BIOLOGY (DIV III)

Chair: Professor JOAN EDWARDS

Professors: H. ART***, L. BANTA, J. EDWARDS, D. LYNCH, M. MORALES, R. SAVAGE***, S. SWOAP**, C. TING, H. WILLIAMS, Senior Lecturer: D. C. SMITH. Associate Professor: L. MAROJA. Assistant Professors: M. CARTER*, P. CHEN, T. LEBESTKY, D. TURNER. Lecturers: D. DEAN, J. MACINTIRE. Visiting Assistant Professor of Marine Science for the Williams-Mystic Program: M. NISHIZAKI.

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.

PUBLIC HEALTH

Students interested in Public Health (PH) should consult the general statement under Public Health.

ENVIRONMENTAL STUDIES

Students interested in Environmental Studies (ENVI) should consult with Biology faculty members associated with the program and 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 investigates cell structure and function as a consequence of evolutionary processes, and it stresses the dynamic properties of living systems. Topics include an introduction to biological molecules and enzyme action, membrane structure and function, energy exchange and design of metabolic systems, expression of genetic information, cell signaling, cell trafficking, the cell cycle, and cancer. Student-designed laboratory experiments and discussions based on primary biology literature will highlight how biological knowledge is created and understood.

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
Extra Info: may not be taken on a pass/fail basis
Prerequisites: none
Enrollment Preferences: first year students
Enrollment Limit: 48/Lecture
Expected Class Size: 192
Distributional Requirements:
Division 3
Other Attributes:
BIMO Required Courses

MTSC Related Courses
NSCI Required Courses

Fall 2016
LEC Section: A1 TR 09:55 AM 11:10 AM Instructor: Daniel Lynch

LEC Section: A2 TR 11:20 AM 12:35 PM Instructor: Daniel Lynch

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

LAB Section: A4 T 01:00 PM 04:00 PM Instructor: Jenna MacIntire

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

LAB Section: A6 R 01:00 PM 04:00 PM Instructor: Damian Turner

LEC Section: B1 MWF 10:00 AM 10:50 AM Instructor: Robert Savage

LEC Section: B2 MWF 11:00 AM 11:50 AM Instructor: Robert Savage

LAB Section: B3 M 01:00 PM 04:00 PM Instructor: Janis Bravo

LAB Section: B4 T 01:00 PM 04:00 PM Janis Bravo

LAB Section: B5 W 01:00 PM 04:00 PM Janis Bravo

LAB Section: B6 R 01:00 PM 04:00 PM Janis Bravo

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 in our examination of evolutionary concepts. Topics include meiosis and sexual reproduction, developmental and evolutionary mechanisms, and speciation with representative examples from a diversity of plants and animals. Readings are drawn from a variety of sources, including the recent primary 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
Extra Info: may not be taken on a pass/fail basis
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 2017
LEC Section: A1 TR 09:55 AM 11:10 AM Instructor: Claire Ting

LAB Section: A2 M 01:00 PM 04:00 PM Instructor: Derek Dean

LAB Section: A3 T 01:00 PM 04:00 PM Instructor: David Smith

LAB Section: A4 W 01:00 PM 04:00 PM Instructor: Manuel Morales

LAB Section: A5 R 01:00 PM 04:00 PM Instructor: David Smith

LEC Section: B1 MWF 11:00 AM 11:50 AM Instructor: Manuel Morales

LAB Section: B2 M 01:00 PM 04:00 PM Instructor: Claire Ting

LAB Section: B3 T 01:00 PM 04:00 PM Instructor: Derek Dean

LAB Section: B4 W 01:00 PM 04:00 PM Instructor: Derek Dean

LAB Section: B5 R 01:00 PM 04:00 PM Instructor:Manuel Morales

BIOL 133 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 Preferences: seniors, juniors, sophomores, then first-year students
Enrollment Limit: 120
Expected Class Size: 120
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 2017
LEC Instructor: Steven Swoap

BIOL 134 The Tropics: Biology and Social Issues (D)
Crosslistings: BIOL 134/ENVI 134
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, Oceanea, 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
Extra Info: may not be taken on a pass/fail basis; not available for the fifth course option
Prerequisites: none
Enrollment Preferences: seniors, juniors, sophomores, and first-year students—in that order
Enrollment Limit: 60
Expected Class Size: 60
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
EVST Living Systems Courses
GBST African Studies Electives
PHLH Biomedical Determinants of Health
SCST Elective Courses

Not Offered Academic Year 2017
LEC Instructor: David Smith

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

Enrollment Limit: 20
Expected Class Size: 20
Distributional Requirements:
Division 3
Exploring Diversity
Other Attributes:
PHLH Biomedical Determinants of Health

Not Offered Academic Year 2017
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
Extra Info: may not be taken on a pass/fail basis; not available for the fifth course option
Prerequisites: BIOL 101 and 102
Enrollment Limit: none
Expected Class Size: 84
Dept. Notes: does not satisfy the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Quantitative/Formal Reasoning
Other Attributes:
BGNP Recommended Courses
BIMO Required Courses

Fall 2016
LEC Section: 01 MWF 11:00 AM 11:50 AM Instructor: Luana Maroja

LAB Section: 02 M 01:00 PM 04:00 PM Instructor: Derek Dean

LAB Section: 03 T 01:00 PM 04:00 PM Instructor: Derek Dean

LAB Section: 04 W 01:00 PM 04:00 PM Instructor: Derek Dean

LAB Section: 05 R 01:00 PM 04:00 PM Instructor: Derek Dean

BIOL 203(F) Ecology (Q)
Crosslistings: BIOL 203/ENVI 203
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
Extra Info: may not be taken on a pass/fail basis; not available for the fifth course option
Prerequisites: BIOL 101 and 102, or ENVI 101 or 102, or permission of instructor
Enrollment Limit: none
Expected Class Size: 35
Dept. Notes: required course for the majors in Environmental Policy & Environmental Science and Environmental Studies concentration; satisfies the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Quantitative/Formal Reasoning
Other Attributes:
ENVI Core Courses
ENVI Natural World Electives
ENVP Core Courses
ENVS Core Courses
EVST Environmental Science
EVST Living Systems Courses

Fall 2016
LEC Section: 01 MWF 10:00 AM 10:50 AM Instructor: David Smith

LAB Section: 02 M 01:00 PM 04:00 PM Instructor: David Smith

LAB Section: 03 T 01:00 PM 04:00 PM Instructor: David Smith

BIOL 204(S) Animal Behavior
Crosslistings: BIOL 204/NSCI 204
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
Extra Info: may not be taken on a pass/fail basis
Prerequisites: BIOL 102, or PSYC 101, or permission of instructor
Enrollment Preferences: Biology majors and Neuroscience concentrators
Enrollment Limit: 32
Expected Class Size: 32
Dept. Notes: satisfies the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Other Attributes:
COGS Interdepartmental Electives
NSCI Group A Electives

Spring 2017
LEC Section: 01 MWF 08:30 AM 09:45 AM Instructor: Heather Williams

LAB Section: 02 M 01:00 PM 04:00 PM Instructor: Heather Williams

LAB Section: 03 T 01:00 PM 04:00 PM 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 reports, and a final exam
Prerequisites: BIOL 101 and 102; open to first-year students with permission of the Biology department
Enrollment Preferences: seniors, then juniors, then sophomores
Enrollment Limit: 72
Expected Class Size: 72
Dept. Notes: satisfies the distribution requirement in the Biology major
Distributional Requirements:
Division 3

Spring 2017
LEC Section: 01 MWF 09:00 AM 09:50 AM Instructor: Steven Swoap

LAB Section: 02 M 01:00 PM 04:00 PM Instructor: Steven Swoap

LAB Section: 03 T 01:00 PM 04:00 PM Instructor: Jenna MacIntire

LAB Section: 04 W 01:00 PM 04:00 PM Instructor: Jenna MacIntire

LAB Section: 05 R 01:00 PM 04:00 PM Instructor: Steven Swoap

BIOL 211(S) Paleobiology
Crosslistings: GEOS 212/BIOL 211

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 Preferences: sophomores and juniors
Enrollment Limit: 15
Expected Class Size: 12
Dept. Notes: does not satisfy the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Other Attributes:
MAST Interdepartmental Electives

Spring 2017
LEC Section: 01 TR 09:55 AM 11:10 AM Instructor: Phoebe Cohen

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

BIOL 212(F) Neuroscience
Crosslistings: NSCI 201/BIOL 212/PSYC 212
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, autism, 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
Extra Info: not available for the fifth course option
Prerequisites: PSYC 101 or BIOL 101; open to first-year students with permission of instructor
Enrollment Preferences: sophomores and Biology and Psychology majors
Enrollment Limit: 72
Expected Class Size: 72
Dept. Notes: does not satisfy the distribution requirement in the Biology major
Distribution Notes: meets Division 3 requirement if registration is under PSYC
Distributional Requirements:
Division 3
Other Attributes:
COGS Interdepartmental Electives
NSCI Required Courses
PSYC 200-level Courses

Fall 2016
LEC Section: 01 TR 09:55 AM 11:10 AM Instructors: Heather Williams, Lauren Williamson

LAB Section: 02 M 01:00 PM 04:00 PM Instructor: Martha Marvin

LAB Section: 03 T 01:00 PM 04:00 PM Instructor: Martha Marvin

LAB Section: 04 W 01:00 PM 04:00 PM Instructor: Martha Marvin

BIOL 214T Mathematical Ecology (Q)
Crosslistings: MATH 410/BIOL 214
Using mathematics to study natural phenomena has become ubiquitous over the past couple of decades. In this tutorial, we will study mathematical models comprised of both deterministic and stochastic differential equations that are developed to understand ecological dynamics and, in many cases, evaluate the dynamical consequences of policy decisions. We will learn how to understand these models through both standard analytic techniques such as stability and bifurcation analysis as well as through simulation using computer programs such as MATLAB. Possible topics include fisheries management, disease ecology, control of invasive species, and predicting critical transitions in ecological systems.
Class Format: tutorial
Requirements/Evaluation: written and programming assignments, oral presentations, and exams
Extra Info: may not be taken on a pass/fail basis; not available for the fifth course option
Prerequisites: MATH 250 or permission of instructor; Math 209 preferred

Enrollment Preferences: programming experience, students with interests in the intersection of math and biology
Enrollment Limit: 10
Expected Class Size: 10
Dept. Notes: Does not satisfy 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
ENVS Methods Courses
PHLH Methods in Public Health

Not Offered Academic Year 2017
TUT Instructor: Julie Blackwood

BIOL 218T DNA, Life, and Everything (W)
Since the molecular biology revolution of the 1960s, a view of biology has developed which regards living organisms as predictable products of their encoded DNA programs. A motto for this philosophy and scientific approach could be "To know my DNA is to know me." In this tutorial we'll examine the power and the limitations of DNA analysis and manipulation for understanding life. Students will read and discuss scientific articles that deal with creating artificial life (the field of synthetic biology), environmental DNA sampling (to deduce community structure; to discover new, uncultured species), human genome diversity surveys (to discover the basis for human phenotypic variation and human evolutionary history), comparative genomics to address evolutionary questions (ex., chimps and Neanderthals compared to humans), and resurrecting extinct organisms.
Class Format: tutorial
Requirements/Evaluation: evaluation will be based on 5 papers (4-5 pages each) and on in-class performance as a presenter or challenger
Extra Info: may not be taken on a pass/fail basis, not available for the fifth course option
Prerequisites: none
Enrollment Preferences: junior, seniors, then sophomores
Enrollment Limit: 10
Expected Class Size: 10
Dept. Notes: does not satisfy the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Writing Intensive
Other Attributes:
SCST Related Courses

Not Offered Academic Year 2017
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 Ebola hemorrhagic fever, dengue, 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 disease malaria and why such 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: six 4- to 5-page papers; tutorial presentations, and the student's progress towards intellectual independence and creativity as a presenter and a respondent
Extra Info: may not be taken on a pass/fail basis; not available for the fifth course option
Prerequisites: BIOL 101 and 102
Enrollment Preferences: sophomores, students interested in public health
Enrollment Limit: 10
Expected Class Size: 10
Distributional Requirements:
Division 3
Writing Intensive
Other Attributes:
PHLH Biomedical Determinants of Health

Spring 2017
TUT Section: T1 R 11:20 AM 12:35 PM Instructor: Lois Banta

BIOL 220(S) Field Botany and Plant Natural History
Crosslistings: BIOL 220/ENVI 220
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
Extra Info: may not be taken on a pass/fail basis; not available for the fifth course option
Prerequisites: none
Enrollment Preferences: seniors, Biology majors, and Environmental Studies majors & concentrators
Enrollment Limit: 30
Expected Class Size: 25
Dept. Notes: satisfies the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Other Attributes:
ENVI Natural World Electives
ENVS Group EB-B Electives
EVST Living Systems Courses
EXPE Experiential Education Courses
PHLH Nutrition,Food Security+Environmental Health

Spring 2017
LEC Section: 01 MWF 09:00 AM 09:50 AM Instructor: Joan Edwards

LAB Section: 02 T 01:00 PM 04:00 PM Instructor: Joan Edwards

LAB Section: 03 W 01:00 PM 04:00 PM Instructor: Joan Edwards

BIOL 225(F) Natural History of the Berkshires: Stone Hill (W)
Crosslistings: BIOL 225/ENVI 225
This field-seminar course examines the rich diversity of upland and wetland communities located within walking distance of the Williams College Campus in general and on Stone Hill in particular. The course will utilize the Summer/Fall 2016 exhibition *Sensing Place: The Nature of Stone Hill* that will be hosted by the Clark Art Institute at the Lunder Center on Stone Hill and co-curated by the instructor. Seminars/discussions/field exercises will focus on the biological, geological, climatological, and historical underpinnings needed to observe, interpret, and analyze the biological communities of this place. The field lab investigations will engage students in reading the landscape, field identification of indicator species, natural history, and using historical documents and textural materials. On a weekly basis, students will write response papers that integrate field observations and experiences with reading assignments. Students will also undertake a longitudinal study of a specific site on Stone Hill and write entries in a field journal on a weekly basis. These entries will serve as the foundation for a final research project report on the specific site.
Class Format: seminar / field laboratory, three hours per week
Requirements/Evaluation: based on field journal entries, field trip / reading responses, one hour exam, class presentations, and a final project
Extra Info: may not be taken on a pass/fail basis; not available for the fifth course option
Prerequisites: none
Enrollment Preferences: seniors, Biology majors, and Environmental Studies majors and concentrators
Enrollment Limit: 12
Expected Class Size: 10
Dept. Notes: satisfies the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Writing Intensive
Other Attributes:
AMST Space and Place Electives
ENVI Natural World Electives
ENVS Group EB-B Electives

Fall 2016
SEM Section: 01 W 01:10 PM 03:50 PM Instructor: Henry Art

BIOL 231(F,S) Marine Ecology
Crosslistings: MAST 311/BIOL 231
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
Extra Info: offered only at Mystic Seaport
Prerequisites: BIOL 101 or GEOS/MAST 104, or permission of instructor
Distributional Requirements:
Division 3
Other Attributes:
ENVI Natural World Electives
ENVS Group EB-A Electives
EVST Living Systems Courses
EXPE Experiential Education Courses

Fall 2016
LEC Section: 01 TBA Instructor: Michael Nishizaki

Spring 2017
LEC Section: 01 TBA Instructor: Michael Nishizaki

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 2016
IND Section: 01 TBA Instructor: Joan Edwards

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 2017
IND Section: 01 TBA Instructor: Joan Edwards

BIOL 301 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 Preferences: Biology majors
Enrollment Limit: 24
Expected Class Size: 15
Dept. Notes: does not satisfy the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Other Attributes:
BIMO Interdepartmental Electives

Not Offered Academic Year 2017
LEC Instructor: Robert Savage

BIOL 302(F) Communities and Ecosystems (Q)
Crosslistings: BIOL 302/ENVI 312
An advanced ecology course that examines how species interact with each other and their environment with a focus on conservation implications. This course emphasizes phenomena that emerge in complex ecological systems, building on the fundamental concepts of population biology, community ecology, and ecosystem science. This foundation will be used to understand specific topics relevant to conservation including the functional significance of diversity for ecosystem stability and processes. Lectures and labs will explore how to characterize the emergent properties of communities and ecosystems, and how theoretical, comparative, and experimental approaches are used to understand their structure and function. The lab component of this course will emphasize hypothesis-oriented

field experiments but will also include some laboratory microcosm experiments. The laboratory component of the course will culminate with a self-designed independent or group 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 Preferences: Biology majors and Environmental Studies majors and concentrators
Enrollment Limit: 28
Expected Class Size: 24
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
EVST Living Systems Courses
EXPE Experiential Education Courses

Fall 2016
LEC Section: 01 TR 09:55 AM 11:10 AM Instructor: Manuel Morales

LAB Section: 02 W 01:00 PM 04:00 PM Instructor: Manuel Morales

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 Preferences: Biology majors
Enrollment Limit: 24
Expected Class Size: 24
Dept. Notes: satisfies the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Quantitative/Formal Reasoning
Other Attributes:
BGNP Recommended Courses
COGS Related Courses
ENVS Group EB-A Electives

Spring 2017
LEC Section: 01 MWF 10:00 AM 10:50 AM Instructor: Luana Maroja

LAB Section: 02 W 01:00 PM 04:00 PM Instructor: Luana Maroja

LAB Section: 03 R 01:00 PM 04:00 PM Instructor: Luana Maroja

BIOL 306 Cellular Regulatory Mechanisms
This course explores the regulation of cellular function and gene expression from a perspective that integrates current paradigms in molecular genetics, intracellular trafficking, genomics, and synthetic biology. Selected topics include: the contribution of nuclear organization to genome regulation, mechanisms to maintain genomic integrity, transcriptional and post-transcriptional regulation, nuclear export, cell cycle and cell signaling. A central feature of the course will be discussion of articles from the primary literature, with an emphasis on the molecular bases for a variety of human pathologies such as cancer and aging. The laboratory will consist of a semester-long project that incorporates fluorescence-based approaches, quantitative PCR analysis of transcriptional patterns, bioinformatics, and protein analysis.
Class Format: lecture/discussion/laboratory
Requirements/Evaluation: evaluation will be based on three take-home tests, in-class discussion of papers, laboratory notebook/report, an independent lab research project, and a research paper
Prerequisites: BIOL 202
Enrollment Preferences: Biology majors; not open to first-year students
Enrollment Limit: 24
Expected Class Size: 22
Dept. Notes: does not satisfy the distribution requirement in the Biology major
Distributional Requirements:

Division 3
Other Attributes:
BIMO Interdepartmental Electives

Not Offered Academic Year 2017

BIOL 308 Integrative Plant Biology: Fundamentals and New Frontiers
Plants are one of the most successful groups of organisms on Earth and have a profound impact on all life. Successful use of plants in addressing global problems and understanding their role in natural ecosystems depends on fundamental knowledge of the molecular mechanisms by which they grow, develop, and respond to their environment. This course will examine the molecular physiology of plants using an integrative approach that considers plants as dynamic, functional units in their environment. Major emphasis will be on understanding fundamental plant processes, such as photosynthesis, growth and development, water transport, hormone physiology, and flowering, from the molecular to the organismal level. Environmental effects on these processes will be addressed in topics including photomorphogenesis, stress physiology, mineral nutrition, and plant-microbe interactions. Discussions of original research papers will examine the mechanisms plants use to perform these processes and explore advances in the genetic engineering of plants for agricultural, environmental, and medical purposes. Laboratory activities stress modern approaches and techniques used in investigating plant physiological processes.
Class Format: lecture/discussion/laboratory, six hours per week
Requirements/Evaluation: evaluation will be based on lab reports, a term paper, and exams
Prerequisites: BIOL 202
Enrollment Preferences: Biology majors
Enrollment Limit: 24
Expected Class Size: 12
Dept. Notes: satisfies the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Other Attributes:
BIMO Interdepartmental Electives
ENVS Group EB-A Electives
PHLH Nutrition,Food Security+Environmental Health

Not Offered Academic Year 2017
LEC Instructor: Claire Ting

BIOL 310(F) Neural Development and Plasticity
Crosslistings: BIOL 310/NSCI 310
Development can be seen as a tradeoff between genetically-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
Extra Info: may not be taken on a pass/fail basis; not available for the fifth course option
Prerequisites: BIOL 212 (same as PSYC 212 or NSCI 201) and BIOL 202 (or permission of instructor)
Enrollment Preferences: Biology majors; Neuroscience concentrators; Psych majors
Enrollment Limit: 24
Expected Class Size: 24
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

Fall 2016
LEC Section: 01 MWF 10:00 AM 10:50 AM Instructor: Tim Lebestky

LAB Section: 02 M 01:00 PM 04:00 PM Instructor: Tim Lebestky

LAB Section: 03 T 01:00 PM 04:00 PM Instructor: Tim Lebestky

BIOL 311 Neural Systems and Circuits
Crosslistings: BIOL 311/NSCI 311
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: BIOL 212 (same as PSYC 212 or NSCI 201) or BIOL 205
Enrollment Preferences: Biology majors and Neuroscience concentrators
Enrollment Limit: 24
Expected Class Size: 24
Dept. Notes: does not satisfy the distribution requirement in Biology
Distributional Requirements:
Division 3
Other Attributes:
NSCI Group A Electives

Not Offered Academic Year 2017
LEC Instructor: Matt Carter

BIOL 313(S) 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 Preferences: senior and then junior Biology majors
Enrollment Limit: 24
Expected Class Size: 24
Dept. Notes: does not satisfy the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Other Attributes:
BIMO Interdepartmental Electives
PHLH Biomedical Determinants of Health

Spring 2017
LEC Section: 01 MWF 11:00 AM 11:50 AM Instructor: Damian Turner

LAB Section: 02 M 01:00 PM 04:00 PM Instructor: Damian Turner

LAB Section: 03 T 01:00 PM 04:00 PM Instructor: Damian Turner

BIOL 315 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 Preferences: senior and then junior Biology majors
Enrollment Limit: 24
Expected Class Size: 24
Dept. Notes: does not satisfy the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Other Attributes:
BIMO Interdepartmental Electives
ENVS Group EB-A Electives
PHLH Biomedical Determinants of Health

Not Offered Academic Year 2017
LEC Instructor: Lois Banta

BIOL 319(F) Integrative Bioinformatics, Genomics, and Proteomics Lab (Q)
Crosslistings: BIOL 319/MATH 319/CHEM 319/PHYS 319/CSCI 319
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; students who have not taken BIOL 202 but have taken BIOL 101 and CSCI 315 or PHYS 315, may enroll with permission of instructor. No prior computer programming experience is required.
Enrollment Preferences: seniors, then juniors, then sophomores
Enrollment Limit: 12
Expected Class Size: 12
Dept. Notes: does not satisfy the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Quantitative/Formal Reasoning
Other Attributes:
BGNP Core Courses
BIMO Interdepartmental Electives

Fall 2016
LEC Section: 01 W 12:25 PM 01:00 PM Instructor: Lois Banta

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

BIOL 321(F) Biochemistry I: Structure and Function of Biological Molecules (Q)
Crosslistings: BIMO 321/BIOL 321/CHEM 321
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 quizzes, a midterm exam, a final exam, problem sets and performance in the laboratories including lab reports
Extra Info: may not be taken on a pass/fail basis
Prerequisites: BIOL 101 and CHEM 251/255 and CHEM 155/256
Enrollment Preferences: junior and senior Biology and Chemistry majors and BIMO concentrators
Enrollment Limit: 48
Expected Class Size: 48
Dept. Notes: does not satisfy the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Quantitative/Formal Reasoning
Other Attributes:
BGNP Related Courses
BIMO Required Courses

Fall 2016
LEC Section: 01 MWF 10:00 AM 10:50 AM Instructor: Lawrence Kaplan

LAB Section: 02 M 01:00 PM 05:00 PM

LAB Section: 03 W 01:00 PM 05:00 PM

LAB Section: 04 R 01:00 PM 05:00 PM

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
Extra Info: may not be taken on a pass/fail basis; not available for the fifth course option
Prerequisites: BIOL 101 and CHEM 251/255 or permission of instructor
Enrollment Preferences: junior and senior Biology and Chemistry majors and BIMO concentrators
Enrollment Limit: 64
Expected Class Size: 64
Dept. Notes: does not satisfy the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Quantitative/Formal Reasoning
Other Attributes:
BGNP Related Courses
BIMO Required Courses

Spring 2017
LEC Section: 01 MWF 10:00 AM 10:50 AM Instructor: Daniel Lynch

LAB Section: 02 T 01:00 PM 04:00 PM Dan Lynch

LAB Section: 03 W 01:00 PM 04:00 PM Pei-Wen Chen

LAB Section: 04 R 01:00 PM 04:00 PM Pei-Wen Chen

BIOL 326(F) Cellular Assembly and Movement
This course will focus on how multi-protein complexes are assembled to control key cellular processes in eukaryotic systems: 1) protein sorting and trafficking, 2) establishment and maintenance of cell architecture, and 3) mitosis, cell migration and tissue morphogenesis that require coordination of the membrane transport and cytoskeleton. The course will highlight involvement of these processes in pathological conditions. Laboratories will use mammalian tissue culture as a model system to study cellular functions. Important techniques in cell biology will be introduced in the first half of the semester; in the second half of the term, students will conduct a multi-week independent project. Textbook readings will be supplemented with primary literature.
Class Format: lectures, three hours a week; laboratory, three hours a week, the laboratory projects will require additional time outside of class hours
Requirements/Evaluation: three exams, in-class discussion of papers, lab reports, an oral presentation and research paper based on an independent lab research project
Extra Info: may not be taken on a pass/fail basis
Prerequisites: BIOL 202
Enrollment Preferences: senior and junior Biology majors
Enrollment Limit: 12
Expected Class Size: 12
Dept. Notes: does not satisfy the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Other Attributes:
BIMO Interdepartmental Electives

Fall 2016
LEC Section: 01 MWF 09:00 AM 09:50 AM Instructor: Pei-Wen Chen

LAB Section: 02 T 01:00 PM 04:00 PM Instructor: Pei-Wen Chen

BIOL 405T 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
Extra Info: may not be taken on a pass/fail basis
Prerequisites: BIOL 202 and either BIOL/ENVI 203 or 204 or 302 or 305 or permission of instructor; open to juniors and seniors
Enrollment Preferences: senior Biology majors who have not taken a 400-level course
Enrollment Limit: 10
Expected Class Size: 10
Dept. Notes: satisfies the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Writing Intensive

Not Offered Academic Year 2017
TUT Instructor: Manuel Morales

BIOL 406 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
Extra Info: may not be taken on a pass/fail basis
Prerequisites: BIOL 202
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
Enrollment Limit: 12
Expected Class Size: 12
Distribution Notes: does not satisfy the distribution requirement in Biology
Distributional Requirements:
Division 3
Other Attributes:
BIMO Interdepartmental Electives

Not Offered Academic Year 2017

BIOL 407(S) Neurobiology of Emotion
Crosslistings: BIOL 407/NSCI 347
Emotion is influenced and governed by a number of neural circuits and substrates, and emotional states can be influenced by experience, memory, cognition, and many external stimuli. We will read and discuss articles about mammalian neuroanatomy associated with emotion as defined by classic lesion studies, pharmacology, electrophysiology, fMRI imaging, knockout mouse studies, as well as new opti-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: discussion, 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 Preferences: senior Biology majors who have not taken a 400-level Biology course; then to eligible NSCI concentrators
Enrollment Limit: 12
Expected Class Size: 12
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

Spring 2017
SEM Section: 01 TR 09:55 AM 11:10 AM Instructor: Tim Lebestky

SEM Section: 02 TR 11:20 AM 12:35 PM Instructor: Tim Lebestky

BIOL 408 RNA Worlds
Ribonucleic acids (RNAs) serve as genomes, catalysts, messengers, adaptors, regulators, structural components, and evolutionary substrates. Non-coding RNAs such as microRNAs, ribozymes, and small interfering RNAs control a diverse range of biological processes including plant and animal development, translation, epigenetic chromosome silencing, and cancer. This course explores recently discovered non-coding RNAs and considers evidence for their mechanisms of action. Through extensive reading of primary literature, we will analyze experimental investigations that reveal our current understanding of the functions and evolution of non-coding RNAs in all three domains of life.
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 Preferences: senior Biology majors who have not taken a 400-level course & BIMO concentrators
Enrollment Limit: 12
Expected Class Size: 12
Dept. Notes: does not satisfy the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Other Attributes:
BIMO Interdepartmental Electives

Not Offered Academic Year 2017

BIOL 410(S) Nanomachines in Living Systems
Through reading and discussing the primary literature, this course will explore how nanometer-sized biological molecules like proteins perform functions that require integration of information and transmission of force at much larger scales, microns and above. These nanoscale proteins will be considered as nanomachines that can transform a chemical energy into a mechanical one. We will focus on the cytoskeleton, which gives cells their shape, organizes the internal parts of cells and provides mechanical support for essential cellular processes like cell division and movement. An emphasis will be placed on how the biochemical properties of actin, actin-binding proteins and motors are used to generate mechanical force necessary for the respective biological function. Topics will include some controversial and emerging hypotheses in the field: sliding versus depolymerizing hypotheses for constriction of the contractile ring in cytokinesis, roles of cytoskeleton in pathogen entry and propagation, organelle dynamics, polarity establishment in cell migration, immunological synapse and neuronal function.
Class Format: discussion, three hours per week
Requirements/Evaluation: class participation and several short papers
Extra Info: may not be taken on a pass/fail basis; not available for the fifth course option
Prerequisites: BIOL 202; open to juniors and seniors
Enrollment Preferences: senior Biology majors who have not taken a 400-level course, then juniors
Enrollment Limit: 24
Expected Class Size: 24
Dept. Notes: does not satisfy the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Other Attributes:
BIMO Interdepartmental Electives

Spring 2017
SEM Section: 01 TR 08:30 AM 09:45 AM Instructor: Pei-Wen Chen

SEM Section: 02 TR 11:20 AM 12:35 PM Instructor: Pei-Wen Chen

BIOL 414(F) Life at Extremes: Molecular Mechanisms
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
Extra Info: may not be taken on a pass/fail basis
Prerequisites: BIOL 202; open to juniors and seniors

Enrollment Preferences: senior Biology majors who have not taken a 400-level course; then juniors
Enrollment Limit: 12
Expected Class Size: 12
Dept. Notes: does not satisfy the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Other Attributes:
BIMO Interdepartmental Electives
MAST Interdepartmental Electives

Fall 2016
SEM Section: 01 TR 09:55 AM 11:10 AM Instructor: Claire Ting

SEM Section: 02 TR 11:20 AM 12:35 PM Instructor: Claire Ting

BIOL 416 Epigenetics
After decades of studies emphasizing the role of DNA in heredity, scientists are now turning their attention from genetics to a variety of heritable phenomena that fall under the heading of epigenetics, heritable changes that do not result from an alteration in DNA sequence. Research reveals that 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 Preferences: senior Biology majors who have not taken a 400-level course, then juniors
Enrollment Limit: 12
Expected Class Size: 12
Dept. Notes: does not satisfy the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Other Attributes:
BIMO Interdepartmental Electives

Not Offered Academic Year 2017
SEM Instructor: Benjamin Carone

BIOL 417(F) Translational Immunology: From Bench to Bedside
Recent advances in the field of immunology have led to the development of new approaches to prevent and treat diseases that affect millions of people worldwide. Drugs that modulate the body's natural immune response have become powerful tools in treating the world's major diseases—infection, autoimmunity and cancer. This course will use readings from the primary literature to explore central themes involved in translating basic research to new clinical and therapeutic approaches. Topics will include vaccine development, transplantation immunology, autoimmunity and cancer immunotherapy.
Class Format: seminar/conference
Requirements/Evaluation: evaluation will be based on class participation and several short papers
Extra Info: may not be taken on a pass/fail basis; not available for the fifth course option
Prerequisites: BIOL 202; open to juniors and seniors
Enrollment Preferences: senior biology majors who have not taken a 400-level course; then juniors
Enrollment Limit: 12
Expected Class Size: 12
Dept. Notes: does not satisfy the distribution requirement in Biology
Distributional Requirements:
Division 3
Other Attributes:
PHLH Biomedical Determinants of Health

Fall 2016
SEM Section: 01 TR 09:55 AM 11:10 AM Instructor: Damian Turner

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 targets. 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
Extra Info: may not be taken on a pass/fail basis; not available for the fifth course option
Prerequisites: BIOL 202 or permission of instructor
Enrollment Preferences: seniors and then juniors
Enrollment Limit: 12
Expected Class Size: 12
Dept. Notes: does not satisfy the distribution requirement in Biology
Distributional Requirements:
Division 3
Other Attributes:
BIMO Interdepartmental Electives

Not Offered Academic Year 2017
SEM Instructor: Robert Savage

BIOL 422(F) Ecology of Sustainable Agriculture
Crosslistings: BIOL 422/ENVI 422
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, 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: evaluation will be based on writing assignments, seminar presentation, and course participation
Extra Info: may not be taken on a pass/fail basis; not available for the fifth course option
Prerequisites: BIOL/ENVI 203 or BIOL 302 or permission of instructor
Enrollment Preferences: open to juniors and seniors
Enrollment Limit: 16
Expected Class Size: 12
Dept. Notes: Satisfies the distribution requirement in Biology; 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,Food Security+Environmental Health

Fall 2016
SEM Section: 01 MWF 08:30 AM 09:45 AM Instructor: Henry Art

BIOL 424T Conservation Biology (W)
Crosslistings: BIOL 424/ENVI 424
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, and 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
Extra Info: may not be taken on a pass/fail basis
Prerequisites: BIOL/ENVI 203 or BIOL 302 or 305 or permission of instructor; open to juniors and seniors
Enrollment Preferences: Biology majors who have not taken a 400-level course; then to senior Environmental Studies majors or concentrators
Enrollment Limit: 10
Expected Class Size: 10
Dept. Notes: satisfies the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Writing Intensive
Other Attributes:

ENVI Natural World Electives

Not Offered Academic Year 2017
TUT Instructor: Joan Edwards

BIOL 426T Frontiers in Muscle Physiology: Controversies (W)
While an active muscle produces force, contraction of muscle is far from the only function of this intriguing organ system. Muscle plays a major role in metabolic regulation of organisms, acts as a glucose storage facility, regulates blood pressure in mammals, and produces numerous hormones. The mechanism for contractile activity varies not only among different organisms, but also among different muscles within the same organism. Controversies, disagreements, and arguments pervade the muscle biology literature perhaps because of the integrative nature of the science. In this tutorial course, we will utilize molecular, physiological, comparative, and evolutionary aspects of muscle biology to address current controversies of this dynamic tissue. Some questions that will be addressed include: 1) Lactic acid generated by skeletal muscle is / is not involved with fatigue at high exercise intensity, 2) Satellite cells are / are not obligatory for skeletal muscle hypertrophy, 3) Do mammals possess the same "stretch activation" of skeletal muscle as seen in insect flight muscle?, 4) Are smooth and skeletal muscles from the same lineage of cells, or do they represent convergent evolution on the tissue level?
After an initial group meeting, students meet weekly with a tutorial partner and the instructor for an hour each week. Every other week at this tutorial meeting, students present a written and oral critical analysis of the assigned research articles. Students not making a presentation question and critique the work of their colleague.
Class Format: tutorial meeting one hour a week
Requirements/Evaluation: evaluation is based on five tutorial papers of four pages each, five critiques, tutorial presentations, and general participation
Extra Info: may not be taken on a pass/fail basis
Prerequisites: BIOL 205
Enrollment Preferences: Biology majors who have not had a 400-level biology course
Enrollment Limit: 10
Expected Class Size: 10
Dept. Notes: does not satisfy the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Writing Intensive
Other Attributes:
BIMO Interdepartmental Electives

Not Offered Academic Year 2017
TUT

BIOL 430T 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, have 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
Requirements/Evaluation: evaluation will be based on five (4-5 page) papers, tutorial presentations, and the student's effectiveness as a critic
Extra Info: may not be taken on a pass/fail basis; not available for the fifth course option
Prerequisites: BIOL 202
Enrollment Preferences: open to juniors and seniors; senior Biology majors who have not taken a 400-level course
Enrollment Limit: 10
Expected Class Size: 10
Dept. Notes: BIMO, BIGP; does not satisfy the distribution requirement in the Biology major
Distributional Requirements:
Division 3
Writing Intensive
Other Attributes:
BGNP Recommended Courses
BIMO Interdepartmental Electives

Not Offered Academic Year 2017
TUT Instructor: Claire Ting

BIOL 493(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
Extra Info: this is part of a full-year thesis (493-494)
Dept. Notes: Senior majors and concentrators are required to participate in Biology Colloquium, which are scheduled for most Fridays at 1:10pm
Distributional Requirements:
Division 3

Fall 2016
HON Section: 01 F 01:10 PM 02:30 PM Instructor: Joan Edwards

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 2017
HON Section: 01 F 01:10 PM 02:30 PM Instructor: Joan Edwards

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 2017
LEC Instructor: Steven Swoap