Biology (Div. III)


The Biology curriculum has been designed to provide students with a broad base for understanding principles governing life processes at all levels, from biochemistry and cell biology to physiology to ecology and behavior. Courses emphasize fundamentals common to all sub-disciplines including the coupling of structure to function, the transfer of energy in living systems, communication, and the molding of diversity by the evolutionary process. In upper-level courses and in independent and honors research, students have the opportunity to investigate areas at the frontiers of modern biology.

Although the Biology major is specifically designed to provide a balanced curriculum in the broader context of the liberal arts, it is also excellent preparation for graduate studies in the life sciences and in the health professions.

Major Requirements
In order to make the major accessible to students with diverse interests, required courses are kept to a minimum. The Biology major is satisfied by nine courses, as follows:

- Biology 101 The Cell
- Biology 102 The Organism
- Biology 202 Genetics
- Any two 300-level courses, each of which must have a laboratory associated with it
- Any one 400-level course other than 493-494
- Any other three courses or any other two courses and two semesters of Organic Chemistry

Note: Independent study courses and AMS 311 (Same as Biology 231) do not fulfill the 300-level or 400-level course requirements. WIOX 316, Biology: Evolution, in the Williams Oxford Program qualifies for major credit at the 200-level.

Distribution Requirement
In order to ensure that majors broaden their knowledge of biology, one of the elective courses for the major must include an upper-level course covering biological processes at levels of organization above the cell. Courses that satisfy this distribution requirement are indicated in the individual course description.

Course Selection and Placement
It is preferable for students who plan to major in biology, or think they may be interested in doing so, to take Biology 101, 102 during their first year at Williams. It is also possible to begin the Biology major during the sophomore year, although students should understand that it may require taking two or more biology courses during several semesters.

Students interested in biology, whether or not they intend to major in it, are encouraged to take Biology 101, 102. It is also possible, with permission of the instructor, to take Biology 203 Ecology, Biology 204 Animal Behavior and Biology 220 Field Botany without prerequisite. Other 100-level biology courses are designed specifically for students who do not intend to take additional upper-level courses in biology. All of these courses satisfy the Division III distribution requirement.

Beginning students should normally enroll in Biology 101 and 102. Students with unusually strong backgrounds in biology, such as those with outstanding performance on the College Board Biology Advanced Placement Test, may be permitted to elect a sophomore-level course in lieu of Biology 101 and/or Biology 102 upon successful completion of a departmental qualifying exam, administered during First Days.

Courses Related to the Biology Major
Students planning to pursue their interest in biology and related fields after completing their undergraduate degrees are strongly encouraged to take one year of chemistry, at least one semester of mathematics (a course in statistics is recommended), and one semester of physics. Students may wish to check the requirements for graduate admission at relevant universities, and are also encouraged to consult with the Biology Department’s graduate school advisor about prerequisites for admission to graduate programs.

Biochemistry and Molecular Biology
Students interested in Biochemistry and Molecular Biology (BIMO) should consult the general statement under Biochemistry and Molecular Biology.

Bioinformatics, Genomics and Proteomics
Students interested in Bioinformatics, Genomics and Proteomics (BiGP) should consult the general statement under Bioinformatics, Genomics and Proteomics. Biology majors interested in this field are strongly encouraged to enroll in Integrative Bioinformatics, Genomics, and Proteomics (Biology 319).

Neuroscience
Students interested in Neuroscience (NSCI) should consult the general statement under Neuroscience.

Environmental Studies
Students interested in Environmental Studies (ENVI) should consult the general statement under Environmental Studies.

The Degree with Honors in Biology
In order to be recommended for the degree with honors, a Biology major is normally expected to have completed the equivalent of two semesters and a winter study (031) of independent research culminating in a thesis which demonstrates outstanding achievement of an original and innovative nature. Although the presentation of a thesis and associated oral presentation in the fall and poster defense in the spring are required for consideration for a degree with honors, their completion should not be interpreted as a guarantee of a degree with honors. The principal considerations in admitting a student to the program of independent honors research will be mastery of fundamental material and skills, ability to pursue independent study successfully, and demonstrated interest and motivation. Students interested in participating in the honors program should consult with the department early in the spring semester of the junior year; approval must be received before spring registration in the junior year. The number of Biology Department faculty available to mentor research students and the number of students each can accommodate in her/his lab vary from year to year. Although the department will make every effort to provide an opportunity for students to conduct Honors research, you should be aware that it may not be possible to assign all applicants to a laboratory.
The minimum course requirements for a degree with honors in Biology are Biology 101, Biology 102, Biology 202, two 300-level biology courses (each of which must have a laboratory associated with it), one 400-level biology course, Biology 493, Biology 494, WSP 031, and any other two courses in biology (or any other one course and two semesters of Organic Chemistry). Note: A student who has a double major cannot count any course twice. For example, if a student is a Biology and Chemistry major, Organic Chemistry can only be counted in one of the two majors.

In addition to the normal honors route, which includes two semesters (Biology 493-494) and a winter study of research (WSP 031) during senior year, students have the option, subject to the approval of their thesis advisor, to begin the honors research during winter study junior year or during the second semester junior year. In general, thesis students who start during WSP or spring semester of their junior year are working on a project that requires winter or spring field work. Students beginning honors in winter study of junior year would take Biology 494 in the spring of their junior year followed by Biology 493 in the fall of their senior year; students beginning honors during the second semester of junior year would take Biology 494 that semester, followed by Biology 493 in the fall of senior year and winter study research in the winter of the senior year.

**STUDY ABROAD**

Students planning on majoring in Biology are strongly advised to take Biology 202 before going abroad, since Biology 202 is required for the major and a prerequisite for many upper-level courses; a Genetics course taken while studying away cannot substitute for Biology 202. Biology majors studying abroad may receive credit toward the major for at most two 200-level electives; the departmental distribution requirement can be satisfied through an appropriate course taken during study abroad. Students should meet with the Department Chair to discuss study abroad options. You can find general study away guidelines for Biology here.

**CREDIT FOR COURSES AT OTHER INSTITUTIONS**

Students who enroll in study away programs may receive credit for up to two 200-level electives towards the biology major upon approval of the course syllabi by the Biology Department Chair.

Students wishing to satisfy prerequisites for courses offered by the Biology Department with courses taken at other institutions should consult, in person, with a member of the Biology Department, prior to registering for the course that requires a prerequisite. Such consultations will include a review of the course syllabi and the transcripts of the relevant previous college work, and students should bring these materials with them.

**RESEARCH AND THESIS COURSES**

Individual research projects must be approved by the department. Application should be made to the department prior to spring registration.

**NOTE:** Senior thesis and independent study courses do not count as 300-level or 400-level course requirements for the major. Only one research course (i.e., BIOL 297, BIOL 298, BIOL 493, or BIOL 494) may be counted towards the major requirements.

**BIOL 101(F) The Cell**

This course provides an introduction to cellular and molecular aspects of modern biology. It explains the development of cell structure and function as a consequence of evolutionary processes, and it stresses the dynamic properties of living systems. Topics considered include biological molecules and enzyme action, membrane structure and function, energy exchange and design of metabolic systems, expression of genetic information, cell signalling, cell trafficking, the cell cycle, and cancer. In addition to textbook and laboratory assignments, articles from the recent biological literature will be assigned and discussed.

**Class Format:** Lecture, 3 hours per week; laboratory and discussion, 3 hours per week

**Requirements/Evaluation:** evaluation will be based on hour tests, a final exam, lab reports, discussion assignments, and discussion participation

**Prerequisites:** none

**Enrollment Limit:** 48/Lecture

**Expected Class Size:** 192

**Enrollment Preferences:** first year students

**Dept. Notes:** satisfies the distribution requirement for the Biology major

**Extra Info:** not available for the Gaudino option

**Distributional Requirements:**

- Division 3

**Other Attributes:**
- BIMO Required Courses
- MTSC Related Courses
- NSCI Required Courses

**Fall 2014**

**LEC Section:** A1 TR 09:55 11:10 Instructor: Steven Swoap

**LEC Section:** A2 TR 08:30 09:45 Instructor: Steven Swoap

**LAB Section:** A3 M 01:00 04:00 Instructor: Jenna MacIntire

**LAB Section:** A4 T 01:00 04:00 Instructor: Alex Engel

**LAB Section:** A5 W 01:00 04:00 Instructor: Jenna MacIntire

**LAB Section:** A6 R 01:00 04:00 Instructor: Derek Dean

**LEC Section:** B1 MWF 10:00 10:50 Instructor: Daniel Lynch

**LEC Section:** B2 MWF 11:00 11:50 Instructor: Daniel Lynch

**LAB Section:** B3 M 01:00 04:00 Instructor: Benjamin Carone

**LAB Section:** B4 T 01:00 04:00 Instructor: Benjamin Carone

**LAB Section:** B5 W 01:00 04:00 Instructor: Benjamin Carone

**LAB Section:** B6 R 01:00 04:00 Instructor: Benjamin Carone

**BIOL 102(S) The Organism**

This course focuses upon the developmental and evolutionary processes that have given rise to a wide diversity of multicellular organisms. We consider many levels of biological organization, from molecular and cellular to individuals and populations. Topics include meiosis and sexual reproduction, animal and plant development, evolutionary mechanisms, and speciation, with examples from the three main groups of multicellular organisms (animals, plants, and fungi). Readings are drawn from a variety of sources, including the recent biological literature.
Class Format: lecture/discussion/laboratory, six hours per week
Requirements/Evaluation: evaluation will be based on hour tests, a final exam, three lab reports, and problem sets
Prerequisites: BIOL 101 or permission of instructor
Enrollment Limit: none
Expected Class Size: 152
Distributional Requirements: Division 3
Other Attributes: BIMO Required Courses

ENVS Group EB-B Electives

Spring 2015
LEC Section: A1 TR 09:55 11:10 Instructor: Robert Savage
LAB Section: A2 M 01:00 04:00 Instructor: Derek Dean
LAB Section: A3 T 01:00 04:00 Instructor: Derek Dean
LAB Section: A4 W 01:00 04:00 Instructor: Derek Dean
LAB Section: A5 R 01:00 04:00 Instructor: Derek Dean
LEC Section: B1 MWF 11:00 11:50 Instructor: Manuel Morales
LAB Section: B2 M 01:00 04:00 Instructor: Derek Dean
LAB Section: B3 T 01:00 04:00 Instructor: Derek Dean
LAB Section: B4 W 01:00 04:00 Instructor: Derek Dean
LAB Section: B5 R 01:00 04:00 Instructor: Derek Dean

BIOL 132 The Human Genome
An ambitious plan was launched in 1988 to determine the DNA sequence of the human genome. That project was “completed” in 2001—but that was really only the beginning. Sequencing of additional genomes goes on, but, more importantly, scientists and society are putting considerable effort into trying to understand what all those A’s, G’s, C’s, and T’s mean. Lectures will acquaint students with the fundamentals of human DNA research and its applications in the fields of medicine, human evolution, and biotechnology. The implications of this research for individuals and for society as a whole will be addressed in readings and discussions.
Class Format: lecture 3 hours per week; discussion one hour every other week
Requirements/Evaluation: based on three exams, discussion participation and one short paper
Prerequisites: none; open to students who have not taken BIOL 202
Enrollment Limit: 60
Expected Class Size: 60
Enrollment Preferences: seniors, then juniors, then sophomores, then first years
Dept. Notes: does not satisfy the distribution requirement for the Biology major
Distributional Requirements: Division 3
Other Attributes: PHLH Biomedical Determinants of Health

Not Offered Academic Year 2014-2015
LEC Instructor: Marsha Altschuler

BIOL 133(S) Biology of Exercise and Nutrition
This class, intended for the non-scientist, focuses on the impact of exercise and nutrition on the human body. We will discuss topics such as how different types of training influence exercise performance; the changes that occur in the cardiovascular system during an exercise routine; the inherent limits of the body to perform aerobic and anaerobic tasks; and the long-term health consequences of a lifetime of activity of inactivity. We will also examine how nutrition and metabolism affect body composition. For example, we will rigorously and scientifically scrutinize the use of “fad” diets as a means to lose weight.
Class Format: lecture 3 hours per week
Requirements/Evaluation: evaluation will be based on exams and lab notebook and class participation
Prerequisites: none
Enrollment Limit: 120
Expected Class Size: 120
Enrollment Preferences: seniors, juniors, sophomores, then first-year students
Dept. Notes: does not satisfy the distribution requirement for the Biology major
Distributional Requirements: Division 3
Other Attributes: INST Global Health Studies Electives
PHLH Biomedical Determinants of Health

Spring 2015
LEC Section: 01 TR 08:30 09:45 Instructor: Steven Swoap
LAB Section: 02 M 01:00 04:00 Instructor: Jenna MacIntire
LAB Section: 03 T 01:00 04:00
LAB Section: 04 W 01:00 04:00
LAB Section: 05 R 01:00 04:00


BIOl 134 The Tropics: Biology and Social Issues (D)

Crosslistings: BIOl 134/ENVI 134

Primary Crosslisting

Intended for the non-scientist, this course explores the biological dimensions of social issues in tropical societies, and focuses on specifically on the peoples and cultures of tropical regions in Africa, Asia, Latin America, Oceania, and the Caribbean. Tropical issues have become prominent on a global scale, and many social issues in the tropics are inextricably bound to human ecology, evolution, and physiology. The course begins with a survey of the tropical environment of humans, including major climatic and habitat features. The next section focuses on human population biology, and emphasizes demography and the role of disease particularly malaria and AIDS. The final part of the course covers the place of human societies in local and global ecosystems including the challenges of tropical food production, the importance of organic diversity, and the interaction of humans with their supporting ecological environment.

This course fulfills the EDI requirement. Through lectures, debates and readings, students confront social issues in the tropics from the perspective of biologist. This builds a framework for lifelong exploration of human diversity.

Class Format: lecture/debate, three hours per week

Requirements/Evaluation: evaluation will be based on two hour exams, a short paper, panel preparation, and a final exam

Prerequisites: none

Enrollment Limit: 60

Expected Class Size: 60

Enrollment Preferences: preference given to seniors, juniors, sophomores, and first-year students— in that order

Dept. Notes: does not count for major credit in Biology; does not satisfy the distribution requirement in the Biology major

Distributional Requirements:

Division 3

Exploring Diversity

Other Attributes:

ENVI Natural World Electives
ENVS Group EB-B Electives
INST African Studies Electives
PHLH Biomedical Determinants of Health
SCST Elective Courses

Not Offered Academic Year 2014-2015

LEC Instructor: Joan Edwards

BIOl 136 Studying Human Genetic Diversity: Individuals, Populations, and 'Races'—Dangerous Biology (D)

Scientists are rapidly acquiring DNA sequence information on thousands of individuals from a wide variety of human populations. This information can be used to illuminate human history and evolution. It can also be used in the field of medicine to develop new drugs and as a first step toward tailoring treatments to match individuals’ genomes. This information can also create new ethical and social dilemmas. Do such studies support or refute the idea of a biological basis for 'race'? Can the data be used to justify societal inequities? Do the data have any use outside of scientific circles? Through reading scientific articles we will explore genome sequencing data to determine the types of DNA differences that exist among humans. We’ll examine the data in the light of human population history (migration, population bottlenecks, selection) to understand how these variations come about. Throughout we’ll discuss the implications of these studies for individuals and for society. In particular we’ll critique the use of such information in guiding policy and practice in areas such as genetic screening and eugenics, ancestry testing, 'race-based' medicine, forensics. As an EDI course, we’ll examine issues of power and privilege in shaping practice and policy associated with these genetic initiatives, such as in deciding what populations to study, in administering informed consent, and in addressing health disparities.

Class Format: seminar

Requirements/Evaluation: one exam, one short paper (4-6 pages), final paper (10-12 pages); class participation

Prerequisites: none

Enrollment Limit: 20

Expected Class Size: 20

Enrollment Preferences: juniors, sophomores, seniors, first-years; not open to students who have taken BIOL 202 or BIOL132

Distributional Requirements:

Division 3

Exploring Diversity

Other Attributes:

PHLH Biomedical Determinants of Health

Not Offered Academic Year 2014-2015

SEM

BIOl 202(F) Genetics (Q)

Genetics, classically defined as the study of heredity, has evolved into a discipline whose limits are continually expanded by innovative molecular technologies. This course covers the experimental basis for our current understanding of the inheritance, structures, and functions of genes. It introduces approaches used by contemporary geneticists and molecular biologists to explore questions in areas of biology ranging from evolution to medicine. The laboratory part of the course provides an experimental introduction to modern genetic analysis. Laboratory experiments include linkage analysis, bacterial transformation with plasmids and DNA restriction mapping.

Class Format: lecture/laboratory, six hours per week

Requirements/Evaluation: evaluation will be based on biweekly problem sets, weekly laboratory exercises and laboratory reports, and examinations

Prerequisites: BIOl 101 and 102

Enrollment Limit: none

Expected Class Size: 84

Dept. Notes: satisfies the distribution requirement in the Biology major.

Distributional Requirements:

Division 3

Quantitative/Formal Reasoning

Other Attributes:

BGNP Recommended Courses
BIMO Required Courses

Fall 2014

LEC Section: 01 MWF 11:00 11:50 Instructor: Luana Maroja

LAB Section: 02 M 01:00 04:00 Instructor: Derek Dean
BIOL 203(F) Ecology (Q)
Crosslistings: BIOL 203/ENVI 203

Primary Crosslisting

This course combines lectures with field and indoor laboratory exercises to explore factors that determine the distribution and abundance of plants and animals in natural systems. The course begins with an overall view of global patterns and then builds from the population to the ecosystem level. An emphasis is given to basic ecological principles and relates them to current environmental issues. Selected topics include population dynamics (competition, predation, mutualism); community interactions (succession, food chains and diversity) and ecosystem function (biogeochemical cycles, energy flow).

Class Format: lecture/laboratory, six hours per week
Requirements/Evaluation: evaluation will be based on problem sets, lab reports, hour exams, and a final exam
Prerequisites: BIOL 101 and 102, or ENVI 101 or 102, or permission of instructor
Enrollment Limit: none
Expected Class Size: 35

Dept. Notes: it is a required course for the majors in Environmental Policy & Environmental Science and Environmental Studies concentration; satisfies the distribution requirement in the Biology major

Distributional Requirements:
Activated division 3
Quantitative/Formal Reasoning
Other Attributes:
ENVI Core Courses
ENVP Core Courses
ENVS Core Courses

Fall 2014
LEC Section: 01 MWF 10:00 10:50 Instructor: Joan Edwards
LAB Section: 02 M 01:00 04:00 Instructor: Joan Edwards
LAB Section: 03 T 01:00 04:00 Instructor: Joan Edwards
LAB Section: 04 W 01:00 04:00 Instructor: Manuel Morales

BIOL 204(S) Animal Behavior
Crosslistings: BIOL 204/NSCI 204

Primary Crosslisting

Making sense of what we see while watching animals closely is both an enthralling pastime and a discipline that draws on many aspects of biology. Explanations can be found on many levels: evolutionary theory tells us why certain patterns have come to exist, molecular biology can help us understand how those patterns are implemented, neuroscience gives insights as to how the world appears to the behaving animal, endocrinology provides information on how suites of behaviors are regulated. The first part of the course focuses upon how descriptive studies provide the basis for formulating questions about behavior as well as the statistical methods used to evaluate the answers to these questions. We then consider the behavior of individuals, both as it is mediated by biological mechanisms and as it appears from an evolutionary perspective. The second half of the course is primarily concerned with the behaviors of groups of animals from a wide variety of vertebrate and invertebrate species, concentrating upon the stimuli, responses, and internal mechanisms that maintain social systems and on the selection pressures that drive animals toward a particular social system.

Class Format: lecture/laboratory, six hours per week
Requirements/Evaluation: evaluation will be based on examinations, lab reports, and a research paper
Prerequisites: BIOL 102, or PSYC 101, or permission of instructor
Enrollment Limit: 32
Expected Class Size: 32

Dept. Notes: satisfies the distribution requirement in the Biology major

Distributional Requirements:
Activated division 3
Quantitative/Formal Reasoning
Other Attributes:
COGS Related Courses
NSCI Group A Electives

Spring 2015
LEC Section: 01 MWF 08:30 09:45 Instructor: Heather Williams
LAB Section: 02 M 01:00 04:00 Instructor: Heather Williams
LAB Section: 03 W 01:00 04:00 Instructor: Heather Williams

BIOL 205(S) Physiology

This lecture-based course examines principles, patterns, and mechanisms of biological function from the level of cells and tissues to the whole organism. The themes of the course include structure and function, mechanisms of regulation, control and integration, and adaptation to the environment. Examples of these themes are taken from a wide variety of organisms with a focus on vertebrates. Laboratories provide practical experience in measurement and experimental elucidation of physiological phenomena and functional analysis of gross structure.

Requirements/Evaluation: evaluation will be based on hour exams, laboratory practical, laboratory reports, and a final exam
Prerequisites: BIOL 101 and 102; open to first-year students with permission of the Biology department
Enrollment Limit: 60
Expected Class Size: 60

Dept. Notes: satisfies the distribution requirement in the Biology major

Distributional Requirements:
Activated division 3
**Biol 209T Animal Communication (W)**

**Crosslistings:** BIOL 209/NSCI 209

**Primary Crosslisting**
Animal communication systems come in as many varieties as the species that use them. What they have in common are a sender that encodes information into a physical signal and a receiver that senses the signal, extracts the information, and adjusts its subsequent behavior accordingly. This tutorial will consider all aspects of communication, using different animal systems to explore different aspects of the biology of signaling. Topics will include the use of syntax to carry meaning in chickadee calls, the "piracy" of signaling system by fireflies, statements of identity and affiliation in the form of toothed whales' signature whistles, long-distance chemical attractants that allow male moths to find the object of their desire, and cultural evolution within learned signaling systems.

**Class Format:** tutorial

**Requirements/Evaluation:** evaluation will be based on five 5-page papers, five short response papers, & the student's effectiveness in tutorial presentations.

**Prerequisites:** BIOL 101 and BIOL212/PSYC212/NSCI201; open to sophomores, juniors, and seniors

**Enrollment Limit:** 10

**Expected Class Size:** 10

**Enrollment Preferences:** Biology majors and senior Neuroscience concentrators who need a Biology elective to complete the concentration

**Dept. Notes:** satisfies the distribution requirement in the Biology major

**Extra Info:** may not be taken on a pass/fail basis

**Distributional Requirements:**
- Division 3
- Writing Intensive

**Other Attributes:**
- COGS Related Courses
- NSCI Group A Electives

**Not Offered Academic Year 2014-2015**

**TUT Instructor:** Heather Williams

**Biol 211(S) Paleobiology**

**Crosslistings:** GEOS 212/BIOL 211

**Secondary Crosslisting**
The fossil record is a direct window into the history of life on Earth and contains a wealth of information on evolution, biodiversity, and climate change. This course investigates the record of ancient life forms, from single-celled algae to snails to dinosaurs. In addition to the intellectual discovery of fossils as organic relics and the ways in which fossils have been used to support conflicting views on nature, geologic time, and evolution, we will cover a range of topics central to modern paleobiology. These include: how the fossil record informs our understanding of evolutionary processes including speciation; the causes and consequences of mass extinctions; how fossils help us tell time and reconstruct the Earth's climactic and tectonic history; statistical analysis of the fossil record to reconstruct biodiversity through time; analysis of fossil morphology to recreate the biomechanics of extinct organisms; and using fossil communities to reconstruct past ecosystems. Laboratory exercises will take advantage of Williams' superb fossil collections as well as published datasets to provide a broad understanding of fossils and the methods we use to study the history of life on Earth. We will also view a diversity of fossils in their geologic and paleo-environmental context on our field trip to Eastern New York.

**Class Format:** lecture/laboratory; field trip to the the Paleozoic of New York State

**Requirements/Evaluation:** evaluation will be based on lab assignments, short quizzes and writing assignments, and a final exam

**Prerequisites:** any 100-level GEOS course or BIOL 102, 203 or 205

**Enrollment Limit:** 15

**Expected Class Size:** 12

**Enrollment Preferences:** sophomores and juniors

**Dept. Notes:** does not satisfy the distribution requirement in the Biology major

**Distributional Requirements:**
- Division 3

**Other Attributes:**
- GEOS Earth Surface Processes + Life Courses
- MAST Interdepartmental Electives

**Spring 2015**

**LEC Section:** 01 TR 09:55 11:10 Instructor: Phoebe Cohen

**LAB Section:** 02 W 01:00 04:00 Instructor: Phoebe Cohen

**Biol 212(F) Neuroscience**

**Crosslistings:** NSCI 201/BIOL 212/PSYC 212

**Secondary Crosslisting**
A study of the relationship between brain, mind, and behavior. Topics include a survey of the structure and function of the nervous system, basic neurophysiology, development, learning and memory, sensory and motor systems, consciousness and clinical disorders such as schizophrenia, spinal cord injury, Parkinson's disease, and addiction. The laboratory focuses on current topics in neuroscience.

**Class Format:** lecture, three hours a week; laboratory, every other week

**Requirements/Evaluation:** evaluation will be based on a lab practical, lab reports, two hour exams and a final exam

**Prerequisites:** PSYC 101 or BIOL 101; open to first-year students with permission of instructor

**Enrollment Limit:** 72

**Expected Class Size:** 72

**Enrollment Preferences:** sophomores and Biology and Psychology majors

**Dept. Notes:** does not satisfy the distribution requirement in the Biology major

**Extra Info:** not available for the Gaudino option
Mathematical models are extensively used to understand biological phenomena. In this course we will study how differential and difference equations can be used to model various ecological systems ranging from predator-prey interactions to infectious disease dynamics. We will explore how to formulate these models, and methods for analyzing these systems including local and global stability analysis will be introduced.

**Class Format:** lecture

**Requirements/Evaluation:** homework, quizzes, projects and exams

**Prerequisites:** MATH 209/210 or permission of instructor

**Enrollment Limit:** 50

**Expected Class Size:** students with backgrounds in both math and biology

**Distributional Requirements:**
- Division 3
- Quantitative/Formal Reasoning

**Other Attributes:**
- ENVI Natural World Electives
- ENVS Group EB-A Electives
- ENVS Methods Courses

**Not Offered Academic Year 2014-2015**

**LEC Instructor:** Julie Blackwood

**BIOL 214 Mathematical Modeling of Ecological Systems (Q)**

**Crosslistings:** MATH 310/BIOL 214

Secondary Crosslisting

Mathematical models are extensively used to understand biological phenomena. In this course we will study how differential and difference equations can be used to model various ecological systems ranging from predator-prey interactions to infectious disease dynamics. We will explore how to formulate these models, and methods for analyzing these systems including local and global stability analysis will be introduced.

**Class Format:** lecture

**Requirements/Evaluation:** evaluation will be based on 5 papers (4-5 pages each) and on in-class performance as a presenter or challenger

**Prerequisites:** none

**Enrollment Limit:** 10

**Expected Class Size:** 10

**Enrollment Preferences:** junior, seniors, then sophomores

**Dept. Notes:** does not satisfy the distribution requirement in the Biology major

**Extra Info:** may not be taken on a pass/fail basis

**Distributional Requirements:**
- Division 3
- Writing Intensive

**Not Offered Academic Year 2014-2015**

**TUT Instructor:** Marsha Altschuler

**BIOL 219T(S) Dangerous Exposures: Environment, Immunity, and Infectious Disease (W)**

Global reports of emerging infectious diseases and old diseases with new pathogenic properties incite fears for personal safety as well as national security. The specter of a contagious pandemic has captured the public imagination through the mass news media, movies, and even popular on-line and board games. In this tutorial course, we will explore the ecology and evolution of several recently emergent diseases such as SARS, Ebola hemorrhagic fever, and AIDS. Topics to be considered include transmission dynamics, epidemiological modeling of vaccination strategies, and wildlife reservoirs that contribute to human virus exposure. We will examine progress in preventing the parasitic diseases malaria and sleeping sickness in Africa and why these diseases have proven so refractory. We will also discuss the science behind the recent development of the vaccine against the human papillomavirus, which causes cervical cancer, and the intriguing and highly unusual transmissible cancers in dogs and Tasmanian devils. Finally, we will think about the contributions of inadequate diagnostic capacities world-wide and broader issues of resource shortages in driving the global emergence of drug resistance in tuberculosis and other diseases. One common theme in each of these case studies will be the interplay between the host immune response and the evolution of the pathogen. Although the primary focus of the course is on biology rather than policy, each week's readings will have implications for public health and/or conservation biology.

**Class Format:** tutorial

**Requirements/Evaluation:** five 4- to 5-page papers; tutorial presentations, & the student's progress towards intellectual independence and creativity as a presenter and a respondent

**Prerequisites:** BIOL 101 and 102

**Enrollment Limit:** 10

**Expected Class Size:** 10

**Enrollment Preferences:** sophomores, students interested in public health

**Extra Info:** may not be taken on a pass/fail basis

**Distributional Requirements:** Division 3
Writing Intensive
Other Attributes: PHLH Biomedical Determinants of Health

Spring 2015
TUT Section: T1 R 11:20 12:35 Instructor: Lois Banta
BIOL 220(F) Field Botany and Plant Natural History
Crosslistings: BIOL 220/ENVI 220
Primary Crosslisting
This field-lecture course covers the evolutionary and ecological relationships among plant groups represented in our local and regional flora. Lectures focus on the evolution of the land plants, the most recent and revolutionary developments in plant systemics and phylogeny, and characteristics of plant families and cultural and economic uses of plants, native species. The labs cover field identification, natural history, and ecology of local species.
Class Format: lecture
Requirements/Evaluation: evaluation will be based on exams, field quizzes, field notebook and a class project
Prerequisites: none
Enrollment Limit: 40
Expected Class Size: 25
Enrollment Preferences: seniors, Biology majors, and Environmental Studies majors & concentrators
Dept. Notes: satisfies the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Other Attributes: ENVI Natural World Electives
ENVS Group EB Electives
EXPE Experiential Education Courses
PHLH Nutrition and Food Security

Fall 2014
LEC Section: 01 MWF 09:00 09:50 Instructor: Henry Art
LAB Section: 02 T 01:00 04:00 Instructor: Henry Art
LAB Section: 03 W 01:00 04:00 Instructor: Henry Art
BIOL 231(F,S) Marine Ecology
Crosslistings: MAST 311/BIOL 231
Secondary Crosslisting
Using the principles of evolutionary biology and experimental ecology, this course examines the processes that control the diversity, abundance and distribution of marine organisms. Major marine communities, including estuaries, the rocky shore, sandy beaches, salt marshes, coral reefs, and the deep sea are discussed in detail.
Class Format: lecture/laboratory, including coastal and near-shore field trips, 10 days offshore, and a laboratory or field research project
Requirements/Evaluation: two tests, a research project, and a presentation
Prerequisites: BIOL 101 or GEOS/MAST 104, or permission of instructor
Extra Info: offered only at Mystic Seaport
Distributional Requirements:
Division 3
Other Attributes: ENVI Natural World Electives
ENVS Group EB Electives
EXPE Experiential Education Courses

Fall 2014
LEC Section: 01 TBA Instructor: James Carlton
Spring 2015
LEC Section: 01 TBA Instructor: James Carlton
BIOL 297(F) Independent Study: Biology
Biology 200-level independent study. Each student carries out independent field or laboratory research under the supervision of a member of the department.
Class Format: independent study
Distributional Requirements:
Division 3

Fall 2014
IND Section: 01 TBA Instructor: Steven Swoap
BIOL 298(S) Independent Study: Biology
Biology 200-level independent study. Each student carries out independent field or laboratory research under the supervision of a member of the department.
Class Format: independent study
Distributional Requirements:
Division 3

Spring 2015
IND Section: 01 TBA Instructor: Steven Swoap
BIOL 301(F) Developmental Biology
Developmental biology has undergone rapid growth in recent years and is becoming a central organizing discipline that links cells and molecular biology, evolution, anatomy and medicine. We are now beginning to have a molecular understanding of fascinating questions such as how cells decide their fate, how patterns are created, how male and females are distinguished, and how organisms came to be different. We have also
discovered how the misregulation of important development regulatory genes can lead to a variety of known cancers and degenerative diseases in humans. In this course we will examine these and related topics combining a rich classical literature with modern genetic and molecular analyses.

**Class Format:** lecture/discussion/laboratory, six hours per week

**Requirements/Evaluation:** evaluation will be based on hour exams, short papers, and a final exam

**Prerequisites:** BIOL 202 or permission of instructor

**Enrollment Limit:** 24

**Expected Class Size:** 15

**Enrollment Preferences:** Biology majors

**Dept. Notes:** does not satisfy the distribution requirement in the Biology major

**Distributional Requirements:**

Division 3

**Other Attributes:**

BIMO Interdepartmental Electives

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**BIOL 302 Communities and Ecosystems (Q)**

**Crosslistings:** BIOL 302/ENVI 312

**Primary Crosslisting**

An advanced ecology course that examines how organisms interact with each other and with abiotic factors. This course emphasizes phenomena that emerge in complex ecological systems, building on the fundamental concepts of population biology, community ecology, and ecosystem science. Lectures and workshops explore how communities and ecosystems are defined, and how theoretical, comparative, and experimental approaches are used to elucidate their structure and function. Field laboratories emphasize hypothesis-oriented experiments, some of which will continue with laboratory analyses; field trips introduce the diversity of natural communities and ecosystems of the region. There will be one all-day field trip to Mt. Greylock State Reservation. Extensive use will be made of the 75-year database of the Hopkins Memorial Forest. Students will engage in self-designed term project.

**Class Format:** lecture/laboratory, six hours a week

**Requirements/Evaluation:** evaluation will be based on lab reports, a midterm exam, a term project presentation, and a final project paper

**Prerequisites:** BIOL/ENVI 203 or 220

**Enrollment Limit:** 28

**Expected Class Size:** 24

**Enrollment Preferences:** Biology majors and Environmental Studies majors and concentrators

**Dept. Notes:** satisfies the distribution requirement in the Biology major

**Distributional Requirements:**

Division 3

Quantitative/Formal Reasoning

**Other Attributes:**

ENVI Natural World Electives
ENVS Group EB-A Electives
EXPE Experiential Education Courses

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**BIOL 304 Neurobiology**

**Crosslistings:** BIOL 304/NSCI 304

**Primary Crosslisting**

This course is concerned with understanding the biology of the nervous system, focusing primarily on the cellular bases of neuronal function. Lectures will cover such topics as nerve resting and action potentials, ion channels, neurotransmitters and synapses, and the neural correlates of behavior in organisms with simple nervous systems. Reading original research papers and discussing them constitutes an important part of the course. Some of the topics that may be covered include: transmitter release mechanisms, ion permeation through channels, plasticity in the nervous system, and various clinical disorders. Laboratories are designed to introduce the students to modern techniques in neurobiology including extracellular and intracellular recording, histochemistry, and immunohistochemistry.

**Class Format:** lecture/laboratory, six hours per week

**Requirements/Evaluation:** evaluation will be based on class participation, laboratory notebooks and posters, two hour exams and a final exam

**Prerequisites:** BIOL 205 or BIOL 212

**Enrollment Limit:** 16

**Expected Class Size:** 16

**Enrollment Preferences:** Biology majors and Neuroscience concentrators

**Dept. Notes:** does not satisfy the distribution requirement in the Biology major

**Distributional Requirements:**

Division 3

**Other Attributes:**

BIMO Interdepartmental Electives
NSCI Group A Electives

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**BIOL 305(S) Evolution (Q)**

This course offers a critical analysis of contemporary concepts in biological evolution. We focus on the relation of evolutionary mechanisms (e.g., selection, drift, and migration) to long term evolutionary patterns (e.g., evolutionary innovations, origin of major groups, and the emergence of diversity). Topics include micro-evolutionary models, natural selection and adaptation, sexual selection, speciation, the inference of evolutionary history among others.

**Class Format:** lecture/discussion/laboratory, six hours per week

**Requirements/Evaluation:** evaluation will be based on independent research project, problem sets, participation in discussions and exams

**Prerequisites:** BIOL 202

**Enrollment Limit:** 24
Plasticity is reduced as development and differentiation proceed, and the potential for determined processes and environmental stimuli. The tension between these two inputs is particularly apparent in the developing nervous system, where many events must be predetermined, and where plasticity, or altered outcomes in response to environmental conditions, is also essential. Plasticity is reduced as development and differentiation proceed, and the potential for...
regeneration after injury or disease in adults is limited; however some exceptions to this rule exist, and recent data suggest that the nervous system is not hard-wired as previously thought. In this course we will discuss the mechanisms governing nervous system development, from relatively simple nervous systems such as that of the fruitfly, to the more complicated nervous systems of humans, examining the roles played by genetically specified programs and non-genetic influences.

**Class Format:** lecture

**Requirements/Evaluation:** exams

**Prerequisites:** BIOL 212/PSYC 212/NSCI 201 and BIOL 202 (or permission of instructor)

**Enrollment Limit:** 24

**Expected Class Size:** 24

**Enrollment Preferences:** Biology majors; Neuroscience concentrators; Psych majors

**Dept. Notes:** does not satisfy the distribution requirement in the Biology major

**Extra Info:** may not be taken on a pass/fail basis

**Distributional Requirements:**

Division 3

**Other Attributes:**

BIMO Interdepartmental Electives

NSCI Group A Electives

**Not Offered Academic Year 2014-2015**

LEC Instructor: Tim Lebestky

**BIOL 311(F) Neural Systems and Circuits**

**Crosslistings:** BIOL 311/NSCI 311

**Primary Crosslisting**

This course will examine the functional organization of the vertebrate brain, emphasizing both neuroanatomy and neurophysiology. How do specific populations of neurons and their connections analyze sensory information, form perceptions of the external and internal environment, make cognitive decisions, and execute movements? How does the brain produce feelings of reward/motivation and aversion/pain? How does the brain regulate homeostatic functions such as sleep, food intake, and thirst? We will explore these questions using a holistic, integrative approach, considering molecular/cellular mechanisms, physiological characterizations of neurons, and connectivity among brain systems. Laboratory sessions will provide experience in examining macroscopic and microscopic neural structures, as well as performing experiments to elucidate the structure and function of neural systems using classical and cutting-edge techniques.

**Class Format:** lecture/lab, six hours per week

**Requirements/Evaluation:** class participation, laboratory notebooks and posters, hour exams and a final exam

**Prerequisites:** NSCI 201 or BIOL 205

**Enrollment Limit:** 24

**Expected Class Size:** 24

**Enrollment Preferences:** Biology majors and Neuroscience concentrators

**Dept. Notes:** does not fulfill the distribution requirement in the major

**Distributional Requirements:**

Division 3

**Other Attributes:**

NSCI Group A Electives

**Fall 2014**

LEC Section: 01 MWF 09:00 09:50 Instructor: Matt Carter

LAB Section: 02 M 01:00 04:00 Instructor: Matt Carter

LAB Section: 03 T 01:00 04:00 Instructor: Matt Carter

**BIOL 313 Immunology**

The rapidly evolving field of immunology examines the complex network of interacting molecules and cells that function to recognize and respond to agents foreign to the individual. In this course, we will focus on the biochemical mechanisms that act to regulate the development and function of the immune system and how alterations in different system components can cause disease. Textbook readings will be supplemented with current literature.

**Class Format:** lectures, three hours a week; laboratory, three hours a week

**Requirements/Evaluation:** evaluation will be based on exams, laboratory reports, and a research paper

**Prerequisites:** BIOL 202

**Enrollment Limit:** 24

**Expected Class Size:** 24

**Enrollment Preferences:** senior and then to junior Biology majors

**Dept. Notes:** does not satisfy the distribution requirement in the Biology major

**Distributional Requirements:**

Division 3

**Other Attributes:**

BIMO Interdepartmental Electives

INST Global Health Studies Electives

PHLH Biomedical Determinants of Health

**Not Offered Academic Year 2014-2015**

LEC Instructor: Alex Engel

**BIOL 315(F) Microbiology: Diversity, Cellular Physiology, and Interactions**

Bioterrorism and the alarming spread of antibiotic resistant bacteria are but two of the reasons for the resurgence of interest in the biology of microorganisms. This course will examine microbes from the perspectives of cell structure and function, genomics, and evolution. A central theme will be the adaptation of bacteria as they evolve to fill specific ecological niches, with an emphasis on microbe:host interactions that lead to pathogenesis. We will consider communication among bacteria as well as between bacteria and their environment. Topics include: microbial development, population dynamics, bioremediation, plant and animal defenses against infection, and bacterial strategies to subvert the immune system. In the lab, major projects will focus on horizontal gene transfer, metagenomics, and the isolation and characterization of bacteria from natural environments. Students will also use flow cytometry to investigate fundamental aspects of the mammalian immune system. The lab experience will culminate in multi-week independent investigations. Readings will be supplemented by articles from the primary literature.

**Class Format:** lectures, three hours a week; laboratory, three hours a week

**Requirements/Evaluation:** evaluation will be based on three exams, a lab report, and a poster presentation or term paper
Prerequisites: BIOL 202
Enrollment Limit: 24
Expected Class Size: 24
Enrollment Preferences: senior and then to junior Biology majors
Dept. Notes: does not satisfy the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Other Attributes:
BIMO Interdepartmental Electives

BGNP Related Courses

Other Attributes:
Division 3
Distributional Requirements:

Dept. Notes:

Expected Class Size:
Enrollment Limit:
Prerequisites:
Requirements/Evaluation:
Class Format:

Fall 2014
LEC Section: 01 MWF 09:00 09:50 Instructor: Anne Farewell

LAB Section: 02 M 01:00 04:00 Instructor: Anne Farewell

LAB Section: 03 T 01:00 04:00 Instructor: Anne Farewell

BIMO 319(F) Integrative Bioinformatics, Genomics, and Proteomics Lab (Q) Croslistings: BIOL 319/MATH 319/CHEM 319/PHYS 319/CSCI 319

Primary Croslisting
What can computational biology teach us about cancer? In this capstone experience for the Genomics, Proteomics, and Bioinformatics program, computational analysis and wet-lab investigations will inform each other, as students majoring in biology, chemistry, computer science, mathematics/statistics, and physics contribute their own expertise to explore how ever-growing gene and protein data-sets can provide key insights into human disease. In this course, we will take advantage of one well-studied system, the highly conserved Ras-related family of proteins, which play a central role in numerous fundamental processes within the cell. The course will integrate bioinformatics and molecular biology, using database searching, alignments and pattern matching, phylogenetics, and recombinant DNA techniques to reconstruct the evolution of gene families by focusing on the gene duplication events and gene rearrangements that have occurred over the course of eukaryotic speciation. By utilizing high-through-put approaches to investigate genes involved in the MAPK signal transduction pathway in human colon cancer cell lines, students will uncover regulatory mechanisms that are aberrantly altered by siRNA knockdown of putative regulatory components. This functional genomic strategy will be coupled with independent projects using phosphorylation-state specific antisera to test our hypotheses. Proteomic analysis will introduce the students to de novo structural prediction and threading algorithms, as well as data-mining approaches and Bayesian modeling of protein network dynamics in single cells. Flow cytometry and mass spectrometry will be used to study networks of interacting proteins in colon tumor cells.

Class Format: two afternoons of lab, with one hour of lecture, per week
Requirements/Evaluation: lab participation, several short homework assignments, one lab report, a programming project, and a grant proposal
Prerequisites: BIOL 202; or; students who have not taken BIOL 202 but have taken BIOL 101/AP Biology and CSCI 315 or PHYS 315 or CSCI 106, may enroll with permission of instructor; No prior computer programming experience is required
Enrollment Limit: 12
Expected Class Size: 12
Enrollment Preferences: seniors, then juniors/sophomores
Dept. Notes: does not satisfy the distribution requirement in the Biology major

BIMO Interdepartmental Electives

Fall 2014
LEC Section: 01 W 12:25 01:10 Instructor: Lois Banta

LAB Section: 02 WR 01:15 04:00 Instructor: Lois Banta

BIOI 321(F) Biochemistry I: Structure and Function of Biological Molecules (Q) Croslistings: BIMO 321/BIOI 321/CHEM 321

Secondary Croslisting
This course introduces the basic concepts of biochemistry with an emphasis on the structure and function of biological macromolecules. Specifically, the structure of proteins and nucleic acids are examined in detail in order to determine how their chemical properties and their biological behavior result from those structures. Other topics covered include catalysis, enzyme kinetics, mechanism and regulation; the molecular organization of biomembranes; and the flow of information from nucleic acids to proteins. In addition, the principles and applications of the methods used to characterize macromolecules in solution and the interactions between macromolecules are discussed. The laboratory provides a hands-on opportunity to study macromolecules and to learn the fundamental experimental techniques of biochemistry including electrophoresis, chromatography, and principles of enzymatic assays.

Class Format: lecture, three hours per week; laboratory, four hours per week
Requirements/Evaluation: evaluation is based on midterm exams, a final exam, problem sets and performance in the laboratories including lab reports
Prerequisites: BIOL 101 and CHEM 251/255 and CHEM 155/256
Enrollment Limit: 48
Expected Class Size: 48
Enrollment Preferences: junior and senior Biology and Chemistry majors and BIMO concentrators
Dept. Notes: does not satisfy the distribution requirement in the major

Distributional Requirements:
Division 3
Quantitative/Formal Reasoning
Other Attributes:
BIMO Related Courses

BIMO Required Courses

Fall 2014
LEC Section: 01 MWF 10:00 10:50 Instructor: Rebecca Taurog

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BIOL 322(S) Biochemistry II: Metabolism (Q)

Crosslistings: BIMO 322/BIOL 322/CHEM 322

This lecture course provides an in-depth presentation of the complex metabolic reactions which are central to life. Emphasis is placed on the biological flow of energy including alternative modes of energy generation (aerobic, anaerobic, photosynthetic); the regulation and integration of the metabolic pathways including compartmentalization and the transport of metabolites; and biochemical reaction mechanisms including the structures and mechanisms of coenzymes. This comprehensive study also includes the biosynthesis and catabolism of small molecules (carbohydrates, lipids, amino acids, and nucleotides). Laboratory experiments introduce the principles and procedures used to study enzymatic reactions, bioenergetics, and metabolic pathways.

Class Format: lecture, three hours per week; laboratory, three hours per week

Requirements/Evaluation: evaluation is based on several exams and performance in the laboratories including lab reports that emphasize conceptual and quantitative and/or graphic analysis of the data generated

Prerequisites: BIOL 101 and CHEM 251/255

Enrollment Limit: 64

Expected Class Size: 64

Enrollment Preferences: junior and senior Biology and Chemistry majors and BIMO concentrators

Dept. Notes: does not satisfy the distribution requirement in the major

Extra Info: not available for the Gaudino option

Distributional Requirements:
Division 3
Quantitative/Formal Reasoning

Other Attributes:
BGNP Related Courses
BIMO Required Courses

Spring 2015

LEC Section: 01 MWF 10:00 10:50 Instructor: Alex Engel

LAB Section: 02 T 01:00 04:00 Instructor: Alex Engel

LAB Section: 03 W 01:00 04:00 Instructor: Alex Engel

LAB Section: 04 R 01:00 04:00 Instructor: Benjamin Carone

BIOL 405T(F) Sociobiology (W)

Sociobiology, or the study of social behavior, has challenged the limits of evolutionary theory since Darwin described the non-reproducing castes among social insects (i.e., eusociality) as 'one special difficulty.' Inclusive fitness theory and Hamilton's rule—that an altruistic act can evolve where the benefit to related individuals exceeds the cost to the actor—potentially resolves Darwin's paradox. Nevertheless, explanations including delayed fitness benefits and ecological constraints have been suggested as alternatives to inclusive fitness theory. Moreover, the theoretical justification for inclusive fitness theory has recently been vigorously challenged. This course will use readings from the primary literature to examine the evidence for inclusive fitness as a potential explanation for topics including the evolution of helping behavior, eusociality and its relationship to extraordinary sex ratios, and spiteful behavior. Other topics that we will cover include the evolution of deceit and self-deception.

Class Format: tutorial

Requirements/Evaluation: evaluation will be based on five (4-5-page) papers; tutorial presentations, & the student's effectiveness as a critic

Prerequisites: BIOL 202 and either BIOL/ENVI 203 or 204 or 302 or 305 or permission of instructor; open to juniors and seniors

Enrollment Limit: 10

Expected Class Size: 10

Enrollment Preferences: senior Biology majors who have not taken a 400-level course

Dept. Notes: Satisfies distribution requirement in the major

Extra Info: may not be taken on a pass/fail basis

Distributional Requirements:
Division 3
Writing Intensive

Fall 2014

TUT Section: T1 TBA Instructor: Manuel Morales

BIOL 406(F) Dynamics of Internal Membrane Systems

Eukaryotic cells build and maintain a diverse set of internal membrane compartments, such as the endoplasmic reticulum, the Golgi compartment, and lysosomes, which exist as parts of an interconnected and dynamic membrane system. Each of these membrane compartments has unique functions despite a high rate of exchange between the different organelles. This course will mechanistically examine how the identity of organelles is achieved via highly regulated membrane trafficking events and investigate the importance of membrane trafficking in specialized biological processes including neurotransmission, glucose homeostasis, and immune cell killing. We will read classic and current primary literature articles and discuss the essential techniques, experimental design, and models of cell biology.

Class Format: seminar

Requirements/Evaluation: discussion, three hours per week; evaluation will be based on class participation and 4 three page papers

Prerequisites: BIOL 202

Enrollment Limit: 12

Expected Class Size: 12

Enrollment Preferences: open to juniors and seniors with preference given to senior biology majors who have not taken a 400-level course, then to juniors

Distribution Notes: does not satisfy distribution requirement in the major

Extra Info: may not be taken on a pass/fail basis; not available for the Gaudino option

Distributional Requirements:
Division 3

13
After decades of studies emphasizing the role of DNA in heredity, scientists are now turning their attention from genetics to biotechnological applications of these molecular mechanisms in areas such as protein engineering. This course will examine how chaperonins, proteases, and heat shock proteins are regulated in response to changes in environmental conditions, such as high temperatures or low pH. We will read and discuss articles about mammalian neuroanatomy associated with emotion as defined by classic lesion studies, pharmacology, electrophysiology, MRI imaging, knockout mouse studies, and new opto-genetic methods for investigating neural circuit function in order to gain an understanding of the central circuits and neurotransmitter systems that are implicated in emotional processing and mood disorders.

**Class Format:** lecture, three hours per week
**Requirements/Evaluation:** evaluation will be based on class participation and several short papers
**Prerequisites:** BIOL 202 and 212; open to juniors and seniors
**Enrollment Limit:** 12
**Expected Class Size:** 12

All organisms face variability in their environments, and the molecular and cellular responses to stresses induced by environmental change often illuminate otherwise hidden facets of normal physiology. Moreover, many organisms have evolved unique molecular mechanisms, such as novel cellular compounds or macromolecular structural modifications, which contribute to their ability to survive continuous exposure to extreme conditions, such as high temperatures or low pH. This course will examine how chaperonins, proteases, and heat- and cold-shock proteins are regulated in response to changes in the external environment. We will then consider how these and other molecular mechanisms function to stabilize DNA and proteins- and, ultimately, cells and organisms. Other extreme environments, such as hydrothermal vents on the ocean floor, snow fields, hypersaline lakes, the intertidal zone, and acid springs provide further examples of cellular and molecular responses to extreme conditions. Biotechnological applications of these molecular mechanisms in areas such as protein engineering will also be considered. Class discussions will focus upon readings from the primary literature.

**Class Format:** discussion, three hours per week
**Requirements/Evaluation:** evaluation will be based on class participation and several short papers
**Prerequisites:** BIOL 202; open to juniors and seniors
**Enrollment Limit:** 12
**Expected Class Size:** 12

All organisms face variability in their environments, and the molecular and cellular responses to stresses induced by environmental change often illuminate otherwise hidden facets of normal physiology. Moreover, many organisms have evolved unique molecular mechanisms, such as novel cellular compounds or macromolecular structural modifications, which contribute to their ability to survive continuous exposure to extreme conditions, such as high temperatures or low pH. This course will examine how chaperonins, proteases, and heat- and cold-shock proteins are regulated in response to changes in the external environment. We will then consider how these and other molecular mechanisms function to stabilize DNA and proteins- and, ultimately, cells and organisms. Other extreme environments, such as hydrothermal vents on the ocean floor, snow fields, hypersaline lakes, the intertidal zone, and acid springs provide further examples of cellular and molecular responses to extreme conditions. Biotechnological applications of these molecular mechanisms in areas such as protein engineering will also be considered. Class discussions will focus upon readings from the primary literature.

**Class Format:** discussion, three hours per week
**Requirements/Evaluation:** evaluation will be based on class participation and several short papers
**Prerequisites:** BIOL 202; open to juniors and seniors
**Enrollment Limit:** 12
**Expected Class Size:** 12

All organisms face variability in their environments, and the molecular and cellular responses to stresses induced by environmental change often illuminate otherwise hidden facets of normal physiology. Moreover, many organisms have evolved unique molecular mechanisms, such as novel cellular compounds or macromolecular structural modifications, which contribute to their ability to survive continuous exposure to extreme conditions, such as high temperatures or low pH. This course will examine how chaperonins, proteases, and heat- and cold-shock proteins are regulated in response to changes in the external environment. We will then consider how these and other molecular mechanisms function to stabilize DNA and proteins- and, ultimately, cells and organisms. Other extreme environments, such as hydrothermal vents on the ocean floor, snow fields, hypersaline lakes, the intertidal zone, and acid springs provide further examples of cellular and molecular responses to extreme conditions. Biotechnological applications of these molecular mechanisms in areas such as protein engineering will also be considered. Class discussions will focus upon readings from the primary literature.

**Class Format:** discussion, three hours per week
**Requirements/Evaluation:** evaluation will be based on class participation and several short papers
**Prerequisites:** BIOL 202; open to juniors and seniors
**Enrollment Limit:** 12
**Expected Class Size:** 12
stable changes in cell function can result from, for example, stable changes in protein conformation, protein modification, DNA methylation, or the location of a molecule within the cell. Using readings from the primary literature, we will explore the epigenetic nature and molecular mechanisms underlying a diverse array of phenomena such as prion propagation, genetic imprinting, dosage compensation, transvection, centromere formation, vernalization, and programmed genome rearrangements. The significance of epigenetic processes for development, evolution, and human health will be discussed.

**Class Format:** discussion, three hours per week

**Requirements/Evaluation:** evaluation will be based on class participation and several short papers

**Prerequisites:** BIOL 202; open to juniors and seniors

**Enrollment Limit:** 12

**Expected Class Size:** 12

**Enrollment Preferences:** senior Biology majors who have not taken a 400-level course, then to juniors

**Dept. Notes:** does not satisfy the distribution requirement in the Biology major

**Distributional Requirements:**
- Division 3

**Other Attributes:**
- BIMO Interdepartmental Electives

**Spring 2015**

**SEM Section:** 01 TR 11:20 12:35  Instructor: Benjamin Carone

**SEM Section:** 02 TR 09:55 11:10  Instructor: Benjamin Carone

**BIOL 418 Signal Transduction to Cancer**

Division of normal cells is a highly regulated process based on input from both intrinsic and extrinsic signals. The cell's response to its environment affects all aspects of cell behavior: proliferation, death, differentiation and migration. The goal of the course is to understand the molecular mechanisms of signal transduction that guide normal cell behavior and how disruptions in this process can lead to cancer. We will focus on the Hedgehog-Gli signaling pathway that is activated in 30% of all known cancers. Genetic studies will serve as an introduction to the components of the pathway, followed by an examination of the molecular mechanisms of signal reception, transduction of intracellular information, scaffolding and transcriptional regulation. The final section of the course will investigate how high throughput screens, medicinal chemistry studies and mouse models are used to identify small molecular inhibitors of pathway components. We will consider the effectiveness of these inhibitors in pharmacological studies, clinical trials and potential cancer treatments.

**Class Format:** seminar

**Requirements/Evaluation:** four papers

**Prerequisites:** BIOL 202 or permission of instructor

**Enrollment Limit:** 12

**Expected Class Size:** 12

**Enrollment Preferences:** seniors and then junior

**Extra Info:** may not be taken on a pass/fail basis; not available for the Gaudino option

**Distributional Requirements:**
- Division 3

**Not Offered Academic Year 2014-2015**

**SEM Instructor:** Robert Savage

**BIOL 422(S) Ecology of Sustainable Agriculture**

**Crosslistings:** BIOL 422/ENVI 422

**Primary Crosslisting**

A seminar / field course investigating patterns, processes, and concepts of stability in human-dominated, food production ecosystems. As a capstone course, the course will draw upon the experiences that students have had in biology and environmental studies courses. Topics will include: the relationships among diversity, ecosystem function, sustainability, resilience, and stability of food production and distribution systems, nutrient pools and processing in human-dominated ecosystems. Two extensive field trips will be taken to agricultural operations in the region. Each student will present a seminar on a topic requiring extensive reading of primary resources and is responsible for leading the discussion that ensues. Reading question paper assignments will be due prior to the seminar. Criticism paper assignments will be made at approximately bi-weekly intervals and due two days after the seminar to which they relate.

**Class Format:** seminar, two 75 minute sessions per week

**Requirements/Evaluation:** will be based on writing assignments, seminar presentation, and course participation

**Prerequisites:** BIOL/ENVI 203 or BIOL 302 or permission of instructor

**Enrollment Limit:** 16

**Expected Class Size:** 16

**Enrollment Preferences:** open to juniors and seniors

**Dept. Notes:** satisfies the distribution requirement in the major; the ENVS biology track; the Natural World distributional requirement of the Environmental Studies program

**Distributional Requirements:**
- Division 3

**Other Attributes:**
- ENVI Natural World Electives
- ENVS Group EB-A Electives
- PHLH Nutrition and Food Security

**Spring 2015**

**SEM Section:** 01 MWF 08:30 09:45  Instructor: Henry Art

**BIOL 424T Conservation Biology (W)**

**Crosslistings:** BIOL 424/ENVI 424

**Primary Crosslisting**

This tutorial examines the application of population genetics, population ecology, community ecology, and systematic to the conservation of biological diversity. While the focus of this tutorial is on biological rather than social, legal, or political issues underlying conservation decisions, the context is to develop science-based recommendations that can inform policy. Topics include extinction, the genetics of small populations, habitat fragmentation, the impact of invasive species, restoration ecology, design of reserves and conservation strategies.

Format: tutorial/field trip, one to three hours per week. Requirements: evaluation will be based on 5 writing assignments, tutorial presentation, performance in the role of paper critic, & course participation.

**Class Format:** tutorial/field trip, one to three hours per week

**Requirements/Evaluation:** based on 5 writing assignments, tutorial presentation, performance in the role of paper critic, & course participation
**Biology 403T Genome Sciences: At the Cutting Edge (W)**

Research in genomics has integrated and revolutionized the field of biology, including areas of medicine, plant biology, microbiology, and evolutionary biology. Moreover, recent developments in “metagenomics” (genomic studies of entire communities of microorganisms in natural environments, such as the mammalian gut and the deep sea) and “metatranscriptomics” (studies of genome wide changes in expression and mRNA levels in natural communities of organisms) have generated unprecedented knowledge about the genomic potential of a community and the in situ biological activity of different ecological niches. In this course we will explore how research in these and related areas, including proteomics, has advanced our fundamental understanding of (1) organisms in the three domains of life, and their interactions and evolutionary relationships; (2) biological systems and environments, such as the human body, extreme environments, and the oceans; (3) strategies for solving global challenges in medicine, agriculture, energy resources, and environmental sciences. During the course, students will meet each week for one hour with a tutorial partner and the instructor. Every other week, students will present a written and oral critical analysis of the assigned research articles. On alternate weeks, students will question/critique the work of their colleague.

**Class Format:** tutorial meeting one hour a week

**Requirements/Evaluation:** evaluation will be based on five tutorial papers of four pages each, five critiques, tutorial presentations, and general participation.

**Prerequisites:** BIOL 205

**Enrollment Limit:** 10

**Expected Class Size:** 10

**Enrollment Preferences:** Biology majors who have not had a 400-level biology course

**Dept. Notes:** does not satisfy the distribution requirement in the Biology major

**Extra Info:** may not be taken on a pass/fail basis; not available for the Gaudino option

**Distributional Requirements:**

- Division 3
- Writing Intensive

**Other Attributes:**

- BIMO Interdepartmental Electives

**Not Offered Academic Year 2014-2015**

**TUT**

**Instructor:** Claire Ting

**Biology 403(F) Senior Thesis Research: Biology**

Each student prepares a thesis under the supervision of a member of the department. Thesis work can begin either in the spring of the junior or the fall of the senior year, and includes the Winter Study period of the senior year. The number of Biology Department faculty available to mentor research students and the number of students each can accommodate in her/his lab vary from year to year. Although the department will make every effort to provide an opportunity for students to conduct Honors research, you should be aware that it may not be possible to assign all applicants to a laboratory.

**Class Format:** independent study

**Dept. Notes:** Senior majors and concentrators are required to participate in Biology Colloquium, which are scheduled for most Fridays at 1:10pm.
BIOL 494(S) Senior Thesis Research: Biology
Each student prepares a thesis under the supervision of a member of the department. Thesis work can begin either in the spring of the junior or the fall of the senior year, and includes the Winter Study period of the senior year. The number of Biology Department faculty available to mentor research students and the number of students each can accommodate in her/his lab vary from year to year. Although the department will make every effort to provide an opportunity for students to conduct Honors research, you should be aware that it may not be possible to assign all applicants to a laboratory.

Class Format: independent study

Extra Info: this is part of a full-year thesis (493-494)

Distributional Requirements:
Division 3

Spring 2015
HON Section: 01 TBA Instructor: Steven Swoap

BIOL 499 Biology Colloquium
Scientists from around the country who are on the cutting edge of biological research come to talk about their work. Students of Biology at any level are welcome.

Class Format: lecture

Extra Info: this is not a for-credit course; registration is not necessary to attend

Distributional Requirements:
Non-divisional

Not Offered Academic Year 2014-2015
LEC Instructor: Steven Swoap