory

Sequeira

In this course, we will focus on patterns of population differentiation and speciation in oceanic islands. Little is known about the ecological and historical forces responsible for speciation although these are key for the generation of biological diversity. By looking at relationships between organisms, populations and species, we can interpret how historical processes can leave evolutionary footprints on the geographic distribution of traits. After a series of introductory lectures, the course will involve student presentations and discussion of primary literature examining cases in archipelagos (Hawaii, Canaries and Galapagos). In the laboratory, we will explore computational biology tools for analysis of DNA sequences, and apply methods of phylogeny, phylogeography reconstruction and population demographics. We will also explore the growing field of molecular dating of evolutionary events.

Prerequisite: 201 or 202 or 210 or 219 or by permission of the instructor.
Distribution: Natural and Physical Science
Semester: Spring Unit: 1.25

BISC 320 Proteomics with Laboratory

Harris

The sequencing of the genomes of many organisms has provided biologists with vast storehouses of information. However, it is important to remember that DNA sequences only provide a recipe for life. To a great extent the living condition arises from the complex interactions of thousands of cellular proteins. Research that focuses on the large-scale study of proteins is called proteomics. This course introduces students to the techniques utilized and the scientific questions being addressed in this newly emerging discipline. Student participation and the use of original literature will be emphasized. In the laboratory students will perform two-dimensional gel electrophoresis, peptide mass fingerprinting using MALDI-TOF mass spectrometry, and DNA microarrays.

Prerequisite: 219, 220 and CHEM 211, or by permission of the instructor
Distribution: Natural and Physical Science
Semester: Spring Unit: 1.25

BISC 322 Designs for Life: The Biomechanics of Animals and Plants with Laboratory

Ellerby

This course will focus on how organisms cope with a complex physical world. Their sophisticated designs withstand large environmental forces, caused by gravity, wind, and water flow. Animals, as well as confronting the problems of not falling over or apart, must overcome additional challenges associated with locomotion. Biomaterials, including spider silk that is stronger than steel and springy tendons that power prodigious jumps, help make this possible. Topics for discussion will include how biomaterials give organisms structure and strength, how muscle acts as a biological motor during locomotion, how animals swim and fly, and how they run, walk and jump effectively on land. Class discussion and student presentation of recent primary literature will be an integral part of the course. Labs will include the analysis of video images to calculate accelerations and power during movement, and the use of force plates to quantify contact forces during running and jumping.

Prerequisite: Two units in Biological Sciences at the 200 level or permission of the instructor. Not open to students who have taken 321.
Distribution: Natural and Physical Science
Semester: Spring Unit: 1.25

BISC 327/ES 327 Biodiversity Topics

NOT OFFERED IN 2010-11.

Prerequisite: ES 201/GEOS 201 or BISC 201 or BISC 207 or permission of instructor
Distribution: Natural and Physical Sciences
Semester: N/O Unit: 1.0

BISC 331 Seminar. Cancer Genomics

Webb

Cancer can be attributed to disruption of gene structure and function. Functional genomics has contributed more to the understanding and treatment of cancer in the last five years than the previous half century of oncology research. This course will provide a comprehensive study of the biological basis of malignancy from pathophysiology to the genetics of the transformed phenotype with a view to use of genomics in diagnosis, prognosis and treatment directed at specific molecular targets. Topics to be discussed include pharmacogenomics, immunotherapy, tumor stem cells, RNAi, biomarkers, oncolytic viruses, nanotechnology, transcriptional profiling of both coding and non-coding RNAs, and reprogramming of epigenomic as well as epithelial-mesenchyme transition profiles. Class discussion and student presentation of recent original literature will be an integral part of the course.

Prerequisites: 219 or 220 or by permission of the instructor
Distribution: Natural and Physical Science
Semester: Spring Unit: 1.0

BISC 334 The Biology of Stem Cells

O'Donnell

In this course, we will study stem cells in terms of molecular, cellular and developmental biology. We will focus on different types of stem cells, particularly embryonic stem cells, adult stem cells, cancer stem cells, and induced pluripotent stem cells. More specifically, we will explore how stem cells develop, the criteria by which stem cells are currently defined, and stem cell characteristics under investigation. Current research in the area of therapeutic cloning (somatic cell nuclear transfer) and potential stem cell therapies for the treatment of degenerative diseases will also be discussed. Bioethical issues related to stem cell biology will be described. Students will present and discuss original literature throughout the course.

Prerequisites: 216 or 219 or 220
Distribution: Natural and Physical Science
Semester: Fall Unit: 1.0

BISC 336 Seminar

Pratt (Olin College)

Topic for 2010-11: Immunology. In this course, we will study the molecular, cellular and biochemical features of the immune system. We will also develop an appreciation for the interrelationship of immune components and their ability to function as an interactive system. Specific topics to be addressed include tissues, cells, lymphocyte activation, the Immune system, Innate Immunity, cellular and humoral immune responses, cytokines, lymphocyte activation, the major histocompatibility complex, antibody structure and genetics, autoimmunity and the Immune system and cancer. In this discussion- and presentation-based class, current research in immunology will be emphasized through the analysis of primary literature.

Prerequisite: 209 or 219 or 220 or permission of the instructor.
Distribution: Natural and Physical Sciences
Semester: Spring Unit: 1.0

BISC 338 Seminar: The Biology of Social Insects

Mattila

Warfare, communication, agriculture, and caring for family are phenomena that are typically attributed to human societies, but social insects do these same things. In this course, we will explore the weird and wonderful world of social insects to discover their diverse strategies for success. We will learn about how conflict and selfishness have shaped the cooperative effort that characterizes these seemingly utopian communities. Topics will include the natural history of social insects, self organization in systems, models of division of labor, communication, and an examination of some of the biological oddities that have arisen as a result of kin selection. The format for the course will consist of demonstrations of basic principles, followed by discussion and presentation of classic literature and ground-breaking, current research.

Prerequisite: 201, 202, or 214 or by permission of instructor
Distribution: Natural and Physical Sciences
Semester: Spring Unit: 1.0

BISC 339 Seminar. Biology of Parasites

NOT OFFERED IN 2010-11.

Prerequisite: Two units in Biological Sciences at the 200- level or permission of the instructor.
Distribution: Natural and Physical Science
Semester: N/O Unit: 1.0

BISC 350 Research or Individual Study

Prerequisite: Open by permission of the instructor, ordinarily to students who have taken at least four units in biology.
Distribution: None
Semester: Fall, Spring Unit: 1.0

BISC 360 Senior Thesis Research

Prerequisite: By permission of the department. Occasional group meetings and one oral presentation will be required. See Academic Distinctions.
Distribution: None
Semester: Fall, Spring Unit: 1.0

BISC 370 Senior Thesis

Prerequisite: 360 and permission of department. Occasional group meetings and one oral presentation will be required.
Distribution: None
Semester: Fall, Spring Unit: 1.0

Related Courses

Attention Called

CHEM 221 Biochemistry I with Laboratory

CHEM 222 Introduction to Biochemistry with Laboratory

CHEM 328 Biochemistry II with Laboratory

CS 112 Computation for the Sciences

ES 212/RAST 212 Lake Baikal: The Soul of Siberia

EXTD 225 Biology of Fishes

EXTD 226 Biology of Whales

GEOS 110 The Coastal Zone: Intersection of Land, Sea, and Humanity with Laboratory

GEOS 200 The Earth and Life Through Time with Laboratory

GEOS 205 Vertebrate Paleontology: Revolutions in Evolution

GEOS 208 Oceanography

NEUR 100 Brain, Behavior, and Cognition:
An Introduction to Neuroscience

NEUR 200 Neurons, Networks, and Behavior with Laboratory

NEUR 320 Vision and Art: Physics, Physiology, Perception, and Practice with Laboratory

NEUR 335 Computational Neuroscience with Laboratory

PE 205 Sports Medicine

PHIL 217 Philosophy of Science: Traditional and Feminist Perspectives

PHIL 233 Environmental Philosophy

PHIL 249 Medical Ethics

PHYS 103 The Physics of Marine Mammals

PHYS 222 Medical Physics

RAST 212/ES 212 Lake Baikal: The Soul of Siberia

Requirements for the Major

For students who enter the College in the fall of 2008 or later, a major in Biological Sciences includes: nine biological sciences courses, at least seven of which must be taken at Wellesley, plus two units of college chemistry (CHEM 105 or higher). BISC 110/112 and 111/113 are required for the major. Four 200-level courses are required, with at least one course from each of the following three groups: cell biology (206, 219, 220); systems biology (203, 207, 216); and community biology (201, 202, [208], 209, 210, 214, 217/ES 217). A minimum of two 300-level courses are also required for the major. One of these courses, exclusive of 350, 360, or 370, must include laboratory and must be taken at Wellesley. Additional chemistry beyond the two required units is strongly recommended or required for certain 300-level courses. CHEM 221 and 328, and BISC 350, 360, and 370 do not count toward the minimum major.

BISC 103, 104, 105, 106, 107, 108, and 109, which do count toward the minimum major in Biological Sciences, may also be used to fulfill the College distribution requirements; 106, 108 and 109 as laboratory sciences; 103, 104, 105 and 107 as nonlaboratory science courses. BISC 109, 111/113, 198 and 201 fulfill the Quantitative Reasoning overlay course requirement.

For students who entered the College prior to the fall of 2008, a major in Biological Sciences includes: eight biological sciences courses, at least six of which must be taken at Wellesley, plus two units of college chemistry (CHEM 105 or higher). BISC 110/112 and 111/113 or their equivalent are required for the major. Four 200-level courses are required, with at least one course from each of the following three groups: cell biology (206, 219, 220); systems biology (203, 207, [213], 216); and community biology (201, 202, 209, 210, 214, 217). A minimum of two 300-level courses are also required for the major. One of these courses, exclusive of 350, 360, or 370, must include laboratory and must be taken at Wellesley. Additional chemistry beyond the two required units is strongly recommended or required for certain 300-level courses. CHEM 221 and 328, and BISC 350, 360, and 370 do not count toward the minimum major.

BISC 103, 104, 105, 106, 107, 108, and 109, which do not count toward the minimum major in biological sciences, do fulfill the College distribution requirements; 106, 108 and 109 as laboratory sciences; 103, 104, 105 and 107 as nonlaboratory science courses. BISC 109, 111/113, 198, and 201 fulfill the Quantitative Reasoning overlay course requirement.

Requirements for the Minor

A minor in Biological Sciences (five units) consists of: (A) BISC 110/112 and 111/113; (B) two 200-level units, each of which must be in a different group as described in the first paragraph above under major requirements; and (C) one 300-level unit, excluding 350, which must be taken at Wellesley. Four of the five courses for a minor must be taken at Wellesley. Chemistry is recommended. Students planning a minor should consult the chair.

Honors

Honors in Biological Sciences is earned by the demonstration of excellence in both coursework and a thesis research project. All junior majors are invited to apply for the honors program. Final acceptance into the program is contingent on a vote of the department faculty and, typically, a grade point of 3.5 or higher in courses in the major above the 100 level. The primary goal of the thesis project is the development of independent research capabilities, culminating in the writing of a research paper. Honors candidates present the results of their thesis research to an examination committee in the thesis oral discussion, which takes place during reading period. After the oral examination, the thesis committee evaluates the candidate's performance and may recommend approval of the degree with honors. For more information, please see the bulletin "Guidelines for Research Students and Advisors" and the biological sciences department Web site for honors and theses: www.wellesley.edu/Biology/honors_theses.html.

Graduate Study

Students planning graduate work are advised to take calculus, statistics, organic chemistry, two units of physics, and to have a reading knowledge of a second language. They should consult the catalogs of the graduate schools of their choice for specific requirements. Premedical students are referred to the requirements given in the Academic Program section.

Advanced Placement Policy

AP credit does not replace any course offered in the Department of Biological Sciences and does not count toward a major or a minor in biological sciences, biological chemistry, or neuroscience. No exemption exams will be given for BISC 110/112 or 111/113. All biology courses require the fulfillment of the Quantitative Reasoning basic skills requirement as a prerequisite.

Transfer Credit

In order to obtain Wellesley credit for any biology course taken at another institution during the summer or the academic year, preliminary approval must be obtained from the chair of the department prior to enrolling in the course. After enrolling at Wellesley, courses from two-year colleges will not be accepted at any level. Transfer students wishing to obtain credit for biology courses taken prior to enrollment at Wellesley should consult the chair of the department.

Interdepartmental Majors

Students interested in the interdepartmental major in **biological chemistry** are referred to the section of the catalog where the program is described. They should consult with the director of the biological chemistry program.

Students interested in the interdepartmental major in **neuroscience** are referred to the section of the catalog where this program is described. They should consult with the director of the neuroscience program.

Students interested in the interdepartmental major in **environmental studies** are referred to the section of the catalog where this program is described. They should consult with the directors of the environmental science program. Students interested in concentrating in community biology may wish to supplement and enrich their work at Wellesley by taking extradepartmental courses offered through the Marine Studies Consortium or the Semester in Environmental Science (SES) offered each fall at the Ecosystems Center of the Marine Biological Laboratory, Woods Hole, Massachusetts. Students are referred to the sections of the catalog titled Extradepartmental and Special Academic Programs where these opportunities are described.