BIOLOGY (Div III)
Chair: Professor Rob Savage

- Lois M. Banta, Halvorsen Professor for Distinguished Teaching and Research of Biology
- Charlotte L. Barkan, Assistant Professor of Biology
- Caitlyn E. Bowman-Cornelius, Assistant Professor of Biology
- Janis E. Bravo, Lecturer in Biology
- Deborah L. Carlisle, Instructor in Biology
- Matt E. Carter, Associate Professor of Biology; Faculty Director, Rice Center for Teaching; affiliated with: Biology, Neuroscience
- Pei-Wen Chen, Associate Professor of Biology
- Derek Dean, Senior Lecturer in Biology
- Joan Edwards, Samuel Fessenden Clarke Professor of Biology
- Allison L. Gill, Assistant Professor of Biology
- Cynthia K. Holland, Assistant Professor of Biology
- Tim J. Lebestky, Associate Professor of Biology, Chair of Neuroscience Program; affiliated with: Biology, Neuroscience
- David W. Loehlin, Assistant Professor of Biology
- Luana S. Maroja, Professor of Biology, Chair of Biochemistry & Molecular Biology Program; affiliated with: Biology, BIMO (Biochemistry and Molecular Biology)
- Manuel A. Morales, Professor of Biology
- Robert M. Savage, Chair of Biology and Charles L. MacMillan Professor in Natural Sciences
- Gordon P. Smith, Visiting Assistant Professor of Biology
- Steven J. Swoap, Howard B. Schow ’50 and Nan W. Schow Professor of Biology
- Claire S. Ting, Professor of Biology
- Damian Turner, Assistant Professor of Biology
- Heather Williams, William Dwight Whitney Professor of Biology; affiliated with: Biology, Neuroscience

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:

BIOL 101 The Cell
BIOL 102 The Organism

Any two 200-level electives with labs in which at least one faculty member is a member of the Williams College Biology Department. (Tutorials may not be used to fulfill this requirement.)

Any two 300-level electives. (Both of these must have an associated lab component).

Any one 400-level seminar course. (Honors thesis BIOL 493-494 do not fulfill this requirement).
Any two more courses which can be at the 200-, 300- or 400-level, OR one such course plus two semesters of Organic Chemistry (CHEM 156 and 251) OR General Chemistry II and Organic Chemistry I (CHEM 200 and 201).

**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.

**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.

It is recommended beginning students enroll in Biology 101 and 102 in sequence. Students may take Biology 102 prior to taking Biology 101, but both must be completed to major in Biology. 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.

The Biology Department encourages majors to have breadth in their course selections. Biology encompasses a wide spectrum of disciplines and uses different methodologies to approach research questions. Yet advances in each discipline of biology increasingly inform thinking throughout the field. We encourage biology majors to gain exposure to diverse conceptual frameworks and methodologies through their choice of courses.

**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 winter study 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, two 200-level biology courses with labs, 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 Chemistry: Chemistry 200/201 or Chemistry 156/251). 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 and/or Biology 203 and/or Biology 212 before going abroad, since these courses are prerequisites for many upper-level courses. Biology majors studying abroad may receive credit toward the major for at most two 200-level electives. Students should meet with the Department's study abroad advisor to discuss study abroad options.

FAQ

Students MUST contact departments/programs BEFORE assuming study away credit will be granted toward the major or concentration.

Can your department or program typically pre-approve courses for major/concentration credit?

Yes, in many cases, if appropriate course information is available in advance (e.g. syllabi and/or course descriptions), though students should be sure to contact the department. We usually want to see a syllabus.

What criteria will typically be used/required to determine whether a student may receive major/concentration credit for a course taken while on study away?

Course title and description, ideally complete syllabus including readings/assignments.

Does your department/program place restrictions on the number of major/concentration credits that a student might earn through study away?

Yes. Only two of the nine major course credits can be taken somewhere other than Williams.

Does your department/program place restrictions on the types of courses that can be awarded credit towards your major?

Yes. Courses taken for major credit anywhere other than Williams will only count as 200-level elective credit, regardless of the level or format of the course.

Are there specific major requirements that cannot be fulfilled while on study away?

Yes. Two 200-level lab courses, 300-level lab courses, and 400-level senior seminar.

Are there specific major requirements in your department/program that students should be particularly aware of when weighing study away options? (Some examples might include a required course that is always taught in one semester, laboratory requirements.)

Yes. Biology 202, Biology 203 and Biology 212 are only offered in the fall. Those late to the major need to be aware of this as these courses are prerequisites for most upper division courses.

Give examples in which students thought or assumed that courses taken away would count toward the major or concentration and then learned they wouldn’t:

Courses that are focused on clinical areas of study, and courses in environmental studies that focus on policy or sociology rather than biology, would not be granted credit in biology.

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. Courses must be pre-approved by the Biology Department Study Away Advisor.

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, or the combination of BIOL 493 and BIOL 494) may be counted towards the major requirements.

BIOL 100  (W)  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; an examination of the inherent limits of the body to perform aerobic and anaerobic tasks; and long-term health consequences of a lifetime of activity or 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: Daily 10:15am-noon and 1:30-3:30pm

Requirements/Evaluation: Two examinations will make up 1/2 of the grade, with the other 1/2 of the grade from laboratory assignments. Laboratory assignments include pre-lab questions and post-lab data analysis.

Prerequisites: Permission of a dean.

Enrollment Limit: 15

Expected Class Size: 15

Grading: no pass/fail option, no fifth course option

Unit Notes: This course is designed to count for both full semester and Winter Study credit. Once a dean approves enrollment, the Registrar's Office will register students in both BIOL 100 and BIOL 41.

Distributions: (D3)

Not offered current academic year

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, protein trafficking, cell signaling, 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: 3 hours of lecture per week and one laboratory/discussion per week (3 hours).

Requirements/Evaluation: Exams, lab reports, discussion assignments, and discussion participation

Prerequisites: none

Enrollment Limit: 45/lecture

Enrollment Preferences: first-year students

Expected Class Size: 180

Grading: no pass/fail option, no fifth course option

Distributions: (D3)

Attributes: BIMO Required Courses  NSCI Required Courses

Fall 2024

LEC Section: 01  MWF 9:00 am - 9:50 am  Pei-Wen Chen
LEC Section: 02  MWF 10:00 am - 10:50 am  Pei-Wen Chen
LEC Section: 03  TR 8:30 am - 9:45 am  Caitlyn E. Bowman-Cornelius
LEC Section: 04  TR 9:55 am - 11:10 am  Caitlyn E. Bowman-Cornelius
LAB Section: 05  M 1:00 pm - 3:50 pm  Janis E. Bravo
LAB Section: 06  T 1:00 pm - 3:50 pm  Janis E. 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. Although BIOL 101 is not a prerequisite for BIOL 102, students are expected to have basic knowledge of the cell and cellular processes, including: the structure and function of the cell, nucleic acids and proteins; as well as mechanisms of transcription, translation, and the regulation of genes.

Requirements/Evaluation: exams and laboratory reports

Prerequisites: none

Enrollment Limit: 56/section

Enrollment Preferences: first year students

Expected Class Size: 152

Grading: no pass/fail option, yes fifth course option

Distributions: (D3)

Attributes: BIMO Required Courses

BIOL 133 (F) 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: three hours per week

Requirements/Evaluation: exams and bi-weekly laboratory exercises and laboratory report

Prerequisites: none

Enrollment Limit: 90
BIOL 134  (F)  The Tropics: Biology and Social Issues  (DPE)

**Cross-listings:**  CAOS 134

**Primary Cross-listing**

Biology and Social Issues of the Tropics explores the biological dimensions of social and environmental issues in tropical societies, focusing specifically on the tropics of Africa, Asia, Latin America, Oceania, and the Caribbean. Social issues are inextricably bound to human ecologies and their environmental settings. Each section of the course provides the science behind the issues and ends with options for possible solutions, which are debated by the class. The course highlights differences between the tropics and areas at higher latitudes while also emphasizing global interconnectedness. It begins with a survey of the tropical environment, including a global climate model, variation in tropical climates and the amazing biodiversity of tropical biomes. The next section focuses on human population biology, and emphasizes demography and the role of disease particularly malaria, AIDS and Covid-19 (SARS-CoV-2). 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 interaction of humans with their supporting ecological environment, and global climate change. This course fulfills the DPE requirement. Through lectures, debates and readings, students confront social and environmental issues and policies from the perspective of biologists. This builds a framework for lifelong exploration of human diversity in terms of difference, power and equity.

**Class Format:** Debate

**Requirements/Evaluation:** two hour exams, a short paper, debate presentation, and a final exam

**Prerequisites:** none

**Enrollment Limit:** 62

**Enrollment Preferences:** Preference will be given to Environmental Studies majors/concentrators, students in need of a Division III or DPE requirement, and then Seniors, Juniors, Sophomores, and First Year students.

**Expected Class Size:** 62

**Grading:** no pass/fail option, no fifth course option

**Unit Notes:** Does not count for credit in the Biology major.

**Distributions:** (D3) (DPE)

This course is cross-listed and the prefixes carry the following divisional credit:

BIOL 134(D3) CAOS 134(D3)

**Difference, Power, and Equity Notes:** This course highlights differences between the tropics and higher latitudes. For each section we focus on difference--different natural habitats and biodiversity, different patterns of population growth, different human disease profiles, different types of agriculture and different contributions to and impacts of climate change. For each section we highlight differences in power and the inequities of resource distribution. We then debate potential solutions to ameliorate these inequities.

**Attributes:** ENVI Natural World Electives  GBST African Studies  PHLH Biomedical Determinants of Health

Not offered current academic year

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BIOL 135 (F)  Evolution as Fact and Theory
This course examines evolution as a science and its current and historical importance. Lectures focus on the evidence for evolution, the main evolutionary forces (natural selection and others) and the diversification processes that generate biodiversity. We will also explore recent evolutionary trends and discussions such as human evolution, heritability, personalized genomics, antibiotic and pesticide resistance, climate change, and the conflict between creationists and evolutionists. The course has a required day trip to the American Museum of Natural History in NYC.

Requirements/Evaluation: exams, panel discussion, short papers and participation

Prerequisites: none

Enrollment Limit: 60

Enrollment Preferences: Non biology majors, 1st year students

Expected Class Size: 60

Grading: yes pass/fail option, yes fifth course option

Unit Notes: may not be taken as credit towards the Biology major; not open to students who took BIOL 305

Distributions: (D3)

Not offered current academic year

**BIOL 202  (F)  Genetics  (QFR)**

Genetics, classically defined as the study of heredity, is today a multidisciplinary field whose principles provide critical insight and tools to most areas of biology and medicine. 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. A primary focus of the course is on students developing familiarity with problem solving, the logic and quantitative reasoning required to understand how genetic mechanisms lead to biological patterns. The laboratory part of the course provides an experimental introduction to modern genetic analysis as well as introductions to interpreting genetic reasoning in the primary research literature. Laboratory experiments include investigating chromosome structure using microscopy, mapping a mutation to the genome by integrating multiple streams of evidence, and determining the structure of a DNA plasmid using molecular tools.

Class Format: Lecture: three hours per week, Lab: three hours per week.

Requirements/Evaluation: bi-weekly problem sets; weekly laboratory exercises and laboratory reports; three exams

Prerequisites: BIOL 101 and 102

Enrollment Limit: 120

Enrollment Preferences: students interested in the Biology major

Expected Class Size: 60

Grading: no pass/fail option, no fifth course option

Distributions: (D3) (QFR)

Quantitative/Formal Reasoning Notes: This course develops quantitative skills through solving problems. Students learn to apply basic calculations and logic to predict the outcomes of biological systems, for example, describing the likelihood that an individual will be affected by an inherited disease. Application of quantitative and logical analysis contributes to a large component of the in-class work and the graded material for the class, in the form of problem sets, exams, and data analysis for lab reports.

Attributes: BIGP Courses  BIMO Required Courses

Fall 2024

LEC Section: 01  MWF 11:00 am - 11:50 am  Luana S. Maroja

LAB Section: 02  M 1:00 pm - 3:50 pm  Derek Dean

LAB Section: 03  T 1:00 pm - 3:50 pm  Derek Dean

LAB Section: 04  W 1:00 pm - 3:50 pm  Derek Dean

LAB Section: 05  R 1:00 pm - 3:50 pm  Derek Dean

**BIOL 203  (F)  Ecology  (QFR)**

Cross-listings: ENVI 203
Primary Cross-listing

This course combines lectures & discussion with field and indoor laboratory activities to explore factors that determine the distribution and abundance of plants and animals in natural systems. The course begins with an overview of global environmental patterns and then builds from the population to ecosystem level. Throughout the course, we will emphasize the connection between basic ecological principles and 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). Laboratory activities are designed to engage students in the natural history of the region and build skills in data analysis and scientific writing.

Requirements/Evaluation: pre-class quizzes, lab reports, two mid-term exams, and a final exam
Prerequisites: BIOL 102, or ENVI 102, or permission of instructor
Enrollment Limit: 30
Enrollment Preferences: students planning to pursue Biology and/or ENVI
Expected Class Size: 30
Grading: yes pass/fail option, yes fifth course option
Distributions: (D3) (QFR)

This course is cross-listed and the prefixes carry the following divisional credit:
BIOL 203(D3) ENVI 203(D3)

Quantitative/Formal Reasoning Notes: Much of the material in this course centers on the interpretation and application of mathematical models used to describe ecological systems. The laboratory section of this course also contains a large data analysis component (based in R). Students are introduced to linear models, multidimensional data analysis and contingency tables.

Attributes: ENVI Natural World Electives EVST Environmental Science

Fall 2024

LEC Section: 01 TR 8:30 am - 9:45 am Manuel A. Morales
LAB Section: 02 T 1:00 pm - 3:50 pm Manuel A. Morales
LAB Section: 03 W 1:00 pm - 3:50 pm Manuel A. Morales

BIOL 204 (S) Animal Behavior

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, concentrating upon the selection pressures that drive animals toward a particular social system.

Class Format: six hours per week
Requirements/Evaluation: quizzes, exams, and lab reports
Prerequisites: BIOL 102, or PSYC 101, or permission of instructor
Enrollment Limit: 32
Enrollment Preferences: Biology majors and Neuroscience concentrators
Expected Class Size: 32
Grading: yes pass/fail option, no fifth course option
Distributions: (D3)
Attributes: COGS Interdepartmental Electives NSCI Group C Electives

Spring 2025
BIOL 205 (S) Physiology

This course explores animal physiology—the principles and mechanisms by which animals live and function. Across the semester we will survey a variety of physiological processes including intracellular communication, animal movement, circulation, gas exchange, ion/water balance, digestion and metabolism, and thermoregulation. We will explore these topics from the level of cells and tissues to the whole organism, surveying a wide variety of animals with a focus on vertebrates. Laboratories provide practical experience in the experimental measurement and analysis of physiological parameters in animal models and in human subjects.

Requirements/Evaluation: Daily practice problems, problem sets, midterm exams, laboratory exercises, and a final exam

Prerequisites: BIOL 101; open to first-year students only with permission of instructor

Enrollment Limit: 72

Enrollment Preferences: Seniors, then juniors, then sophomores.

Expected Class Size: 72

Grading: no pass/fail option, no fifth course option

Distributions: (D3)

BIOL 206 (S) Marine Biology

The oceans impact almost all life and processes on Earth. In this course we will explore the astounding diversity of life in the world's oceans, from the smallest photosynthetic microbes on the planet to the largest animals that weigh almost 200 tons. Using an integrative approach that spans from the molecular to the organismal to the ecological levels, we will focus on the biology of marine organisms, and their interactions and interrelationships. Topics including primary production, reproduction, acclimation to stresses, adaptation, and evolution will be discussed in the context of environments such as the open oceans, coastal waters, rocky intertidal zones, coral reefs, and the deep sea. We will emphasize how recent scientific advances have revolutionized our understanding of marine organisms and explore solutions to global challenges, including climate change and ocean acidification, pollution, sustainable fishing and aquaculture, and habitat conservation.

Requirements/Evaluation: two exams, one two-page research paper, one final project with a three-page written component and an oral presentation component, participation in discussions, laboratory assignments

Prerequisites: Biology 101 and Biology 102, or permission of instructor

Enrollment Limit: 20

Enrollment Preferences: Biology majors: seniors who need a second 200-level course for the major, and then juniors who need a second 200-level course for the major

Expected Class Size: 20

Grading: no pass/fail option, yes fifth course option

Distributions: (D3)

Not offered current academic year

BIOL 209 (F) Animal Communication (WS)

Cross-listings: NSCI 209
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, synchronous signaling by fireflies, gestural communication by primates, long-distance chemical attractants that allow male moths to find the object of their desire, and cultural evolution within learned signaling systems.

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

Prerequisites: BIOL 101 and 102; open to sophomores, juniors, and seniors

Enrollment Limit: 10

Enrollment Preferences: Biology majors and Neuroscience concentrators who need a Biology elective to complete the concentration; then sophomores.

Expected Class Size: 10

Grading: no pass/fail option, no fifth course option

Distributions: (D3) (WS)

This course is cross-listed and the prefixes carry the following divisional credit:

NSCI 209 (D3) BIOL 209 (D3)

Writing Skills Notes: This course is a tutorial, and each student will write five position papers and five response papers. Extensive feedback will be provided; students will be required to rewrite one position paper, and may rewrite any of them.

Attributes: COGS Related Courses NSCI Group A Electives

Fall 2024

TUT Section: T1 TBA Heather Williams

BIOL 211 (S) Paleobiology

Cross-listings: GEOS 212

Secondary Cross-listing

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. We will explore how, why, when, and where fossils form and learn about the major groups of fossilized organisms and how they have changed through time. In addition, 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' 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, including using the programming language R (no previous experience is required). We will also view a diversity of fossils in their geologic and paleo-environmental context on our field trip to Eastern New York. This course is in the Sediments and Life group for the Geosciences major.

Class Format: One day field trip to the Paleozoic of New York State

Requirements/Evaluation: Weekly lab assignments, frequent short quizzes and writing assignments, and a final research project presented in poster form.

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

Enrollment Limit: 24

Enrollment Preferences: sophomores, and junior GEOS majors

Expected Class Size: 20

Grading: no pass/fail option, no fifth course option

Unit Notes: does not satisfy the distribution requirement for the Biology major

Distributions: (D3)
BIOL 212 (F) Neuroscience

Cross-listings: NSCI 201 / PSYC 212

Secondary Cross-listing

This course is designed to give an overview of the field of neuroscience progressing from a molecular level onwards to individual neurons, neural circuits, and ultimately regulated output behaviors of the nervous system. Topics include a survey of the structure and function of the nervous system, basic neurophysiology and neurochemistry, development, learning and memory, sensory and motor systems, and clinical disorders. Throughout the course, many examples from current research in neuroscience are used to illustrate the concepts being considered. The lab portion of the course will emphasize a) practical hands-on exercises that amplify the material presented in class; b) interpreting and analyzing data; c) presenting the results in written form and placing them in the context of published work; and d) reading and critiquing scientific papers.

Requirements/Evaluation: Evaluation will be based on participation in discussion groups, exercises, problem sets and quizzes performed in small groups, lab reports, midterm exams, and a final exam.

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

Enrollment Limit: 72

Enrollment Preferences: Sophomores and Biology and Psychology majors

Expected Class Size: 72

Grading: yes pass/fail option, no fifth course option

Distributions: (D3)

This course is cross-listed and the prefixes carry the following divisional credit:
BIOL 212(D3) NSCI 201(D3) PSYC 212(D3)

Attributes: COGS Interdepartmental Electives NSCI Required Courses PSYC 200-level Courses

Fall 2024

LEC Section: 01 TR 9:55 am - 11:10 am Shivon A. Robinson, Charlotte L. Barkan

LAB Section: 02 M 1:00 pm - 4:00 pm Martha J. Marvin

LAB Section: 03 T 1:00 pm - 4:00 pm Martha J. Marvin

LAB Section: 04 W 1:00 pm - 4:00 pm Martha J. Marvin

BIOL 220 (S) Field Botany and Plant Natural History

Cross-listings: ENVI 220

Primary Cross-listing

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 systematics and phylogeny, the cultural and economic uses of plants and how plants shape our world. The course covers the role of plants in ameliorating global climate change, their importance in contributing to sustainable food production and providing solutions to pressing environmental problems. Throughout we emphasize the critical role of biodiversity and its conservation. The labs cover field identification, natural history and the ecology of local species.

Class Format: both field and indoor laboratories

Requirements/Evaluation: Based on two hour exams, field quizzes, a final project, and a final exam

Prerequisites: none

Enrollment Limit: 30

Enrollment Preferences: Biology majors, and Environmental Studies majors & concentrators

Expected Class Size: 24
BIOL 231 (F)(S) Marine Ecology

Cross-listings: CAOS 311

Secondary Cross-listing

We have explored only a fraction of the ocean, with about 10% of marine species classified and 20% of the ocean mapped. Many discoveries remain to be made, and marine ecology is one technique to uncover new insights. The field of marine ecology, rooted in the theory of evolution, describes the mechanisms and processes that drive the diversity, abundance, and distribution of marine organisms. The goal is to document natural patterns and make predictions about how species will respond to environmental changes by investigating the relationship between the abiotic environment and biotic interactions. This course will take a deep dive into the unique challenges to life in the ocean. You will compare and contrast different marine ecosystems, such as coral reefs, kelp forests, and the deep sea. You will also practice a marine ecologist's skillset as you design, carry out, and analyze your own research project, which will improve your scientific writing, data analysis, and communication skills. Importantly, you will connect your research and course topics to larger marine conservation issues and broader societal impacts.

Class Format: 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

Enrollment Limit: 16

Enrollment Preferences: none

Expected Class Size: 12

Grading: yes pass/fail option, yes fifth course option

Unit Notes: This course is only offered through Williams-Mystic Coastal and Ocean Studies Program located in Mystic, CT. satisfies the distribution requirement for the Biology major.

Distributions: (D3)

This course is cross-listed and the prefixes carry the following divisional credit:
BIOL 231(D3) CAOS 311(D3)

Attributes: ENVI Natural World Electives EXPE Experiential Education Courses PHLH Nutrition, Food Security + Environmental Health

Spring 2025

LEC Section: 01  MWF 10:00 am - 10:50 am  Joan Edwards
LAB Section: 02  T 1:00 pm - 3:50 pm  Joan Edwards
LAB Section: 03  W 1:00 pm - 3:50 pm  Joan Edwards

Fall 2024

LEC Section: 01  TR 10:30 am - 11:45 am  Tim J. Pusack
LAB Section: 02  TR 1:00 pm - 4:30 pm  Tim J. Pusack

Spring 2025

LEC Section: 01  TR 10:30 am - 11:45 am  Tim J. Pusack
LAB Section: 02  TR 1:00 pm - 4:30 pm  Tim J. Pusack
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.

Requirements/Evaluation: 10-page paper
Prerequisites: Students must have found a faculty member who is willing to mentor them in the lab before enrolling in this course.
Enrollment Limit: 5
Enrollment Preferences: None.
Expected Class Size: 3
Grading: no pass/fail option, yes fifth course option
Distributions: (D3)

Fall 2024
IND Section: 01   TBA   Robert M. Savage

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.

Requirements/Evaluation: 10 page paper
Prerequisites: Students must have found a faculty member who is willing to mentor them in the lab before enrolling in this course.
Enrollment Limit: N/A
Enrollment Preferences: None
Expected Class Size: N/A
Grading: no pass/fail option, yes fifth course option
Distributions: (D3)

Spring 2025
IND Section: 01   TBA   Robert M. Savage

BIOL 303 (F) Pharmacology
Pharmacology explores how molecules interact with biological systems to elicit a response. Roughly half of modern medicines are derived from metabolites with origins in nature, including drugs used to treat cancers and heart disease. In this course, we will consider these natural origins from plant, microbial, and animal sources, as well as how and why organisms synthesize these molecules. We will follow the path of molecules from biosynthesis in one organism to ingestion by another, to interactions with proteins in the body, to metabolism, and ultimately to excretion. Close examination of the molecular interactions between metabolites and proteins will allow us to explore how metabolite binding alters protein function and how genetic variation impacts bioactivity. In the first half of the semester, laboratory experiments will investigate caffeine metabolism using in vitro pharmacokinetic assays and protein structure analysis; these experiments lead up to a multi-week independent project in the second half of the semester. Readings for the lecture will come from the primary literature.

Class Format: Three hours of lecture; three hours of lab with the possibility of occasional experiments outside of the scheduled lab time.
Requirements/Evaluation: Three exams, short response papers based on in-class paper discussions, a lab notebook, a lab report based on an independent project, and an oral presentation.
Prerequisites: BIOL 202 or any two 200-level Biology courses
Enrollment Limit: 20
Enrollment Preferences: senior and then junior Biology majors
Expected Class Size: 20
Grading: no pass/fail option, no fifth course option
Distributions: (D3)
BIOL 305  (S) Evolution  (QFR)
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 adaptation). Topics include micro-evolutionary models, natural and sexual selection, speciation, the inference of evolutionary history, evolutionary medicine among others.

Requirements/Evaluation: independent research project, problem sets, participation in discussions and exams

Prerequisites: BIOL 102 and one 200 level BIOL course

Enrollment Limit: 24

Enrollment Preferences: Seniors and biology majors

Expected Class Size: 24

Grading: yes pass/fail option, yes fifth course option

Unit Notes: satisfies the distribution requirement for the Biology major

Distributions: (D3) (QFR)

Quantitative/Formal Reasoning Notes: We will use mathematical models to study population genetics.

Attributes: BIGP Courses  BIMO Interdepartmental Electives  COGS Related Courses

BIOL 308  (F) 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: six hours per week

Requirements/Evaluation: short papers, lab reports and exams

Prerequisites: BIOL 101 and BIOL 102, or permission of instructor

Enrollment Limit: 24

Enrollment Preferences: Biology majors

Expected Class Size: 24

Grading: no pass/fail option, yes fifth course option

Distributions: (D3)
BIOL 312  (F)  Sensory Biology

Cross-listings:  NSCI 312

Primary Cross-listing

How do animals sense properties of the physical world? How do they convert physical or chemical energy to a signal within a cell that carries information? How is that information represented? What are the limits on what can be sensed? We will look for answers to these questions by investigating the molecular and cellular mechanisms of sensory transduction and how these mechanisms constrain the types of information that the nervous system encodes and processes. We will also ask how natural selection shapes the type of sensory information that animals extract from the world, and what adaptations allow some species to have "special" senses. Some of the examples we will consider are: bat echolocation (hair cells in the ear), detecting visual motion (amacrine cells in the mammalian retina), the constant reshaping of the olfactory system (chemical mapping of odors), what makes a touch stimulus noxious, and enhanced color vision (in birds, bees, and shrimp). Laboratory exercises will focus on the nematode C. elegans, an important model system, to explore and extend how we understand touch, temperature sensation, chemosensation, and light sensation.

Requirements/Evaluation:  Four take-home exams, an independent group research project (proposal, followed by results/discussion), presentation about a non-standard sensory system, many short online quizzes, and lab + class participation.

Prerequisites:  BIOL 101 and either BIOL 212/NSCI 201 or BIOL 205

Enrollment Limit:  24

Enrollment Preferences:  Preference to senior Biology majors who need a 300-level course; then to senior Neuroscience concentrators who need a Group A elective; then to Biology majors. Not open to students who have taken Biology 213.

Expected Class Size:  20

Grading:  no pass/fail option,  no fifth course option

Distributions:  (D3)

This course is cross-listed and the prefixes carry the following divisional credit:

NSCI 312(D3) BIOL 312(D3)

Attributes:  BIMO Interdepartmental Electives  NSCI Group A Electives

Not offered current academic year

BIOL 313  (F)  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:  Video lectures with in class discussions.  Three hour laboratory each week

Requirements/Evaluation:  exams, laboratory reports, and a research paper

Prerequisites:  BIOL 102

Enrollment Limit:  24

Enrollment Preferences:  Senior and then junior Biology majors

Expected Class Size:  24

Grading:  no pass/fail option,  no fifth course option

Distributions:  (D3)

Attributes:  BIMO Interdepartmental Electives  PHLH Biomedical Determinants of Health
BIOL 314 (S) Neuroethology

Cross-listings: NSCI 324

Primary Cross-listing

How does an animal experience its environment? What mechanisms allow an animal to select and generate behaviors? In this course we will use a comparative approach to examine how nervous systems have evolved to solve problems inherent to an animal’s natural environment. We will discuss how animals sense physical and chemical properties of their surroundings and convert this information to a signal encoded in their brain. We will explore how nervous systems of diverse species are adapted to extract sensory information that is relevant to their survival—such as sound, light, and smell. We will also examine how neural circuits control muscles to generate motor behaviors such as locomotion and vocalization and how sensory information is integrated to influence behavior. To highlight the discovery process, we will read and discuss primary research articles that complement course content. During labs we will use a variety of approaches such as electrophysiology, optogenetics, behavior, and data analysis to understand sensory and motor systems in several different organisms.

Requirements/Evaluation: Participation in class and lab, several take-home exams, independent group research project and presentation, and short written class and lab assignments.

Prerequisites: BIOL 212 or BIOL 205

Enrollment Limit: 24

Enrollment Preferences: Senior, then junior, Biology majors and NSCI concentrators who need a 300-level course or a NSCI elective

Expected Class Size: 24

Grading: no pass/fail option, yes fifth course option

Distributions: (D3)

This course is cross-listed and the prefixes carry the following divisional credit:

BIOL 314(D3) NSCI 324(D3)

Attributes: NSCI Group A Electives

Spring 2025

LEC Section: 01 TR 9:55 am - 11:10 am Charlotte L. Barkan

LAB Section: 02 W 1:00 pm - 3:50 pm Charlotte L. Barkan

LAB Section: 03 R 1:00 pm - 3:50 pm Charlotte L. Barkan

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

The Covid pandemic and the alarming spread of antibiotic resistant bacteria are but two of the reasons for the resurgence of interest in the biology of viruses and 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, metagenomics, bioremediation, plant and animal defenses against infection, and bacterial strategies to subvert the immune system. We will also discuss a few viral examples, including SARS-CoV2, in the context of pathogen-host co-evolution and the immune system. In the lab, major projects will focus on the mammalian gut microbiome and the isolation and characterization of bacteria from natural environments. The lab experience will culminate in multi-week independent investigations. Readings will be comprised primarily of articles from the primary literature.

Class Format: lectures three hours a week and laboratory three hours a week

Requirements/Evaluation: three exams/writing assignments, responses to thought questions on readings, a lab report/notebook, and an oral presentation

Prerequisites: BIOL 202 or 203

Enrollment Limit: 24

Enrollment Preferences: senior and then junior Biology majors

Expected Class Size: 24
BIOL 319 (S) Integrative Bioinformatics, Genomics, and Proteomics Lab (QFR)

Cross-listings: CHEM 319 / CSCI 319 / PHYS 319 / MATH 319

Primary Cross-listing

What can computational biology teach us about cancer? In this lab-intensive 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, and phylogenetics 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 throughput approaches to investigate genes involved in the inflammatory and MAPK signal transduction pathways 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 may also be used to study networks of interacting proteins in colon tumor cells.

Class Format: The lab for this course will meet for two afternoons per week. Some lab sessions will be shorter than 3 hours.

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 a CSCI course, or CSCI/PHYS 315, may enroll with permission of instructor. No prior computer programming experience is required.

Enrollment Limit: 12

Enrollment Preferences: seniors, then juniors, then sophomores

Expected Class Size: 12

Grading: yes pass/fail option, no fifth course option

Distributions: (D3) (QFR)

This course is cross-listed and the prefixes carry the following divisional credit:

BIOL 319(D3) CHEM 319(D3) CSCI 319(D3) PHYS 319(D3) MATH 319(D3)

Quantitative/Formal Reasoning Notes: Through lab work, homework sets and a major project, students will learn or further develop their skills in programming in Python, and about the basis of Bayesian approaches to phylogenetic tree estimation.

Attributes: BIGP Courses BIMO Interdepartmental Electives

Not offered current academic year

BIOL 320 (S) Ecosystem ecology in the Anthropocene

Cross-listings: ENVI 320 / GEOS 320

Primary Cross-listing

Ecosystem ecology provides a framework for understanding the multidirectional interactions between biological organisms and their physical environments, and provides critical insight into our approaches for managing resource use in an era of anthropogenic change. In this class, we will explore the biological and biogeochemical underpinnings of ecosystem carbon and nutrient cycling. Topics will include interactions between species composition and ecosystem function, nutrient use efficiency, resource transformations, ecosystem management and restoration, and feedbacks to
global change. Lecture content will be supported by regular discussions of the primary literature. Labs will introduce students to field and laboratory techniques to study resource and energy flow in local ecosystems, as well as approaches to project design, hypothesis development, data collection, and analysis. The laboratory program will culminate with a multi-week independent project.

**Class Format:** lectures, discussions, and a weekly lab

**Requirements/Evaluation:** Evaluation will be based on lab assignments, discussion participation, three exams, and an independent project

**Prerequisites:** BIOL/ENVI 203 or GEOS 208 or BIOL 211 or GEOS 212

**Enrollment Limit:** 20

**Enrollment Preferences:** Biology majors, then Environmental studies majors/concentrators or Geosciences majors

**Expected Class Size:** 20

**Grading:** no pass/fail option, no fifth course option

**Distributions:** (D3)

**This course is cross-listed and the prefixes carry the following divisional credit:**

BIOL 320(D3) ENVI 320(D3) GEOS 320(D3)

**Attributes:** ENVI Natural World Electives

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Spring 2025

LEC Section: 01    MWF 11:00 am - 11:50 am     Allison L. Gill

LAB Section: 02    T 1:00 pm - 3:50 pm     Allison L. Gill

LAB Section: 03    W 1:00 pm - 3:50 pm     Allison L. Gill

**BIOL 321 (F) Biochemistry I: Structure and Function of Biological Molecules (QFR)**

**Cross-listings:** BIMO 321 / CHEM 321

**Secondary Cross-listing**

This course introduces the foundational 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 times per week and laboratory, four hours per week

**Requirements/Evaluation:** quizzes, a midterm exam, a final exam, problem sets and performance in the laboratories including lab reports

**Prerequisites:** BIOL 101, CHEM 200 and CHEM 201; or either CHEM 155 or 256 and CHEM 251

**Enrollment Limit:** 12/lab

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

**Expected Class Size:** 36

**Grading:** no pass/fail option, no fifth course option

**Unit Notes:** Cannot be counted towards the Biology major in addition to BIOL 222

**Distributions:** (D3) (QFR)

**This course is cross-listed and the prefixes carry the following divisional credit:**

BIOL 321(D3) BIMO 321(D3) CHEM 321(D3)

**Quantitative/Formal Reasoning Notes:** This course fulfills the QFR requirement with regular problem sets in which quantitative/formal reasoning skills are practiced.

**Attributes:** BIGP Courses BIMO Required Courses

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Fall 2024
LEC Section: 01     MWF 10:00 am - 10:50 am     B Thuronyi
LAB Section: 02     T 1:00 pm - 5:00 pm
LAB Section: 03     W 1:00 pm - 5:00 pm
LAB Section: 04     R 1:00 pm - 5:00 pm

**BIOL 322 (S) Biochemistry II: Metabolism** (QFR)

**Cross-listings:** BIMO 322 / CHEM 322

**Secondary Cross-listing**

This lecture course provides an in-depth presentation of the complex metabolic reactions that 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 and laboratory three hours per week.

**Requirements/Evaluation:** several exams and performance in the laboratories including lab reports that emphasize conceptual and quantitative and/or graphic analysis of data

**Prerequisites:** BIOL 101, plus either: CHEM 156 and CHEM 256, or CHEM 155 and CHEM 156, or CHEM 200 and CHEM 201, or permission of instructor

**Enrollment Limit:** 48

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

**Expected Class Size:** 48

**Grading:** no pass/fail option, no fifth course option

**Unit Notes:** cannot be counted towards the Biology major in addition to BIOL 222

**Distributions:** (D3) (QFR)

**This course is cross-listed and the prefixes carry the following divisional credit:**

BIMO 322(D3) CHEM 322(D3) BIOL 322(D3)

**Quantitative/Formal Reasoning Notes:** The laboratory program is quantitative covering data analyses, numerical transformations, graphical displays.

**Attributes:** BIGP Courses  BIMO Required Courses

Spring 2025

LEC Section: 01     TR 11:20 am - 12:35 pm     Caitlyn E. Bowman-Cornelius
LAB Section: 02     M 1:00 pm - 3:50 pm     Caitlyn E. Bowman-Cornelius
LAB Section: 03     W 1:00 pm - 3:50 pm     Caitlyn E. Bowman-Cornelius
LAB Section: 04     R 1:00 pm - 3:50 pm     Caitlyn E. Bowman-Cornelius

**BIOL 326 (S) 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

Prerequisites: BIOL 202 or BIOL 212 or BIOL 222

Enrollment Limit: 24

Enrollment Preferences: senior and junior Biology majors

Expected Class Size: 24

Grading: no pass/fail option, yes fifth course option

Distributions: (D3)

Attributes: BIMO Interdepartmental Electives

Not offered current academic year

BIOL 329 (F) Conservation Biology

Cross-listings: ENVI 339

Primary Cross-listing

Conservation Biology focuses on protection of the Earth's biodiversity. This course starts with an overview of biodiversity including patterns of species richness, causes of species loss (extinction), and the critical contributions of biodiversity to ecosystem function and human welfare. Then we analyze ways to conserve biodiversity at the genetic, population, species and community/ecosystem levels. Labs are field oriented, and focus on local New England communities and ecosystems. Labs emphasize knowing the dominant species in each system; they also stress how to collect and analyze the field data on ecological community structure and function that are critical to test hypotheses that relate to different conservation goals.

Class Format: lectures, discussions, and a weekly lab.

Requirements/Evaluation: Evaluation will be based on lab assignments and reports, discussion participation, two exams and an independent project.

Prerequisites: BIOL 203/ENVI 203 or BIOL 220 or BIOL 305 or permission of instructor.

Enrollment Limit: 24

Enrollment Preferences: Biology majors, Environmental Studies majors, seniors, and juniors

Expected Class Size: 15

Grading: no pass/fail option, no fifth course option

Distributions: (D3)

This course is cross-listed and the prefixes carry the following divisional credit:

BIOL 329(D3) ENVI 339(D3)

Attributes: ENVI Natural World Electives

Not offered current academic year

BIOL 330 (S) Genomes: Structure, Function, Evolution

Genome sequencing technologies have opened the "book of life" to biologists. But making sense of genomes is still a work in progress. This course will examine central features of genomes, their evolution, and their contribution to human diseases such as cancer. Genome biology is a new field, and this presents the opportunity to learn science as it is being done. Biologists working today started out knowing nothing about core features of genomes, such as why most of the DNA is repetitive, or why segments of genes get removed in the RNA, or why silenced genes wake up in cancer cells. They began to find meaning by adopting dual perspectives of function and neutral evolution. Students will learn to walk these same paths and learn to evaluate for themselves what genome complexity means. In lab, students will develop hands-on and computational skills for investigating genome structural variation, then apply them in the second half of the semester in independent lab investigations.

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

Requirements/Evaluation: Written responses to readings in primary literature; three take-home written exams; two laboratory reports; oral presentation of an independent laboratory project.

Prerequisites: BIOL 202

Enrollment Limit: 24
**BIOL 337 (F) Evolutionary Ecology (QFR)**

Evolutionary ecology is an interdisciplinary field that integrates concepts in genetics, adaptation, and ecology to understand how evolution operates in the context of ecological communities. This course provides an overview of the discipline including foundational concepts in evolutionary demography, phenotypic plasticity, and population genetics. It also explores how breakthroughs in these topics provide a framework for advances in our understanding of the evolution of reproductive timing and ageing, interspecific interactions (e.g., competition, predation), cooperation, and altruism. The course combines lectures, readings, in-class discussion, and a lab section that includes a mixture of field, computer, and lab projects. Laboratories will give students practical, hands-on experience in how to develop, plan, and carry out evolutionary ecology research from start to finish.

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

**Requirements/Evaluation:** Evaluation will be based on lab assignments, two exams, discussion participation, and a written paper.

**Prerequisites:** BIOL 102, plus either BIOL 202 or BIOL 203 or equivalent

**Enrollment Limit:** 24

**Enrollment Preferences:** preference given to biology majors, seniors, and juniors

**Expected Class Size:** 24

**Grading:** no pass/fail option, no fifth course option

**Unit Notes:** Satisfies the distribution requirement for the Biology major

**Distributions:** (D3) (QFR)

**Quantitative/Formal Reasoning Notes:** Evolutionary ecology uses concepts in genetics and ecology to understand how the frequency of alleles in a population changes over time. These changes are formalized in equations that describe these processes. Students will gain experience in utilizing these equations to describe, analyze, and predict the evolutionary outcome of ecological interactions for both theoretical and experimental purposes. Thus, the students will gain experience in solving systems of equations using algebra and in stat

Not offered current academic year

**BIOL 407 (S) Neurobiology of Emotion**

**Cross-listings:** NSCI 347

**Primary Cross-listing**

Emotion is influenced and governed by a number of neural circuits and substrates, and emotional states can be influenced by 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 and optogenetic mouse studies, for investigating neural circuit function in order to gain an understanding of the central circuits and neurotransmitter systems that are implicated in emotional processing. We will focus initially on the neural circuits involved in fear, as a model for how human and animal emotion and physiology is studied, with special sessions on emotional responses to music and art, as well as discussions about burgeoning neurobiological research into the emotion of disgust. The larger goal of the course is to give students opportunities and experience in critical evaluation and discussion of primary scientific literature, and to develop and refine strategies on how to use scientific evidence in building arguments in essays.

**Requirements/Evaluation:** class participation and several short papers

**Prerequisites:** BIOL212/NSCI201; open to juniors and seniors. Sophomores must get instructor's consent prior to enrolling.

**Enrollment Limit:** 12

**Enrollment Preferences:** senior Biology majors who have not taken a 400-level Biology course; then to eligible NSCI concentrators

**Expected Class Size:** 12

**Grading:** no pass/fail option, no fifth course option

Not offered current academic year
BIOL 408  (S)  RNA Worlds

RNA is known best as the message cells use to turn genes into proteins. Yet investigations of several unusual genetic phenomena over the past few decades did not find protein-coding genes, but instead uncovered non-coding RNAs with a cornucopia of functions. Today, biologists have begun to develop a framework for how RNA’s non-coding functions play central roles in immune defense and genetic conflicts, in gene regulation and cancer. We will develop our own understanding of the power of small noncoding RNA to protect the genome and direct cellular processes through reading and discussion of primary scientific literature. We will learn how this emerging perspective of RNA’s non-coding functions helps to resolve genetic mysteries and has opened the door to RNA-based medications.

Class Format: discussion, three hours per week
Requirements/Evaluation: class participation and 4 three-page papers
Prerequisites: BIOL 202; open to juniors and seniors
Enrollment Limit: 12
Enrollment Preferences: senior Biology majors who have not taken a 400-level course
Expected Class Size: 12
Grading: no pass/fail option, yes fifth course option
Distributions: (D3)
Attributes: BIMO Interdepartmental Electives

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: several short papers, participation in class discussions and course notebook
Prerequisites: open to juniors and seniors who are Biology majors; all other students interested in this course should contact the professor; BIOL 202 recommended
Enrollment Limit: 12
Enrollment Preferences: senior Biology majors who have not taken a 400-level course; then junior Biology majors
Expected Class Size: 12
Grading: no pass/fail option, yes fifth course option
Distributions: (D3)
BIOL 417  (S)  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 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, autoimmunity and cancer immunotherapy.

Requirements/Evaluation:  Class participation and 4 essays
Prerequisites:  BIOL 202; open to juniors and seniors
Enrollment Limit:  12
Enrollment Preferences:  senior biology majors who have not taken a 400-level course; then juniors
Expected Class Size:  12
Grading:  no pass/fail option,  no fifth course option
Distributions:  (D3)
Attributes:  PHLH Biomedical Determinants of Health

BIOL 419  (S)  Secrets of Enzymes: Fidelity, Promiscuity, and Disease

Living organisms have spent the past 4 billion years evolving proteins and enzymes that perform basic cellular functions to support life. Over time, duplications and mutations of these enzymes have led to novel reactions, pathways, and chemistries. To gain an appreciation for these molecular catalysts, we will start by considering how enzymes are synthesized and how errors are introduced and naturally corrected. The course will focus on how enzymes such as CRISPR/Cas9 act as ‘molecular scissors’ to cut DNA and how these enzymes are used to correct errors. We will explore the implications of this field in active areas of biomedical, agricultural, and ecological research. Discussions and writing assignments will focus on reading and critiquing the scientific literature.

Class Format: discussion three hours per week
Requirements/Evaluation:  three 3-page papers, a 3-page original research proposal, and participation in discussions
Prerequisites:  BIOL 202 recommended
Enrollment Limit:  12
Enrollment Preferences:  senior Biology majors that have not had a 400-level course, followed by senior Biology majors, then junior Biology majors
Expected Class Size:  12
Grading:  no pass/fail option,  yes fifth course option
Distributions:  (D3)
Attributes:  BIMO Interdepartmental Electives

Spring 2025
SEM Section: 01  MW 11:00 am - 12:15 pm  Cynthia K. Holland

BIOL 420  (S)  Mathematical Biology  (QFR)

Cross-listings:  MATH 412
Secondary Cross-listing

This course will provide an introduction to the many ways in which mathematics can be used to understand, analyze, and predict biological dynamics. We will learn how to construct mathematical models that capture essential properties of biological processes while maintaining analytic tractability. Analytic techniques, such as stability and bifurcation analysis, will be introduced in the context of both continuous and discrete time models. Additionally, students will couple these analytic tools with numerical simulation to gain a more global picture of the biological dynamics. Possible
biological applications may include, but are not limited to, single and multi-species population dynamics, neural and biological oscillators, tumor cell growth, and infectious disease dynamics.

**Requirements/Evaluation:** problem sets, quizzes/exams, participation, final project and paper

**Prerequisites:** MATH 250 and MATH 309, or permission of instructor

**Enrollment Limit:** 30

**Enrollment Preferences:** preference for senior math/stats major and also based on an interest statement

**Expected Class Size:** 30

**Grading:** yes pass/fail option, no fifth course option

**Distributions:** (D3) (QFR)

*This course is cross-listed and the prefixes carry the following divisional credit:*

MATH 412(D3) BIOL 420(D3)

**Quantitative/Formal Reasoning Notes:** The course will introduce methods for developing and analyzing mathematical models.

Spring 2025

LEC Section: 01    TR 9:55 am - 11:10 am    Julie C. Blackwood

**BIOL 421 (S) Thermoregulation: From Molecules to Organisms**

Thermal physiology involves the study of molecular events, organ systems, and organism-environmental interactions that are involved with heat production and temperature maintenance. The area of thermal physiology has been around for over 100 years. However, only in the last 5-7 years has the science progressed to understanding basic fundamental mechanisms for generating and regulating heat production. This tutorial will focus on four questions: 1) how do organisms generate heat? 2) how do organisms sense the temperature in the environment? 3) how do organisms integrate information about the environment (temperature, humidity, time of day, etc.) with internal information (deep body temperature, energy stores, etc.) to regulate their metabolic production of heat? 4) how do animals make "the decision" to enter a state of torpor?

**Requirements/Evaluation:** five 4- to 5-page papers; five 1- to 2-page response papers; tutorial presentations; contribution to the intellectual enterprise

**Prerequisites:** BIOL 205 or permission of instructor

**Enrollment Limit:** 10

**Enrollment Preferences:** senior Biology majors that have not had a 400-level course, followed by senior Biology majors, followed by junior Biology majors

**Expected Class Size:** 10

**Grading:** no pass/fail option, no fifth course option

**Unit Notes:** does not satisfy the distribution requirement for the Biology major

**Distributions:** (D3)

**Attributes:** NSCI Group C Electives

*Not offered current academic year*

**BIOL 427 (F) The Nitrogen Problem**

Nitrogen (N) is a critical component of the proteins and DNA on which living organisms depend, and its availability has historically limited growth in many land ecosystems. In the early 20th century, the development of the Haber-Bosch process, which converts atmospheric dinitrogen gas to biologically-useable ammonium, and the subsequent production of synthetic N fertilizers fundamentally changed the global N landscape. Widespread fertilizer use led to dramatic increases in agricultural yields, which has contributed to our ability to feed and sustain a growing human population, but also generated acute ecological externalities. In this seminar, we will use the primary literature to understand the ways in which a century of fertilizer use has changed the global N cycle, and the effects of those changes on plant (and animal) physiology, community composition and biodiversity, soil biogeochemistry, and aquatic ecosystem health. We will then consider the promises and challenges of new strategies to improve ecosystem N management while supporting robust food production in our changing climate. Discussions and writing assignments will focus on reading and critiquing the scientific literature. Course will culminate with the preparation of a five page grant proposal, with opportunities for peer review and revision.

**Requirements/Evaluation:** Class participation, two three-page papers, five page grant proposal.
BIOL 436 (F) Metabolites as Messengers

Beyond the genome, transcriptome, and proteome is the metabolome, the suite of small-molecule metabolites present in a biological sample. These molecules are not simply the products of the proteome nor a collection of cellular fuels and wastes. In this seminar, we will investigate metabolites as signals that influence cellular processes. Biochemistry and molecular biology textbooks often emphasize the proteins that mediate cellular communication. Of course, specialized metabolites like neurotransmitters and certain hormones are well known to regulate information flow between cells. But what about molecules that participate in the metabolic processes of almost every cell—how can these intermediary metabolites be used as signals? How do they communicate acutely and with specificity? What role do they play in sensing (or promoting) environmental change? And how can metabolites be regulated to override their typical fates in metabolic pathways and serve as signals? We'll examine these questions and more at the levels of inter-organellar, intercellular, and inter-organismal metabolic communication by reading the primary scientific literature together. Familiarity with typical mechanisms of cellular communication and/or physiology (BIOL 205) is recommended but not required.

Class Format: Discussion, three hours per week
Requirements/Evaluation: class participation and three to five papers of length 3-5 pages each
Prerequisites: BIOL 222 or 322; open to juniors and seniors
Enrollment Limit: 12
Enrollment Preferences: senior Biology majors who have not taken a 400-level course
Expected Class Size: 12
Grading: no pass/fail option, no fifth course option
Distributions: (D3)
Attributes: BIMO Interdepartmental Electives

Not offered current academic year

BIOL 437 (F) Neural Flexibility: plasticity, modulation and evolution

Animals must adapt their behaviors to match their environment in order to survive and reproduce. How does the nervous system mediate behavioral change that occurs in seconds, hours, months, or millions of years? In this course we will use a comparative approach to explore how neural circuits control behavioral flexibility over a range of timescales. We will first discuss circuits that control behavioral switches that occur very rapidly based on environmental and social stimuli. Next, we will consider the role that internal state and identity play in modulating neuronal circuits over an organism's lifetime to influence behavioral decisions. Finally, we will examine how evolution tinkers with neural circuits to lead to behavioral change over very long timescales. Throughout the course we will explore how modifications to neural circuits—including connectivity, synaptic plasticity, neuromodulation and neuron physiology—can lead to differences in behavior and ask if there are connections between common mechanisms underlying behavioral change across timescales. Discussions and assignments in this course will focus on reading and critically evaluating primary scientific literature.

Requirements/Evaluation: class participation and three to five papers of length 3-5 pages each
Prerequisites: BIOL 212 or BIOL 205
Enrollment Limit: 12
Enrollment Preferences: senior Biology majors who have not taken a 400-level course
Expected Class Size: 12
Grading: no pass/fail option, no fifth course option
Distributions: (D3)
BIOL 438  (F) Species Interactions Under Global Change

Cross-listings: CAOS 438

Primary Cross-listing

Anthropogenic changes to the world's ecosystems often have clear effects on the abundance and distribution of species. These effects, however, do not occur in a vacuum: changes in any given species' presence, abundance, or behavior can cascade into large and surprisingly context-dependent effects on the interactions of other organisms. In this course we will examine competitive, mutualistic, and antagonistic interactions in the Anthropocene from the species pair to community scale. We will explore the ecological and evolutionary mechanisms underlying the outcomes of these interactions, examining patterns including phenological mismatch, species invasions, and anthropogenic land use change. Classes will focus on critical evaluation of evidence from the primary literature, drawing on examples from community ecology, disease dynamics, and global change biology.

Requirements/Evaluation: class participation and three to five papers of length 3-5 pages each

Prerequisites: BIOL 203 or BIOL 204 or BIOL 329 or permission from instructor

Enrollment Limit: 12

Enrollment Preferences: senior Biology majors who have not taken a 400-level course, open to juniors and seniors

Expected Class Size: 12

Grading: no pass/fail option, no fifth course option

Distributions: (D3)

This course is cross-listed and the prefixes carry the following divisional credit:
CAOS 438(D3) BIOL 438(D3)

Fall 2024
SEM Section: 01    Cancelled

BIOL 440  (S) Cell Signaling and Tissue Engineering: A Potential Fountain of Youth?  (WS)

It is a long quest of mankind to have a healthy and long life but it is inevitable that our bodies lose function due to injury, disease or as we grow old. At the heart of tissue engineering is the idea that we can restore tissue function by replacing with or rebuild the right structure. To artificially generate tissues, organs or even organisms, one fundamental question must be addressed: How do our different organs, composed of cells with the identical genetic information, develop into such functionally different organs? Through the lens of tissue engineering, we will explore the mechanism by which cells sense the surrounding physical and chemical cues, and respond by changing their gene expression and consequent behaviors. We will devote most of our discussion to the scientific rationale and challenges of tissue engineering. Topics to be covered include 3D organoids in regenerative medicine, disease modeling, biobanking and drug discovery, computational modeling of stem cell dynamics, tissue growth and pattern formation, mechanotransduction, biomaterial fabrication, immunomodulation and cultured meat. Bioengineering of bone and cartilage, cardiovascular and nervous systems, etc. will be presented as case studies to illustrate details of certain aspects of tissue engineering in the broader context of the overall strategic approach used to solve a clinical problem. We will also consider the role of social factors like legislative regulation, health care philosophy, ethics and economics in the process of moving concept into the clinic and market.

Requirements/Evaluation: six 4-5 page papers; six 1-2 page response papers; tutorial presentations; contribution to the intellectual enterprise

Prerequisites: BIOL202 or permission of instructor

Enrollment Limit: 10

Enrollment Preferences: Junior and seniors, with preference to senior Biology majors who have not had a 400-level course

Expected Class Size: 10

Grading: no pass/fail option, no fifth course option
**Writing Skills Notes:** Each student will write six 4-5 page papers that address questions given by the professor and six 1-2 page critiques of their tutorial partner's papers, either adding to or refuting the main points made. Both papers and critiques will receive feedback from professor regarding structure, style and argument. As a final assignment, each student will write a paper that requires synthesizing/revising their ideas from the previous five papers and also a peer review of their partner's final paper.

**Attributes:** BIMO Interdepartmental Electives

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**BIOL 477 (S) Evolution of Species Coexistence**

How can two or more species coexist if they compete for the same resources? Or when one preys on the other? Understanding species coexistence has been central to ecology since its inception. The question is important because species diversity is a defining characteristic of natural ecosystems. This course provides an in depth look into the theoretical and empirical evidence for species coexistence. It also explores how the evolution of interacting species can change the identity and number of species in a community thereby playing a key role in determining and maintaining species diversity. Finally, the course will address how this body of theory and empirical evidence can be used to predict how we might expect diversity to change with increases in human-caused disruptions to the natural environment.

**Requirements/Evaluation:** Evaluation will be based on participation in discussions, several short papers, and presentations.

**Prerequisites:** BIOL/ENVI 203

**Enrollment Limit:** 12

**Enrollment Preferences:** Biology seniors who have not yet taken a 400 level course

**Expected Class Size:** 12

**Grading:** no pass/fail option, yes fifth course option

**Distributions:** (D3)

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**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 their 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. This is part of a full-year thesis (493-494).

**Requirements/Evaluation:** Written thesis, poster presentation at the end of the year, oral presentation in October of the senior year.

**Prerequisites:** Students must apply during the first week in February of their junior year to pursue an Honors thesis in Biology.

**Enrollment Limit:** 30

**Enrollment Preferences:** Senior Biology majors

**Expected Class Size:** 25

**Grading:** no pass/fail option, yes fifth course option

**Unit Notes:** Senior majors are required to participate in Biology Colloquium, which is scheduled for most Fridays at 1:10 pm.

**Distributions:** (D3)

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**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. This is part of a full-year thesis (493-494).

**Requirements/Evaluation:** Written thesis, poster presentation at the end of the year, oral presentation in the first semester of the thesis year.

**Prerequisites:** Students must apply during the first week in February of their junior year to pursue an Honors thesis in Biology.

**Enrollment Limit:** 30

**Enrollment Preferences:** Senior Biology majors

**Expected Class Size:** 25

**Grading:** no pass/fail option, yes fifth course option

**Unit Notes:** Senior majors are required to participate in Biology Colloquium, which is scheduled for most Fridays at 1:10 pm.

**Distributions:** (D3)

Spring 2025

HON Section: 01  TBA  Robert M. Savage

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### Winter Study

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**BIOL 13 (W) Intro to Animal Tracking**

Course focuses on identification based on tracks and sign found in the field. Course work includes weekly readings, small group study sites, 1) 6 hour day field trip, 3 page research paper, field test and small group power point presentation.

**Requirements/Evaluation:** Paper(s) or report(s); Presentation(s); Other: Field test

**Prerequisites:** None

**Enrollment Limit:** 15

**Enrollment Preferences:** Seniors to freshman

**Expected Class Size:** NA

**Grading:** pass/fail only

**Unit Notes:** Dan Yacobellis has taught tracking for over two decades and has been leading this WSP for Williams for over 10 years. He holds a level 3 Cyber Tracker North America certification. Dan is also the founder of Tamakoce Wilderness programs in upstate NY

**Materials/Lab Fee:** $75

**Attributes:** EXPE Experiential Education Courses  SLFX Winter Study Self-Expression  STUX Winter Study Student Exploration  WELL Winter Study Wellness

Not offered current academic year

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**BIOL 22 (W) Introduction to Biological Research**

An experimental research project will be carried out under the supervision of the Biology Department. It is expected that the student will spend 20 hours per week in the lab at a minimum, and a 10-page written report is required. This experience is intended for, but not limited to, first-year students and sophomores, and requires the permission of the instructor.

**Class Format:** Independent study

**Requirements/Evaluation:** A 10-page paper

**Prerequisites:** None. Students may not register until they have a confirmed placement in a Williams Biology lab. The instructor will work with student to identify possible mentors, but it is the student's responsibility to talk to the mentor and get approval.

**Enrollment Limit:** 18

**Enrollment Preferences:** First years and sophomores

**Expected Class Size:** NA

**Grading:** pass/fail only
Attributes: EXPE Experiential Education Courses STUX Winter Study Student Exploration

BIOL 24 (W) Introduction to Ecology and Evolutionary Biology Research

An experimental research project in ecology/evolutionary biology will be carried out under the supervision of the Biology Department. It is expected that the student will spend 20 hours per week in the lab at a minimum, and a 10-page written report is required. This experience is intended for, but not limited to, first-year students and sophomores, and requires the permission of the instructor.

Requirements/Evaluation: A 10-page paper.

Prerequisites: None. Students may not register until they have a confirmed placement in a Williams Biology lab. The instructor will work with student to identify possible mentors, but it is the student's responsibility to talk to the mentor and get approval.

Enrollment Limit: 12

Enrollment Preferences: First years and sophomores

Expected Class Size: 8

Grading: pass/fail only

BIOL 27 (W) Introduction to Molecular and Cell Biology and Biochemistry Research

An experimental research project in molecular or cellular biology/biochemistry will be carried out under the supervision of the Biology Department. It is expected that the student will spend 20 hours per week in the lab at a minimum, and a 10-page written report is required. This experience is intended for, but not limited to, first-year students and sophomores, and requires the permission of the instructor.

Requirements/Evaluation: A 10-page paper.

Prerequisites: None. Students may not register until they have a confirmed placement in a Williams Biology lab. The instructor will work with student to identify possible mentors, but it is the student's responsibility to talk to the mentor and get approval.

Enrollment Limit: 12

Enrollment Preferences: First years and sophomores

Expected Class Size: 8

Grading: pass/fail only

BIOL 28 (W) Introduction to Research in Neuroscience and Organismal Biology

An experimental research project in neurobiology/organismal biology will be carried out under the supervision of the Biology Department. It is expected that the student will spend 20 hours per week in the lab at a minimum, and a 10-page written report is required. This experience is intended for, but not limited to, first-year students and sophomores, and requires the permission of the instructor.

Requirements/Evaluation: A 10-page paper.

Prerequisites: None. Students may not register until they have a confirmed placement in a Williams Biology lab. The instructor will work with student to identify possible mentors, but it is the student's responsibility to talk to the mentor and get approval.

Enrollment Limit: 12

Enrollment Preferences: First years and sophomores.

Expected Class Size: 8

Grading: pass/fail only

BIOL 31 (W) Senior Thesis: Biology

Continuation of Senior Honors thesis research. Required of all thesis students.

Prerequisites: Honors thesis student

Enrollment Limit: 33

Enrollment Preferences: To be taken by students registered for Biology 493, 494.

Expected Class Size: NA

Grading: pass/fail only

Attributes: EXPE Experiential Education Courses, STUX Winter Study Student Exploration

Not offered current academic year

BIOL 99 (W) Independent Study: Biology

Open to upperclass students. Students interested in doing an independent project (99) during Winter Study must make prior arrangements with a faculty sponsor. The student and professor then complete the independent study proposal form available online. The deadline is typically in late September. Proposals are reviewed by the pertinent department and the Winter Study Committee. Students will be notified if their proposal is approved prior to the Winter Study registration period.

Class Format: independent study

Grading: pass/fail only

Not offered current academic year