Biology (BIOL)

BIOL 1004 G-Ecology 3 Credits
Overarching course goals are to improve student ecological and environmental literacy, Earth Stewardship, and environmental communication skills in view of learning goals of the Department of Biology and GU Science for All. Students learn about basic ecological and environmental concepts that relate to GU and its environs and their lifetime Earth Stewardships. They study GU's air, buildings, energy use, gardening and landscaping, invasive and native species, recycling, transportation, and water use as well as nearby urban areas in our current Anthropocene climate-change crisis. Hands-on projects are organism responses to their environments involving house plants and GU woody-plant phenology. G-Ecology has guest speakers and local walks to examine GU's environment.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 1008 Ecology the Environment 3 Credits
At a time when we face a number of serious environmental challenges, an understanding of ecology is important. The objectives of this course are to provide nonscience majors with an introduction to ecologic concepts and to discuss several important environmental issues. Includes a survey of mechanisms and processes at work in the environment, with a focus on current understanding of environmental issues such as climate change, population growth, pollution, agriculture, and emerging diseases. The course explores environmental sustainability and the connection between individual actions and global processes.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 1010 Knowing: Science as Narrative 3 Credits
Science is messy. Stories of scientific discoveries are never straightforward. Science is done by people whose judgements could be biased and limited by the tools available. Thus, scientific work is constantly re-evaluated and challenged. This course is designed to help students recognize that science is a method to investigate nature, not a collection of established facts. Students will learn some of the fundamental biological concepts and how they were derived and tested. Articles and videos will be assigned to discuss how scientific knowledge is obtained, subjected to scrutiny, and modified. In order to reinforce the understanding of the scientific method, the course includes lab components in which students will extract DNA from a banana at home and observe the microstructure of biological samples using a Foldscope. This course satisfies the Science for All Core requirement
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 1013 Issues in Biology 3 Credits
Biological concepts taught in the context of current social issues, such as stem cell research and genetically modified organisms. Emphasis on biological literacy to enable students to evaluate scientific advances and their value to society.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 1014 Urban Ecology 3 Credits
Urban ecology is a dynamic field of study exploring the interactions of nature and people in city settings. Over one-half of the world's population lives in urban environments, and this number is expected to reach two-thirds of the population in the near future. Thus, it is critical that we explore the impact of nature on our supply of healthy air, water, and food, as well as the human impact of climate change, pollution, and habitat alteration on urban biodiversity. We will also consider environmental justice issues in the urban context. In this course you will read from academic texts and public media outlets, collect and analyze data, and explore the urban environment of DC through a series of field experiences. Section information text: This course is part of the Capitol Applied Learning Labs and will take place at the Capitol Campus located at 500 1st NW. CALL students receive priority registration. If you are not a CALL student and you wish to take this course, you may join the waitlist at https://forms.gle/3d7xZcAhdADNsUmm7. If you're a CALL student, you will be manually enrolled in the course. For more information, visit http://thecall.georgetown.edu or contact thecall@georgetown.edu
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 1016 Biodiversity and Conservation 3 Credits
This course examines how evolution generates biodiversity, the abundant diversity of life on earth, the interconnectivity of living organisms, the major threats to biological diversity, and the tools that are used in conservation. In doing so, we will build upon current scientific understanding of how our natural world works and explore conservation management in practice. Students will also develop practical skills analyzing data and communicating science. Approaches to better connect the practice of conservation with the needs and priorities of a growing human population are emphasized.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)
Course registration restrictions:
Students cannot enroll who have a major in Biology of Global Health, Biology of Global Health, Biology of Global Health, Biology of Global Health, Biology, Biology, Biology, Biology, Environmental Biology, Environmental Biology, Environmental Biology, Environmental Biology, Environment Sustainability, Environment Sustainability, Environment Sustainability, Environment Sustainability, Neurobiology, Neurobiology, Neurobiology or Neurobiology.
Students cannot enroll who have a minor in Environmental Studies, Environmental Studies, Environmental Studies, Environmental Studies, Environment Sustainability, Environment Sustainability, Environment Sustainability or Environment Sustainability.

BIOL 1019 Extr BlueWrld: Biol Marine Mam 3 Credits
Course Title: Extremes in a Blue World: The Biology of Marine Mammals What is life like in the ocean? We will explore this question from the perspective of the world's largest inhabitants, marine mammals. From the sea otter to the blue whale- it is a world of extremes. While blue whales are the largest animals to ever grace the planet, the bowhead whale is the oldest mammal. Whales are the deepest divers and among the biggest travelers. Outside of humans, only whales (some species) exhibit menopause. The largest brains outside of humans are also in our oceans. Why? In this course we will explore the evolution, anatomy, physiology, life history, cognition, ecology and behavior of marine mammals (cetaceans, pinnipeds, sirenia, sea otters, and polar bears). We will also cover ocean processes and how they influence marine mammal foraging ecology, breeding and migration. Rising seas and conservation issues will dominate the final weeks of the course. The course will consist of discussions and field trips. This is an introductory course in marine mammal biology designed for non-science majors. Biology majors can take it as an elective.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 1020 Bees and Beekeeping 0 or 3 Credits
The course will consist of lectures and hands-on lab activities in the Georgetown bee hives on campus.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 1021 Science of Sustainable Food 3 Credits
The production and processing of food along with disposal of food waste have some of the most profound global environmental effects of all human activities. Modern agriculture accounts worldwide for 11% of land use, 80% of tropical deforestation, 70% of freshwater use, 13% of carbon emissions, well over half of nitrogen emissions, and contributes to soil erosion, water and air pollution, and loss of biodiversity. A more sustainable food system is clearly needed if we are to feed the 9 billion human mouths expected on Earth by 2050. In this course we will examine the scientific underpinnings of a range of environmental issues that pertain to international agriculture since its invention roughly 12,000 years ago. We will look at topics such as the biological origins of crop plants and domesticated animals, patterns of land conversion and use, soil creation and loss, the use and contamination of water, fertilizer and its impact on nutrient cycling, pesticides and other novel chemicals employed in agriculture, the use of fossil fuels for food transport and processing, food packaging, and the processing of food waste. Some potential solutions to the challenge of global food sustainability will be examined such as the use of GMOs and other biotech approaches, the role of subsidies, energy and water policies, changing diets and food sources, alternate farming practices, and food justice issues. Some seats in this class are reserved.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 1022 Environ Sci for Changing World 3 Credits
This course will examine the scientific process, principles, and methodologies required to understand the interrelationships of the natural world; we will identify and analyze environmental problems and evaluate potential solutions for resolving or preventing these issues. Specific topics will include ecosystem resources, biogeochemical cycles, freshwater resources, environmental health, ecology and evolution, biodiversity and conservation, food resources, and climate change. This course will employ a range of teaching methodologies (e.g., lectures, discussions, and case studies), complemented by research activities on campus.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 1025 The Biology of How We Think 3 Credits
Given recent advances in genomics, cognitive science, and neurobiology, we are just now able to understand how our brain works. How do we think? And what don't we know? These are questions we will work to answer in this course. We will explore How we think through many modalities: primary scientific literature, listening to podcasts, watching videos, and more active approaches like mindfulness practices, reflections, and doing real science. This course satisfies the Science for All Core requirement.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 1027 Biology of Viruses 3 Credits
Viruses hover just below the definition of life, yet they are a fundamental part of it. While you fight a cold, your gut bacteria fight bacteriophages. While new pandemic viruses emerge, ancient virus fossils lie scattered in our genome. In this course, we will explore biology principles through the theme of virology. Methods of inquiry and laboratory techniques will be an integral part of the class structure. Through lectures, discussions, research papers, and popular science content, we will learn the fundamentals of cell biology, the immune system, types of viruses, genetics, virus evolution, infection spread, and other relevant topics. In lab you will explore and apply the principles of clinical testing, make observations and test hypotheses, and learn how to analyze data and communicate science. Assessments will include discussion posts, lab reports, short exams, and a final paper. This course meets the science-for-all requirement.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 1030 The Science of Climate Change 3 Credits
Climate change is reshaping the planet, with record-breaking heatwaves, vanishing glaciers, and shifting ecosystems making headlines—but alongside scientific evidence, misinformation persists. This course explores the fundamental principles of climate change, examining the natural and human-driven forces that shape climate, the evidence for global change, and its cascading effects on ecosystems and human societies. Students will analyze past and present climate records, investigate planetary boundaries, and assess the role of biodiversity in maintaining stable ecosystems. Drawing on principles from biology, chemistry, ecology, environmental science, and climatology, this course emphasizes data interpretation, scientific reasoning, and communication. Through case studies and hands-on data analysis, students will explore how climate change affects food and water resources, public health, and economic stability. By the end of the course, students will have the tools to critically evaluate claims about climate change and its impacts.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 1031 Microbes of Tuscany 3 Credits
Both wine and cheese production depend on harnessing the biochemical potential of a variety of different microorganisms. This course will be a rigorous exploration into the characteristics of microbes important for the development of these foods, with an emphasis on the biochemical pathways necessary for production of ethanol and other products that are responsible for the unique flavors and textures associated with these foods. Part of the course will involve hands-on activities comparing genes for these processes among different organisms, using tools of bioinformatics, a relatively new field combining biology, computer science, and statistics. Students will also delve into the literature about the microbiology of wine and cheese making. The classroom work will be complemented by two field trips, one to a vineyard and one to a dairy, so that students can get a first-hand view of these two industries.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 1035 Biodiversity in Tuscany 3 Credits
Biodiversity and Conservation in Tuscany: Ecosystems, Species, and Sustainable Practices This course explores the biodiversity and conservation efforts of Italy, with a particular focus on the Tuscany region. Over four weeks, students will examine the rich ecosystems of Tuscany, key species of flora and fauna, and the challenges posed by human activities such as agriculture, urbanization, and climate change. The course also emphasizes the role of traditional practices, sustainable agriculture, and protected areas in conserving biodiversity. Through readings, discussions, and activities students will gain a comprehensive understanding of biodiversity conservation within the Italian context. This course will employ a range of teaching methodologies (e.g., lectures, discussions, analysis of existing data sets, and case studies), complemented by local excursions.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 1040 Biology for Travelers 3 Credits
Overall: the course is intended to trigger the interest of students in science, especially life-science. A good number will take later regular biology courses as they continue studies in STIA. So, the course highlights main principles and concepts but is not a regular pre-med or bio course. It is especially meant to help policy makers to connect to scientists and to use scientific information in politics, strategy, diplomacy. The course is focused on the practical consideration of living abroad for an extended period of time. Course description: This course prepares students to understand and contribute to the current discussion on COVID. It uses the example of international traveling to present the corresponding scientific concepts: Travelers regularly face health issues that are related to exposure to heat, as well as complications resulting from food and water. Additionally, travelers are susceptible to infectious diseases that are associated with diverse environments. This course provides both, an understanding of the biological systems which are involved in coping with these travelers' issues as well as practical resources to prevent or to address them. Accordingly, this course illustrates relevant sections of immuno-biology, human metabolism, physiology and current diagnostic methods as well as resources such as those which are available on campus, or from the government's CDC. This in turn will offer the student a better understanding about global health measures that are related to international travel, which are crucial for understanding the ongoing international concerns of the COVID pandemic.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 1045 Evolution and Ecology of Food 3 Credits
Why do we eat so much corn and so few acorns? How did the origin of cooking impact early human evolution and migration? Why do plants produce chemical compounds that can heal us or kill us? Will climate change impact the quantity or quality of our food? The foods we eat have been shaped by their evolutionary history and ecological interactions. In turn, harvesting wild plants and animals and producing domesticated crops and livestock impact the environment and biodiversity. We will explore many fundamental concepts of evolution and ecology, including natural selection, phylogenetics, population biology, plant-animal interactions, nutrient cycling, and climate change in order to better understand the plants, animals, and fungi in our diets. The course uses a combination of readings, lectures, discussions, interactive exercises and emphasizes the ability to critically evaluate applications of evolutionary and ecological principles.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 1050 Medicine and Humanity 3 Credits
In this course, we will study biology in the context of three types of diseases: a multifactorial disease, a genetic disease, and an infectious disease. We will consider the biology from a human perspective, including research approaches and consequences—both the good and the problematic. From another angle, we will discuss the role that society plays in the progress of medical science. This course will help students to gain a deeper understanding of biology from proteins to cells to the cardiovascular system, while practicing scientific inquiry, strengthening their communication and critical thinking skills, and placing biology knowledge into a broader context.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 1099 Seeing our World as Scientists 3 Credits
Science lies at the heart of some of our greatest challenges – from infectious disease to climate change – and also at the heart of some of our most profound progress – from vaccines to the exploration of space. Science is not just the knowledge – the names of the organelles of a cell, the equations that quantify the effects of gravity – that helps to explain each of these phenomena. Indeed, almost all knowledge in science should come with a disclaimer that it represents simply our best current understanding of reality. Real science is about how scientists discover new knowledge, what limits that knowledge, how one round of questions and answers can give rise to new questions, and how communicating science profoundly shapes our understanding of it. Science is an inherently social endeavor: society shapes science, and science shapes society. Most introductory science courses teach science as though it is a car, and the class is a showroom at a car dealership – it's all about the external features and gloss. Here we'll tackle science as though we are working in the service part of the dealership, looking under the hood, getting a bit dirty, and tinkering with the engine to really see how it runs. The course will move through three case studies, introducing foundational scientific concepts as a way of understanding complicated scientific challenges. Along the way, we'll work on developing your analytical and communication skills. You'll read a range of different types of scientific writing, apply your new knowledge on weekly problem sets, and tackle one larger project for each case study.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)
Course registration restrictions:
Enrollment is limited to Undergraduate level students.

BIOL 1200 PrinciplePractice in Biology 3 Credits
This is a hands-on, research-intensive course in which students undertake an authentic research project as part of a scientific team. The project focuses on the study of microbial communities (e.g., fungi and bacteria), specifically those living on or around grapes at a local vineyard. We begin by discussing the typical sorts of questions that are asked in this line of research and teaching students how to access and evaluate the relevant scientific literature. The students in the course function as a research team, defining their research questions and working collaboratively in conducting, analyzing, and sharing their research. Basic principles of ecology, molecular biology, and microbiology are taught alongside the analyses and experiments the students do in the pursuit of answers to their questions. We tour these various disciplines not only to provide a broad introduction to the life sciences but also because it is necessary to meet the challenge of these sorts of studies—namely, that to understand a community of organisms requires numerous approaches, and, further, that there is not just a single way to understand a community.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 1201 First-Year Seminar 1 Credit
This seminar will be conducted biweekly over two semesters. It aims to introduce new Biology majors to the program and the faculty. Research in which undergraduate students may engage and the four majors that are available in the Department will be presented. Guidance on enhancing study skills, particularly as they relate to the first year courses in Biology and Chemistry will be discussed as will diversity of careers available to biologists. A biology related popular science book will be assigned for each semester. The course is graded on a pass/fail basis with attendance and engagement being considered.
Level: Undergraduate
Grading: Pass/Fail Default
Course registration restrictions:
Enrollment is limited to students with a major in Biology of Global Health, Biology of Global Health, Biology of Global Health, Biology of Global Health, Biology, Biology, Biology, Biology, Environmental Biology, Environmental Biology, Environmental Biology, Environmental Biology, Neurobiology, Neurobiology, Neurobiology or Neurobiology.

BIOL 1203 Foundations in Biology I 0 or 5 Credits
This first semester of an integrated two semester course focuses upon central concepts in biological chemistry, cell biology, molecular biology, genetics, and development. The relevance of these concepts to the physiology of mammalian systems provides a synthesis opportunity in the last module of the course. This course is a suggested prerequisite for Foundations in Biology II which is offered in the Spring term. Foundations in Biology I and II are prerequisites for higher level biology courses. Three 80-minute lectures and a weekly 50-minute recitation. Students must co-enroll in the laboratory portion of this course (BIOL-113).
Level: Undergraduate
Corequisites: BIOL 1213
Grading: Main Campus (UGrad, Grad)
Course registration restrictions:
Students cannot enroll who have a major in Post Baccalaureate Pre-Medical, Post Baccalaureate Pre-Medical, Post Baccalaureate Pre-Medical or Post Baccalaureate Pre-Medical.

BIOL 1204 Foundations in Biology II 0 or 5 Credits
The second semester of Foundations of Biology emphasizes evolution, the diversity of life on Earth, and ecology. In the course, you will become acquainted with the process of evolution through natural selection, the astonishing diversity of living organisms that has evolved through this process, and the complex ecological interactions that occur among species. Laboratory experiments (in a separate course), demonstrations, on-line exercises, and field studies complement the lectures. Three 70 minute lectures and a weekly recitation; co-enrollment in the separate laboratory (BIOL-114) is required. Spring.
Level: Undergraduate
Corequisites: BIOL 1214
Grading: Main Campus (UGrad, Grad)

BIOL 1205 Found in Biology I 3 Credits
This first semester of an integrated two semester course focuses upon central concepts in biological chemistry, cell biology, molecular biology, genetics, and development. The relevance of these concepts to the physiology of mammalian systems provides a synthesis opportunity in the last module of the course. Foundations in Biology I and II are prerequisites for higher level biology courses. Students should co-enroll in the laboratory portion of this course (BIOL-115). This course is required for pre-meds and many other pre-health programs.
Level: Graduate, Undergraduate
Corequisites: BIOL 1215
Grading: Main Campus (UGrad, Grad)

BIOL 1206 Found in Biology II 3 Credits
In Foundations in Biology II we begin with a detailed look at evolution, the central unifying theme of biology. We next survey the extraordinary diversity of organisms that evolution has produced. In the third section of the course, we examine the science of ecology, as we look at how these organisms interact with one another and with their environment. Foundations in Biology I is not a pre-requisite for this course. BIOL 1206/1216 is the equivalent of BIOL 1204/1214 offered during the academic year. Majors in the Georgetown University Biology department must co-enroll in the lab, BIOL 1216.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 1213 Foundations in Biology I - Lab
Laboratory component of Foundations in Biology 1. Must be taken with Foundations in Biology I Lecture.
Level: Undergraduate
Corequisites: BIOL 1203
Grading: No Grade

BIOL 1214 Foundations in Biology II- Lab
This course is a laboratory associated with Foundations of Biology II. Students must co-enroll in the lecture portion of the course.
Level: Undergraduate
Corequisites: BIOL 1204
Grading: No Grade

BIOL 1215 Found in Biology I-Lab 2 Credits
The lab for Foundations I. Inquiry-based Introductory labs in Biochemistry, Cell Biology, Molecular Biology, Development, Data Analysis and Dissection. Foundations in Biology I and II are prerequisites for higher level biology courses. Students should co-enroll in the lecture portion of this course (BIOL-105). This course is required for pre-meds and many other pre-health programs.
Level: Graduate, Undergraduate
Corequisites: BIOL 1205
Grading: Main Campus (UGrad, Grad)

BIOL 1216 Found in Biology II-Lab 2 Credits
In Foundations in Biology II lab we will explore evolution, diversity, and ecology through hands-on experiments, demonstrations, simulations, and field studies. The laboratory builds on concepts from Foundations in Biology II lectures and emphasizes writing in the sciences and quantitative reasoning. Students must co-enroll in Biol 1206 (Foundations in Biology II) or have taken an equivalent college or university course (AP or IB Biology does not meet this requirement).
Level: Graduate, Undergraduate
Corequisites: BIOL 1206
Grading: Main Campus (UGrad, Grad)

BIOL 1510 Biological Chemistry 3 Credits
This course discusses the structure and function of cells in molecular terms. The primary focus of the course will be: (1) protein conformation, dynamics, and function; (2) generation and storage of metabolic energy; and (3) molecular aspects of selected physiological processes. The course includes three lecture hours. The accompanying laboratory course (BIOL 1511: Biological Chemistry Laboratory) is required for all Biology, Neurobiology, Biology of Global Health, and Environmental Biology majors. Students taking this lecture course as a requirement for other majors or to fulfill pre-health requirements outside of major requirements should check with their advisors if the laboratory course is required for them. Enrollment in the laboratory course requires co-enrollment in or prior completion of this lecture course.
Level: Undergraduate
Prerequisites: (BIOL 1203 or BIOL 1205) or HSCI 2800 or (HSCI 1030 and HSCI 1040) and (CHEM 2100 or CHEM 2300) and CHEM 2105 or (PBPM 117)
Grading: Main Campus (UGrad, Grad)
Mutual exclusion: BIOL 1610, BIOL 161

BIOL 1511 Biological Chemistry Lab 1 Credit
Biological Chemistry Laboratory immerses students in authentic inquiry-based biochemistry. Working in small teams, students investigate the function of hypothetical proteins using experimental and bioinformatics approaches, including protein expression, purification, enzyme assays, and data analysis. Emphasizing research skills, scientific communication, and collaboration, this course prepares students for advanced study in biochemistry and related fields. This laboratory course is required for all Biology, Neurobiology, Biology of Global Health, and Environmental Biology majors when taking BIOL 1510 as part of their major, but is optional for students of other majors. This course requires co-enrollment in or prior completion of BIOL 1510
Level: Undergraduate
Corequisites: BIOL 1510
Grading: Main Campus (UGrad, Grad)

BIOL 1520 Genetics 0 or 4 Credits
This course presents an introduction to both classical and molecular genetics. Topics to be covered include features and patterns of inheritance in bacteria, fungi, plants, animals, and humans; gene and chromosome mutations; structure and function of chromatin; DNA replication; gene expression and regulation; recombinant DNA technology; and non-Mendelian genetics. The laboratory is designed to illustrate topics covered in the lecture and to introduce students to problem solving and experimental design. Three lecture hours and one three-hour laboratory per week. This course fulfills the "Molecules" distribution requirement and serves as an approved course towards a concentration in Biochemistry, Molecular and Cellular Biology, as well as for a concentration in Ecology, Evolution and Behavioral Biology for Biology majors; this course is required for the Environmental Biology major.
Level: Undergraduate
Prerequisites: (BIOL 103 or BIOL 1203) and (BIOL 105 or BIOL 1205)
Course attribute:
Grading: Main Campus (UGrad, Grad)

BIOL 1610 Introduction to Biochemistry 3 Credits
This course is similar to BIOL 151, but is without a laboratory. We will cover protein structure and function, the basics of intermediary metabolism, and the enzymes responsible for the Central Dogma. The class is open to students who are not majoring in Biology, Biology of Global Health, and Neurobiology.
Level: Undergraduate
Prerequisites: (CHEM 115 or CHEM 2100) and (BIOL 103 or BIOL 1203) or (BIOL 105 or BIOL 1205) or (HSCI 280 or HSCI 2800 or HSCI 310) or (CHEM 115 or CHEM 2100) and (CHEM 116 or CHEM 2200) and (CHEM 117 or CHEM 2105) and (CHEM 118 or CHEM 2205)
Grading: Main Campus (UGrad, Grad)
Mutual exclusion: BIOL 151, BIOL 1510
Course registration restrictions:
Students cannot enroll who have a major in Biology of Global Health, Biology of Global Health, Biology of Global Health, Biology of Global Health, Biology, Biology, Biology, Biology, Neurobiology, Neurobiology, Neurobiology or Neurobiology.

Enrollment is limited to Undergraduate level students.

BIOL 1750 Mammalian Physiology 3 Credits
This course will explore function and regulation of all of the major systems of the mammalian body, most of it related to humans. For many systems, structure and function are intimately related and these relationships will be detailed especially in the nervous, muscular, circulatory, pulmonary, excretory and digestive systems. How these systems serve to maintain homeostasis will be a unifying theme throughout the course.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 1760 Mammalian Physiology Lab 1 Credit
Level: Graduate, Undergraduate
Corequisites: BIOL 1750
Grading: Main Campus (UGrad, Grad)

BIOL 1800 Ecology 0 or 4 Credits
The course covers the characteristics of populations, communities and ecosystems and the interactions between organisms and their physical environment. Ecological principles are used to explore major issues, such as global change, biodiversity and invasive species, and disease ecology. These relationships are studied, often in quantitative terms, through case studies and field and laboratory projects, with an emphasis on the interpretation of data and experimental design. This courses fulfills the "Populations" distribution requirement for Biology majors and applies to the concentration in Ecology, Evolution and Behavior; it is required for students majoring in Environmental Biology.
Level: Undergraduate
Prerequisites: (BIOL 104 or BIOL 1204) or (BIOL 106 or BIOL 1206)
Corequisites:
Grading: Main Campus (UGrad, Grad)

BIOL 1801 Ecology: Theory and Practice 3 Credits
Welcome to Ecology: Theory and Practice! In this asynchronous online summer course, we will study the interactions between organisms and their environment across multiple ecological scales, including populations, communities, and ecosystems. In the first two modules, we'll focus on the Physical Environment by surveying Earth's terrestrial and aquatic environments, the physical forces that shape them, and the dynamics of energy and nutrient flow. In the next two modules, we'll focus on Population Dynamics through qualitative and quantitative examination of population growth and fluctuations, with detailed consideration of interspecies interactions. In the final two modules, we'll focus on Communities and Ecosystems by quantifying species diversity and community structure, considering community change through time, and brainstorming ways to address contemporary ecological challenges through collaboration. Throughout each module, we will explore numerous case studies of interest, practice communicating science to diverse audiences, and engage with the natural world by spending time in local natural spaces. Each of these activities is central to exploration and discovery in ecology and will provide opportunities for students to observe, understand, and ultimately protect the natural world and its marvelously diverse array of habitats and species.

Restrictions: This course CANNOT be taken with the 4-credit Ecology (BIOL 1800) lab course. Further, this course does NOT count towards the Environmental Biology major "Ecology" requirement, nor the Biology major "Populations" requirement. This course DOES count as a Biology of Global Health elective in the "Ecology and Evolution" cluster. Students in non-Biology majors are also welcome to register.
Level: Undergraduate
Prerequisites: BIOL 1204 and BIOL 1214
Grading: Main Campus (UGrad, Grad)

BIOL 1850 Evolutionary Processes 0 or 4 Credits
The study of evolution unifies all aspects of biology. This is possible because evolution seeks to explain the diversity of life as an array of processes that produce biological change, variation and diversity. This broad introduction to evolutionary biology will bring to life the forces that cause evolutionary change from populations to species over time scales of hours to epochs. Emphasis will be placed on understanding processes that create patterns in biological systems including the genetic basis of evolution, Darwinian selection, random change, molecular evolution, speciation and phylogenetics. The course includes a weekly recitation section to discuss classic literature and a phylogeny construction laboratory exercise. This course fulfills the "Populations" distribution requirement for Biology majors and serves as an approved course towards a concentration in Ecology, Evolution and Behavioral Biology; it is required for Environmental Biology majors. It was previously numbered BIOL-251.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 1910 Biology Gateway 0 or 4 Credits
This course will serve as a gateway to the Biology and Environmental Biology majors. The course will cover different "case studies" in which a topic will be explored from a number of different biological perspectives (e.g., molecular function, evolution), but also thinking about human and social implications. Case studies may vary from year to year, but topics could include human migration and evolution of pigmentation, epigenetics, evolution of the blood clotting and steroid hormones, and aging. We will also emphasize the importance of communicating science to diverse audiences. Students are expected to participate actively in ongoing class discussions and group projects. The class will meet for two 75 minute lectures and one 55 minute recitation each week. This course is restricted to Biology and Environmental Biology majors. Permission of the instructor is required to open the course to other majors. Credits: 4 Prerequisites: BIOL-103,-104
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 1940 Biology of Global Health 0 or 4 Credits
This course will serve as an introduction to the Biology of Global Health major. The course will cover two different "case studies" in which a health topic will be explored from a number of different angles, especially the science, but also including policy, ethics, law, economics, etc. Case studies may vary from year to year, but topics could include infectious disease, non-communicable disease, environmental effects on disease, and the like. Emphasis is placed on communicating science to diverse audiences using a variety of different media, and may include web sites, short videos, podcasts, newspaper articles, blogs as well as more traditional written work. Students are expected to participate actively in ongoing class discussions and group projects. The class will meet for a 75 minute lecture and two 75 minute recitations each week. This course is restricted to Biology of Global Health majors. Permission of the instructor is required to open the course to other majors. Credits: 4
Prerequisites: BIOL-103,-104
Level: Undergraduate
Prerequisites: (BIOL 103 or BIOL 1203) and (BIOL 104 or BIOL 1204)
Grading: Main Campus (UGrad, Grad)
Course registration restrictions:
Enrollment is limited to students with a major in Biology of Global Health, Biology of Global Health, Biology of Global Health or Biology of Global Health.

BIOL 1950 Neurobiology 0 or 4 Credits
This course covers the fundamentals of neurobiology, the study of the cellular basis of nervous system function. It is intended as the gateway course for a Neurobiology major at the sophomore level. The course will examine the cellular composition of the nervous system, the characteristics and functions of neurons, and the ways that signals are relayed within the nervous system. The cellular and molecular basis of sensory and motor systems, plasticity, development and learning will be analyzed. The process and impact of nervous system evolution also will be considered. The course consists of three 1-hr lectures and a recitation.
Level: Undergraduate
Prerequisites: (BIOL 103 or BIOL 1203)
Grading: Main Campus (UGrad, Grad)
Course registration restrictions:
Enrollment is limited to students with a major in Neurobiology, Neurobiology, Neurobiology or Neurobiology.

BIOL 1960 Sem: Inquiry into Found of Bio 3 Credits
This new course has been designed specifically for students who will be Teaching Assistants in Foundations of Biology (BIOL-103 and -104). Topically, the course will follow Foundations of Biology, but we will delve further into the underlying science to develop a more integrated and nuanced understanding of core biology concepts appropriate to an upper-level course. Course assignments will help students grapple with the underlying logic, complexities and connectivity of core biological concepts, investigate common misunderstandings, design pedagogical interventions to overcome barriers to learning, and study how to accurately assess learning. Students will have the opportunity to apply their findings as Teaching Assistants in the laboratory section of the course and in the tutoring center. Every week students will attend two class hours, run one 3 hour lab group, and participate in the biology peer-tutoring center for 1 hour. Enrollment requires the approval of instructor. The course may only be taken once although students can apply to be Teaching Assistants in subsequent semesters. The course is part of a larger campus initiative – the "Reimagining Tradition Seminars" and will operate as an Inquiry Seminar because of its special emphasis on students' collaborative efforts to research issues related to learning the core biology concepts taught in Foundations of Biology I and II.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 2031 Microbes of Tuscany 3 Credits
Both wine and cheese production depend on harnessing the biochemical potential of a variety of different microorganisms. This course will be a rigorous exploration into the characteristics of microbes important for the development of these foods, with an emphasis on the biochemical pathways necessary for production of ethanol and other products that are responsible for the unique flavors and textures associated with these foods. Part of the course will involve hands-on activities comparing genes for these processes among different organisms, using tools of bioinformatics, a relatively new field combining biology, computer science, and statistics. Students will also delve into the literature about the microbiology of wine and cheese making. The classroom work will be complemented by two field trips, one to a vineyard and one to a dairy, so that students can get a first-hand view of these two industries.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)
Course registration restrictions:
Enrollment is limited to students with a major in Biology, Biology, Biology, Biology, Environmental Biology, Environmental Biology, Environmental Biology or Environmental Biology.

BIOL 2225 Conservation in Action 3 Credits
Students will work over the course of the semester to research and develop a project that will address a conservation issue in Diani Kenya such as environmental education, promoting behavior change, human primate conflict, or conservation education and action. Students will have the opportunity to implement their project during a two-week optional trip to Diani Beach, Kenya. Instructor permission required
Level: Undergraduate
Prerequisites: (BIOL 104 or BIOL 1204) and (ENST 220 or ENST 2220)
Grading: Main Campus (UGrad, Grad)

BIOL 2232 Humans and Nature 3 Credits
Are humans part of or separate from nature? Do our current relationships to our natural surroundings affect how we live our lives? How do various perspectives on these fundamental questions affect the way human societies interact with and use nature? In this three-week study abroad program, you will travel to Cape Town, South Africa to explore answers to these questions and use them to understand how humans both shape and are shaped by the ecological systems in which modern societies exist. Hosted by the University of Cape Town's International Academic Programmes Office, the program will delve into the principles and practices of nature conservation, the use of natural resources, and the impacts of human activities on local wildlife. Students should be prepared for an immersive experience, involving lots of time in nature as well as visiting animal sanctuaries and nature preserves.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 2241 Ecology/Environment of Yucata 3 Credits
Course taught in Yucatan, Mexico. Students may enroll by application only through the Office of Global Education. Visit studyabroad.georgetown.edu for further information.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 2500 Science/Society:Global Challng 3 Credits
This seminar introduces students to some of the most significant and complex science and public interest challenges of our time including: managing a global pandemic, reducing carbon emissions, meeting growing global energy demand, and containing weapons of mass destruction. Guest speakers - including scientists, venture capitalists, congressional staff, and journalists - will examine the science, politics and public perceptions surrounding these challenges. Throughout the semester, students will break into groups and develop a report on one "Grand Challenge" that covers: the science, pending legislation, any Administration initiatives, relevant activity in the private sector, and the various policy options and barriers for solving the problem.

The class, which meets once a week, is open to sophomores through seniors and is three credits. Biology students may count one credit towards a degree. Physics students count the class as a restricted elective towards a degree. This course does not satisfy the General Education Requirements for science.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 2501 Global Health History 3 Credits
This course considers the global history of infectious disease. Topics addressed cover the planet and span millennia, from tuberculosis' alleged 'out-of-Africa' trek and the zoonotic origins of major human pathogens to plague's Andean and Mongolian foci and the ecological triggers of epidemics. Lectures and readings are interdisciplinary and written sources of all sorts (from ancient annals to 21st-century statistics) are married with the fruits of the paleosciences (paleo-pathology, -microbiology, -genetics and -climatology) in order to flesh out our evolving history with infectious disease. Students will be introduced to the methods of multiple fields of study relevant to the history of health and to the advantages and challenges of interdisciplinarity. They will gain historical perspective on global health issues faced today and discover how an understanding of the past can help us presently and in the future.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 2502 Plague in Renaissance Florence 3 Credits
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Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 2504 Global History of the Plague 3 Credits
This course considers the global history of infectious disease. Topics addressed cover the planet and span millennia, from tuberculosis' alleged 'out-of-Africa' trek and the zoonotic origins of major human pathogens to plague's Andean and Mongolian foci and the ecological triggers of epidemics. Lectures and readings are interdisciplinary and written sources of all sorts (from ancient annals to 21st-century statistics) are married with the fruits of the paleosciences (paleo-pathology, -microbiology, -genetics and -climatology) in order to flesh out our evolving history with infectious disease. Students will be introduced to the methods of multiple fields of study relevant to the history of health and to the advantages and challenges of interdisciplinarity. They will gain historical perspective on global health issues faced today and discover how an understanding of the past can help us presently and in the future.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 2600 Select Agents:BiologySecurity 3 Credits
In the development of policy for regulation and research, many nations have employed strategies to stratify and assess the risk of various pathogens. In the United States, the primary mode of regulation of the most dangerous biological pathogens and toxins is through the Select Agent Regulations (SARs). These laws restrict access to a list of select agents that have been deemed of significant threat to national and international public health and security. But what makes an agent part of this elite group, how/why did these regulations come about, how do they work, and what results have come from these efforts? In this discussion-based course, students will study the biology and clinical manifestations of historically weaponized agents, the motivations (biological, political, social, cultural) for establishing the Select Agent Regulations (SARs) in the United States, survey their history, and discuss important issues of biological security in the 21st century. To facilitate this learning, students will review primary literature and various regulatory texts, participate in class presentations and discussions, and execute individual research assignments on agents of their choice.
Level: Undergraduate
Prerequisites: (BIOL 103 or BIOL 1203)
Grading: Main Campus (UGrad, Grad)
Course registration restrictions:
Enrollment is limited to Undergraduate level students.

BIOL 2620 Shaping National Science Polic 3 Credits
Shaping National Science Policy introduces students to science policy, science advocacy, and practical politics. The course is both a reading seminar, where students discuss assigned readings, and a project course. The readings explore issues in science policy and case studies at the intersection of science and politics. The readings are varied and include a play, court decisions, Congressional hearings and other materials. For the projects, students work in groups throughout the semester. Each group works on a science-related topic of its choosing and attempts to get Congress to take action on it, by dealing directly with Congressional offices, other public officials, advocacy groups, academic experts and others, as appropriate. Counts for Biology majors as a 2000-level interdisciplinary connections course, for Biology of Global Health majors as an Interdisciplinary Perspectives course, or for Environmental Biology majors as an upper-level elective. Physics students count the class as a restricted elective towards a degree.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 3001 Research Tutorial II 1-3 Credits
Registration in this class requires instructor approval
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 3275 Animal Behavior:Bees to Whales 3 Credits
This course is about animals, evolution, conservation, and behavior. We start with some basic evolutionary principles, based on Darwin's theory of organic evolution by natural selection. Studies of animal behavior focus on the how, when, where, and why animals behave in certain ways and not in others. General topics include parental, mating, cooperative, foraging, predation and aggressive behavior. We will also discuss nepotism (known more formally as kin selection), reciprocal altruism, cognition, culture, development, social networks, and life histories (how individual behavioral strategies change across the lifespan.) You will learn to interpret what scientists mean when using such terms as "innate" or "learned." Both field and laboratory studies are integral to the course. Specific animal species including representatives from mammalian, avian, reptilian, and insect groups will help illustrate how animal behavior systems work. We also discuss how climate change is impacting animal systems. I hope that by the end of the course you will have the interpretive framework to understand the complexity of animal life and appreciate the wealth of knowledge and insights animal behavior studies offer to a variety of fields
Level: Undergraduate
Prerequisites: (BIOL 104 or BIOL 1204) or (BIOL 106 or BIOL 1206) or (ERTH 1051 or ERTH 1050)
Grading: Main Campus (UGrad, Grad)

BIOL 3500 Microbiology 3 Credits
Microbes are EVERYWHERE! They're in the soil, the water and in and on our bodies (in fact, there are more of them than there are of you). This course will explore the diversity of the microbial world, with emphasis on bacteria and archaea. The course is organized into topics. After discussing basic principles, we will focus on 1.) the evolution of microbial diversity and their role in the environments in which they find themselves; 2.) the unique aspects of microbial biochemistry and metabolism that enable them to make a "microbial living"; 3.) infectious disease microbes and how they make us sick; 4.) putting microbes to work for us; and 5.) the role of microbiology in the greater scientific community and in society.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 3502 Plants and Society 3 Credits
Many people suffer from 'plant blindness': we barely notice plants, don't understand how they work, are not aware of the botanical origins of many products we rely on in our daily lives, and, perhaps most importantly, don't recognize the essential role of plants as one of the primary producers of almost all of the food and oxygen on the planet. Plants, however, are not as different from animals as they may seem; both groups of organisms have the same basic biological needs -- to eat, drink, breathe, grow, locate mates and reproduce, escape from enemies, and sense and respond to their environments. Plants' fascinating solutions to these problems reflect both a shared common ancestry with animals, as well as 1.5 billion years of independent evolutionary history.

In this course, we aim to remediate 'plant blindness'. Through lectures, discussions, critical reading of the literature, group projects, oral presentations, and field trips, students will gain an understanding of basic concepts of plant morphology, physiology, diversity, and ecology. We will also examine human uses of plants (as foods, medicines, spices, dyes, oils, fibers, building materials, etc.), as well as the role that plants have played in human history, from the origin of civilization through the age of discovery, and on into the future. Two 75 minute classes / week.
Level: Undergraduate
Prerequisites: BIOL 104 or BIOL 1204
Grading: Main Campus (UGrad, Grad)

BIOL 3503 Conservation Biology 3 Credits
Earth is currently in its sixth major extinction event. All forms of biodiversity are being lost at rates unprecedented in the geological record and this event is being caused almost entirely by the actions of a single species: Homo sapiens. The need to mitigate the effects of biodiversity loss has given rise to the science and practice of Conservation Biology. This relatively new discipline encompasses core biological perspectives from the fields of ecology and evolution as well as applied approaches such as range management, forestry, and fisheries biology. Additionally, Conservation Biology intersects with political science, sociology, law, economics, and engineering in its pursuit of conserving biological diversity. In this class we will focus on biological principles that form the basis of successful conservation efforts and explore societal frameworks in which Conservation Biology operates.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 3504 Marine Biology 3 Credits
This course takes an ecological approach to studying marine systems. The primary goals are to provide students with an understanding of the processes that drive life in marine systems and how life has adapted to marine environments. In doing so, we take an in depth look at the major marine habitats and their inhabitants including shallow bays and lagoons, estuaries, the abyss, open water habitats, tropical reefs, and rocky shores and discuss how climate change and humans affect the oceans.

Prerequisites: BIOL-104 and BIOL-180 OR BIOL-181 OR BIOL-255 OR BIOL-386 OR permission of the instructor.
Level: Undergraduate
Prerequisites: (BIOL 103 or BIOL 1203) and (BIOL 104 or BIOL 1204)
Grading: Main Campus (UGrad, Grad)

BIOL 3505 Ecology of U.S. National Parks 3 Credits
In this course, we will explore principles of geology, ecology, wildlife conservation, ecosystem restoration, and climate adaptation through the lens of U.S. National Parks. After introducing the history and management of “America’s best idea”, we will spend the semester engaging with the primary scientific literature to gain a deeper understanding of the geological and ecological processes that shape our nation’s landscapes and wildlife. Through detailed exploration of eight focal parks, we will traverse some of America’s most iconic terrestrial biomes and aquatic environments to gain a comprehensive view of their formation, ecosystem dynamics, and future resilience. Geologically, we consider the mechanisms that created these landscapes, including plate tectonics, hydrothermal systems, volcanic hotspots, and high-order rivers capable of carving immense canyons. We will additionally traverse ecological scales from populations through communities, ecosystems, and landscapes, and explore the roles of disturbance, disease, competition, trophic interactions, and changing climatic conditions in shaping terrestrial, aquatic, and marine life. We will explore a myriad of habitats within our eight focal parks (ranging from deserts to rainforests to alpine tundra on land, and from riparian ecosystems to coastal wetlands and coral reefs under water), and additionally survey lesser-known parks through our “Ultimate Park Competition”. Finally, we will engage with nature on a personal level as we visit Shenandoah National Park to create interpretative educational displays that effectively communicate the value of parks to the broader public. As we pursue these goals throughout the semester, we will continually grapple with the difficulties inherent in the dual-vision of U.S. National Parks as protected areas for conservation and popular areas for recreation. We will debate controversial topics circulating within the scientific community (e.g., trophic cascades) and broader public (e.g., responsible ecotourism) in order to formulate our own opinions on these contentious issues. While our focus will be on the science underlying the geology, ecology, and management of these wild spaces, I will also encourage you to consider the value of U.S. National Parks as our shared heritage. As eloquently stated by Mollie Beattie, the first female director of the U.S. Fish and Wildlife Service: “What a country chooses to save is what a country chooses to say about itself.” In this course, we will see what our protected areas say about the United States, while discovering the geological forces and ecological principles that have shaped our nation’s landscapes for millennia.
Level: Undergraduate
Prerequisites: BIOL 1800 or BIOL 1850
Grading: Main Campus (UGrad, Grad)

BIOL 3515 Global Climate Change Ecology 3 Credits
Over the past century, the mean surface temperature of our planet has increased slightly less than 1°C. While this may seem like a small increment, global warming is already profoundly affecting Earth’s organisms and ecological communities, and predictions for the impacts of continued change range from severe to catastrophic. In this class, we will explore the causes and biological consequences of climate change on Earth. Through lectures, discussion, films, critical reading of the literature, and examination of long-term data sets and resources from NASA’s Earth Observatory, students will gain an understanding of: how Earth’s climate system functions, how past climatic fluctuations compare to projected future changes, how human activities contribute to climate change, how climate change affects organisms, communities, and ecosystems, and how science is (or is not) translated into policy. Additionally, we will explore the direct effects of climate change on disease risk and resource shortage for the human population, as well as the possible economic impacts of such changes. Lastly, we will consider what changes would need to occur to stabilize or reverse current trends. We welcome lively discussion and debate that will further our understanding of the impacts of climate change on Earth’s living resources.
Level: Undergraduate
Prerequisites: (BIOL 103 or BIOL 1203) and (BIOL 104 or BIOL 1204)
Grading: Main Campus (UGrad, Grad)
Equivalent to BIOL 5515

BIOL 3518 Infectious Disease Ecology 3 Credits
Infectious disease is a universal phenomenon in the living world: all organisms have parasites, and most species themselves are parasites. As such, understanding infectious disease is a crucial component of understanding nature, and of human society’s place within it. In this course, I will provide a comprehensive overview of the biology, ecology, and evolution of infectious diseases in humans and animals. The course content will span a wide range of processes, building from fine-scale molecular mechanisms and interactions with the immune system, through behavioural processes and disease transmission, up to ecosystem-level phenomena including global change and pandemic disease emergence. In doing so, students will learn to link together complex processes across multiple scales, using the enormous diversity of infectious organisms to understand the inner workings of ecological systems.
Level: Undergraduate
Prerequisites: BIOL 1204 and BIOL 1214
Grading: Main Campus (UGrad, Grad)

BIOL 3535 Microbial Genomics 4 Credits
You’re more them than you! The number of microorganisms found in and on your body far exceeds the number of human cells. This class will investigate aspects of the human microbiome, that is, the microorganisms associated with human body. The course will be oriented around hands-on projects that investigate these microorganisms – using both computer tools to investigate genomes and laboratory investigations to test hypotheses generated from the genome sequences. Although some prior understanding of microbiology, molecular biology, or biochemistry is helpful, the course is open to all biology majors. Computer science majors are also encouraged to apply.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)
Equivalent to BIOL 5535

BIOL 3550 Microbiology Lab 1 Credit
This optional 1 credit laboratory is for students enrolled in BIOL 364. Topics to be covered include working with microbes and microbial diversity in a laboratory setting.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 3551 Dyn Proc in Biological Physics 3 Credits
The class combines basic knowledge of thermodynamics/statistical physics, nonlinear dynamics and biology to highlight physical processes that govern the dynamics of biological systems. The class will concentrate on dynamical aspects emerging on different temporal and spatial scales, random processes, Brownian motion and diffusion, thermodynamics of biological processes and the generation of membrane potentials.

This course serves as an approved course towards a concentration in Biochemistry, Molecular and Cellular Biology as well as the concentration in Ecology, Evolution and Behavioral Biology.
Level: Undergraduate
Prerequisites: PHYS 041 and PHYS 042
Grading: Main Campus (UGrad, Grad)
Equivalent to BIOL 5551

BIOL 3615 Genomics Bioinformatics 3 Credits
This course is an introduction to genomics and the use of computers to analyze genomic data. Genomics is the study of the structure, content and evolution of genomes, including functional analysis of genes and proteins. Students learn applications of genomics to biomedical and biological research by performing computational exercises using genomic databases. Topics include genome sequencing and annotation, gene and regulatory motif prediction, genetic variation, sequence database searching, multiple sequence alignment, phylogenetic tree construction, protein structure prediction, microarray analysis, proteomic analysis, interaction networks.

This course applies towards the concentration in Ecology, Evolution and Behavioral Biology as well as the concentration in Biochemistry, Molecular and Cellular Biology for Biology majors.
Level: Undergraduate
Prerequisites: BIOL 152 or BIOL 1520
Grading: Main Campus (UGrad, Grad)
Equivalent to BIOL 5615

BIOL 3635 Genetic Conflict 3 Credits
You might think that natural selection, if left to its own devices, would craft perfectly fit organisms, well suited to their environment and free of any design flaws. But you'd be wrong. The reason you'd be wrong is that natural selection favors the fittest alleles of genes, and there is no guarantee that the fittest alleles of genes will produce the fittest, most-adapted organisms. Sometimes selection on genes acts at cross-purposes with selection that acts at the organismal level. In other words, what's best for your genes might not be what's best for you. And what's best for one gene might not be best from other genes' perspectives. In these cases, we have genetic conflict. This course will examine a variety of such genetic conflicts. The overarching goals of this course are: to expose students to the role that genetic conflicts have played in shaping the design of genetic systems, organisms, and biodiversity; and to appreciate the role that genetic conflicts have had in shaping evolutionary theory in the last half-century. Students will emerge from this course with a deeper understanding of genetics and evolution. 3 credits; Pre-reqs: BIOL 152 or BIOL 185
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 3700 Infection Immunity 3 Credits
This course will combine topics in microbial pathogenesis, pathogen life cycles, modes of disease transmission, interventions (vaccines & therapeutics) and immunology. Students will become facile with mechanisms used by bacterial, fungal, viral and parasitic pathogens to replicate in hosts, transmit between hosts and to produce disease states in them. Students will also learn about basic immune mechanisms involved in fighting infections, contributing to disease states and important for development of vaccines.
Level: Graduate, Undergraduate
Prerequisites: BIOL 103 or (BIOL 1203 and (BIOL 151 or BIOL 1510) or BIOL 152) or BIOL 1520
Grading: Main Campus (UGrad, Grad)

BIOL 3701 Cell Biology 3 Credits
This course will focus on the major functions of the cell and its cellular components, the dynamic processes that occur within cells, interactions between cells and their environment, and how gene expression regulates cell function.
Level: Undergraduate
Prerequisites: (BIOL 103 or BIOL 1203) and (BIOL 104 or BIOL 1204) (BIOL 151 or BIOL 1510) or (BIOL 152 or BIOL 1520)
Grading: Main Campus (UGrad, Grad)
Equivalent to BIOL 5701

BIOL 3702 Molecular Biology 3 Credits
Level: Undergraduate
Prerequisites: BIOL 152 or BIOL 1502
Grading: Main Campus (UGrad, Grad)
Equivalent to BIOL 5702

BIOL 3703 Immunobiology 3 Credits
Level: Undergraduate
Prerequisites: (BIOL 151 or BIOL 1510) and (BIOL 363 or BIOL 3630) and (BIOL 152 or BIOL 1520)
Grading: Main Campus (UGrad, Grad)

BIOL 3730 Developmental Biology 3 Credits
This course will introduce fundamental mechanisms in embryonic development including the processes of fertilization, gastrulation, cell fate determination and axis formation. In class we will discuss classical experiments as well as recent breakthroughs that have advanced the field of developmental biology. Unlike traditional lecture-based courses, the class time will serve as a platform for group discussions interspersed with short lectures.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)
Equivalent to BIOL 5730

BIOL 3731 Developmental Biology Lab 1 Credit
The Developmental Biology Laboratory aims to supplement what students are learning in the Developmental Biology course(BIOL-3730). We will be utilizing zebrafish for this laboratory course because this model organism provides unparalleled access for visualizing vertebrate development and ease of experimental manipulation. Embryonic development will be carefully observed with an emphasis on the molecular and cellular events driving this amazing process, as well as, assessing the conservation and divergence of these processes throughout the animal kingdom. Genetic mechanisms and the influence of environmental chemicals on animal development will be experimentally tested by students. The results of these experiments will be analyzed, interpreted, and communicated through written and oral student presentations. Students' ability to integrate and communicate new knowledge in developmental biology, derived from experimentation, will be developed through writing a research article, fit for publication
Level: Undergraduate
Prerequisites: BIOL 1520 or BIOL 1510 or BIOL 3730
Grading: Main Campus (UGrad, Grad)

BIOL 3798 Synaptic Transmission 3 Credits
This course will investigate how neurons and glial cells communicate with each other. We will review basic cell biology necessary for understanding processes important for synaptic transmission between neurons and communication between glia and neurons, including protein trafficking, membrane properties, and vesicular transport. This background will allow us to consider in detail how specific chemical neurotransmitters (acetylcholine, glutamate, GABA, dopamine, serotonin, histamine, norepinephrine, neuropeptides, endocannabinoids, etc) function to send different types of information between neurons and glial cells. However, since various functions of the central nervous system are largely defined by structure, we will include a brief overview of human neuroanatomy. We will use each of these transmitter systems to explore general principles of neurons (mechanisms for transducing a signal from outside the cell to the inside, the complexity and evolutionary relatedness of receptor subtypes, differences in signal transmission versus signal modulation, methods for organization of cellular membrane proteins), and relate these principles back to the fundamental biological concepts. We will also investigate how the various neurotransmission systems are altered by medicines, drugs of abuse, and toxins; students will be responsible for giving brief oral presentations on the molecular actions of these molecules. We will consider how disruption of specific neuronal pathways affects specific systems due to the defined anatomy. Finally, we will discuss in detail, papers from the primary literature to highlight advances and areas of interest in mechanisms of synaptic transmission. BIOL-3798 is intended for junior and senior Biology or Neurobiology majors who have taken Neurobiology (BIOL-1950). This course also serves as an approved course towards a concentration in Biochemistry, Molecular and Cellular Biology. BIOL-3798 is an Engelhard course and we will focus on mechanisms of sleep and sleep health.
Level: Undergraduate
Prerequisites: BIOL 195 or BIOL 1950
Grading: Main Campus (UGrad, Grad)
Equivalent to BIOL 5798

BIOL 3799 Developmental Neurobiology 3 Credits
This guided seminar course introduces upper level undergraduates to selected topics of the development of the nervous system of vertebrates and invertebrates. Students will read, present and discuss review articles and primary research literature investigating molecular, cellular, evolutionary and embryological aspects of neurodevelopment. Topics will include dorsal-ventral patterning, induction of the neural plate, neuronal differentiation, axon guidance, and synapse formation. Recent technological advances of each subject and the presentation by the media of these topics to the lay public will be discussed.
Level: Undergraduate
Prerequisites: (BIOL 151 or BIOL 1510) or (BIOL 152 or BIOL 1520) or (BIOL 195 or BIOL 1950)
Grading: Main Campus (UGrad, Grad)
Equivalent to BIOL 5799

BIOL 3800 Sensory Systems 3 Credits
BIOL-3800 is a course designed to investigate the sensory systems: olfaction, vision, somatosensation, audition, vestibular function, and gustation. Each sensory system will be addressed and will include: the cells that compose each pathway, the molecules underlying cellular function and development, the flow of information, plasticity within the processing stream, and the potential for renewal within each sense. This is a research-based course and there will be little in the way of rote memorization. The course will consist of short introduction of the framework of sensory systems followed by interactive analyses of primary literature on each topic. Students will participate in dissecting current and historical papers and building their own sense of scientific inquiry around sensory systems.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)
Equivalent to BIOL 5800

BIOL 3801 Intro Virology Viral Disease 3 Credits
Level: Undergraduate
Prerequisites: BIOL 1203 or BIOL 103
Grading: Main Campus (UGrad, Grad)
Equivalent to BIOL 5801

BIOL 3802 Introduction to Parasites 2 Credits
Level: Undergraduate
Prerequisites: BIOL 152 or BIOL 1520
Grading: Main Campus (UGrad, Grad)

BIOL 3840 Epidemiology Public Health 3 Credits
Epidemiology overview and history; distributions of disease by time, place and person; association and causality; ecological studies; cross-sectional studies and surveys; case-control studies; analysis of case-control studies; types of bias in case-control studies; cohort studies; analysis of cohort studies; bias in cohort studies; population attributable risk; confounding factors; effect modification (interaction); analysis for confounding and interaction; multivariate analysis; sensitivity, specificity and screening; public health practice and prevention; special issues in cancer epidemiology, infectious disease epidemiology and genetic epidemiology. This course includes a discussion session.

This course is cross-listed with BIST 5001.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 3910 Structural Biology 3 Credits
The aim of this course is to explore biological macromolecule structures and to understand how structural changes facilitate the transmission of cellular information. We will follow the journey of an extracellular signal as it travels from the plasma membrane, to the cytoplasm, to the nucleus, and back, delving into the atomic-level details of the relevant macromolecules.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 3940 Genomics, Disability Health 3 Credits
This course explores two main themes in genomic medicine. First, we will review recent advances in “bench to bedside” science, along with policies and emerging trends in reproductive genomic testing and technologies. We will analyze the potential impacts of these developments on individuals, families, and society. Second, we will assess whether—and how—the growing use of genomic medicine could enhance health for individuals and populations. At the same time, we will critically examine the possibility that these innovations might also increase existing disparities in clinical care, research participation, and health outcomes. To provide context for these themes, we will investigate how genomics, disability, and health are depicted in film, literature, and the media. These portrayals offer essential insights into the social, cultural, and ethical dimensions of genomic medicine, revealing underlying assumptions, biases, and values that influence policy and personal decisions. Students will engage in interactive class discussions, oral presentations, and scholarly written reflections. Guest speakers will join selected sessions to provide additional perspectives.
Level: Graduate, Undergraduate
Prerequisites: BIOL 1203 or BIOL 1204 or BIOL 1520
Grading: Main Campus (UGrad, Grad)

BIOL 4050 Adv Top in Mol Bio:Epigenetics 3 Credits
Level: Graduate, Undergraduate
Prerequisites: (BIOL 152 or BIOL 1520)
Grading: Main Campus (UGrad, Grad)
Course registration restrictions:
Enrollment is limited to students with a program in Biology, Biology, Biology or Biology.

BIOL 4070 Biology of Migratory Animals 3 Credits
Migration is one of the most spectacular behaviors seen in nature. It is seen in a tremendous diversity of animal groups, from monarch butterflies and leatherback sea turtles, to ruby-throated hummingbirds and blue whales. Migration also brings enormous complexity to the understanding of these species' ecology, from how they move through air and water to their ability to navigate the globe. Equally fascinating is how they connect people and cultures from distant lands and how we have developed legal frameworks in the forms of treaties, policies and sometimes laws to protect and conserve these species. This course will introduce students to the magnificent biological diversity of migration and dig deep into various aspects of their ecology and evolution all while emphasizing the challenges for their conservation. Several field excursions to the local area will introduce students to the organisms themselves from migration in insects and fish to birds. Students will also develop and defend a research proposal on an emerging topic in migratory species biology.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4080 Evolution of Mammal Diversity 3 Credits
In this course, we will pursue scientific inquiry and communication about mammals, our closest living relatives. We will uncover their evolutionary history and survey the extraordinary diversity of the nearly 6,500 recognized mammalian species. By diving into the scientific literature and visiting the National Museum of Natural History and Smithsonian National Zoo, we will explore the fields of natural history, ecology, evolutionary biology, systematics, behavior, and conservation. Each student will become the community expert on a different mammalian lineage and is tasked with educating and inspiring others to care about the study and long-term wellbeing of mammals worldwide.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4120 Advanced Neurophysiology 3 Credits
NEUB MAJORS ONLY! Neurophysiology seeks to understand the function of a most complex and fascinating system. This course offers a primary literature perspective of the function of the nervous system and the neurophysiological methods to study it. This means we will be reading, presenting, and discussing, some extraordinary neurophysiology articles. How best to do that? We will follow an old but wise piece of advice from Santiago Ramón y Cajal (1852-1934): When reading an article in the field we wish to investigate we must fixate, above all, on two things: the research methods the author has used, and the problems that remained unresolved.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4140 Neurodisorders 3 Credits
Level: Graduate, Undergraduate
Prerequisites: (BIOL 195 or BIOL 1950)
Grading: Main Campus (UGrad, Grad)

BIOL 4160 Advances in miRNA Research 3 Credits
Research on microRNA (miRNAs) has grown since the original discovery of miRNA in 1993. Each year, new discoveries add to our understanding of the complex roles of these deceptively simple biomolecules. In this seminar-style class, we will focus on some aspects of this exciting field by reading and discussing assigned primary papers and focused reviews. Students will develop ability to analyze experimental results and data from primary literature, to then examine evidence for and against scientific arguments, and lastly to identify and determine current gaps in knowledge or conflict within a particular field. There will be weekly-short analysis papers, class-presentations, and the final project will be an NIH-style grant proposal in one of the aspects of miRNA discussed in class.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4180 Exper Desgn Analysis for Bio 4 Credits
Level: Graduate, Undergraduate
Prerequisites: (MATH 040 or MATH 1040) or (MATH 140 or MATH 2140)
Grading: Main Campus (UGrad, Grad)

BIOL 4190 Modern Statistical Models 3 Credits
Advances in statistical modeling are coming faster and faster and are increasingly hard to understand, let alone perform, for non-specialists. Despite this, it is crucial in many fields, especially in the ecological and environmental sciences, to stay on top of the constantly shifting world of modeling because a basic understanding of the statistics underlying research is necessary both for carrying out and keeping up with scientific advancements. Even researchers who don't need advanced statistical models for their own work still need to be able to read and comprehend papers using those models or review papers and proposals that contain them. Researchers who do need to use some of the advanced models but don't have specialized training in their use need to be active collaborators with modelers that are part of their research team.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4200 Perspectives in Infect. Dis. 3 Credits
This course will provide a multidisciplinary foundation to understanding infectious diseases, their impacts and multisectoral approaches to prevention and response. The course will begin with a review of key concepts including: cell and molecular biology, microbiology, pathogenesis, infection and immunity, and epidemiology. Each semester, this course will cover examples of global infectious diseases presented in a comprehensive module. Each module will highlight basic science elements, policy, data analysis and modeling, and use a series of exercises to understand how these areas intersect to prevent and help control the disease. In addition to the course director, this course will include instruction from a set of Professors. Each disease module will have a Professor serving as the Module Lead.
Level: Graduate, Undergraduate
Prerequisites: (BIOL 103 or BIOL 1203) and (BIOL 104 or BIOL 1204) (HSCI 101 or HSCI 1030) and (HSCI 102 or HSCI 1040)(MATH 040 or MATH 1040) or (MATH 140 or MATH 2140) or (MATH 240 or MATH 2540)
Grading: Main Campus (UGrad, Grad)

BIOL 4210 Seminar in Infectious Diseases 3 Credits
Influenza, an RNA virus that causes respiratory infections, has been on the forefront of global health discourse over the last decade. This course will explore topics of influenza virology, ecology, evolution, and epidemiology through lectures led by experts and discussions of contemporary literature. Students will be responsible for presenting primary literature, actively participating in classroom discussions, and midterm and final evaluations.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4240 Advanced Development 3 Credits
This is a seminar-based course where students will present and discuss historical and recent papers on selected topics in regenerative biology. Topics include the role of adult stem cells, tissue repair/regeneration from injury, inflammation, molecules and signaling pathways involved in regeneration, and animal model of regeneration.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4280 Advanced Ecological Analysis 3 Credits
Over the past 20 years, advancements in ecological tools have increasingly allowed more data-intensive methods, either by compiling data from multiple studies or using large-scale records collected for centuries by natural historians (life history descriptions and museum collections) and, more recently, observations recorded by citizen scientists in platforms like iNaturalist and eBird. However, large data sets require skills from both computer sciences (database management and coding) as well as advanced methods in statistics to account for non-random sampling and a lack of formal survey protocols. This course is designed to introduce students to the basic skills necessary to carry out data-intensive research and perform (or in some cases, just be able to understand the basics of) advanced statistical methods. Advanced methods are also a challenge because new statistical methods are constantly emerging and changing. Therefore, this course uses current literature from the ecological sciences to help us target the most up-to-date methodologies they should know if they are interested either in focusing in data-intensive research, or even if they just want to be able to critically evaluate results that are increasingly reported in the literature.
Level: Graduate, Undergraduate
Prerequisites: (BIOL 103 or BIOL 1203) and (BIOL 104 or BIOL 1204) and (BIOL 180 or BIOL 1800)
Grading: Main Campus (UGrad, Grad)

BIOL 4360 Genome Insblty Human Disease 3 Credits
Our genome is subjected to multiple insults from endogenous and exogenous environmental sources that disturb its integrity. This seminar course will focus on the topic of genome instability and its relation to human disease, providing background and historical development of studies, and focusing on molecular mechanisms of these pathways while incorporating current developments in these areas. This course is cross listed with HSCI-374.
Level: Graduate, Undergraduate
Prerequisites: (BIOL 151 (may be taken concurrently) or BIOL 1510 (may be taken concurrently)) and (BIOL 152 or BIOL 1520) and (BIOL 103 or BIOL 1203) and (BIOL 104 or BIOL 1204)
Grading: Main Campus (UGrad, Grad)

BIOL 4370 Bacterial Pathogenesis 1 Credit
This course will explore strategies that bacterial pathogens use to survive and multiply within their hosts, as well as some of the counter strategies hosts use to fight off infection. The primary focus will be in molecular terms and on core principles that emphasize similarities among pathogens including mechanisms of secretion, toxin action, and regulation. These concepts will be illuminated through the use of primary research articles.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4380 Ecology of Infectious Diseases 1 Credit
This module will cover the basic topics in the ecology and evolution of emerging infectious diseases, including the dynamics and diversity of pathogens originating and circulating in wildlife. We will review the major emerging diseases of the past decade, and the ecological drivers underlying their emergence. We will cover how disease dynamics are determined at the organismal scale (immunity, behavior) and at the macroecological scale (coevolution), and the role that global change plays in driving emerging disease. Current research will be used to highlight exciting avenues and possible career paths related to disease ecology, with direct connections to global health, wildlife conservation, and even foreign policy.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4430 Microbial Community Ecology 1 Credit
This course explores community ecology concepts relevant to the study of human- and animal-associated microbiomes, bridging environmental and biomedical disciplines. We will familiarize ourselves with conceptual, technical and statistical challenges in this growing field through reading primary and secondary literature and hands-on data analysis. This course is intended for undergraduate and graduate students who are familiar with basic ecological concepts and have had a previous introduction to using R.
Level: Graduate, Undergraduate
Prerequisites: (BIOL 103 or BIOL 1203) or (BIOL 105 or BIOL 1205) (BIOL 104 or BIOL 1204) or (BIOL 106 or BIOL 1206)
Grading: Main Campus (UGrad, Grad)

BIOL 4440 Urban Foraging and Ecology 1 Credit
Urban foraging and ecology – from winter nuts to spring greens and flowers We will meet weekly throughout the spring semester, to span the winter/spring foraging season. We'll begin by harvesting nuts and roots in January, collecting violets and redbud flowers in May, and enjoying a range of edible leaves, stems, flowers, fruits, and seeds in between. In this one-credit course, we will learn to recognize a range of edible, useful, and poisonous plants in the DC area, and along the way will delve into relevant topics in botany and plant ecology.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4450 Conversations with GLID 1 Credit
The topic of this semester's Conversations with GLID class will be "How to End a Pandemic." This conversations class will focus on stories from the front lines of people engaged in ending the COVID-19 pandemic and the steps they have taken to mitigate the impacts of the virus. COVID-19 has demonstrated that ending a pandemic requires a multisectoral response. This course will highlight how a multidisciplinary approach to infectious diseases has worked in practice. Guest speakers each week will discuss their pandemic activities, such as designing the logistics to vaccinate the American population, ramping up the vaccine development process, advising governments and private sector entities, creating surveillance testing programs, communicating public health practices to the public, standing up contact tracing programs, protecting vulnerable populations, organizing governors, and keeping hospitals safe. Students will be asked to introduce speakers, come up with weekly discussion questions, and write at least one reflection.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4453 Bio of Vector-Borne Diseases 1 Credit
This lecture and discussion-based course will introduce students to basic vector ecology and behavior and will provide an overview of vectors (e.g., insects, mites, ticks) that pose the greatest threats to human health as well as to animals and plants. Specific topics will include the pathogens (e.g., bacteria, viruses) that vectors transmit to humans, animals, and plants and the diseases caused by these pathogens (e.g., malaria, dengue, chikungunya, West Nile virus, and Lyme disease in humans, as well as avian malaria, bluetongue in animals, and potato leaf roll virus, citrus greening in plants). We will also discuss the fascinating biology behind the interactions between vectors, pathogens, and hosts such as the acquisition, dissemination, and persistence of the pathogen within the vector and in the transmission to the host; the environmental dependence; and the vector and pathogen physiology and development. This course is designed for upper-level undergraduate and graduate students.
Level: Graduate, Undergraduate
Prerequisites: BIOL 191 or BIOL 1910 or BIOL 194 or BIOL 1940 or BIOL 1850 or BIOL 185
Grading: Main Campus (UGrad, Grad)

BIOL 4460 GIS: Spatial Data in Program R 3 Credits
This course will provide students with a theoretical and applied understanding of geographic information systems and geospatial analysis using Program R. Topics covered will include projection systems, working with raster and vector data, and spatial data analysis for ecological applications. Special emphasis will be placed on visualizing spatial data through developing publication-quality static maps and interactive maps for web applications.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4485 Mouse Genetics Boot Camp 1 Credit
In this course, students will be introduced to concepts and best practices in mouse genetics in biomedical research. Through lecture and primary literature, students will learn how the mouse genome can be manipulated to test hypotheses. Students will also learn an exciting range of applications stemming from these manipulations (e.g. conditional knockouts, chemogenetics, etc.). Importantly, using online tools and thought exercises, students will develop the skills to fully understand and use the transgenic mouse models in their own research. Students will also experience the thrill of developing their own vertebrate animals page for an NIH grant application.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 4486 Drosophila Genetics 1 Credit
Drosophila melanogaster has been one of the most powerful model organisms in biology and neuroscience for over a century. This course introduces the genetic tools and conceptual frameworks that make Drosophila uniquely suited for studying gene function, neural circuits, and behavior. Students will learn the principles of classical and modern fly genetics, including mutagenesis, transgenesis, binary expression systems, genome engineering, genetic strategies for manipulating neural activity, and connectomics. The course will emphasize how genetic tools are used to answer biological questions, particularly in neuroscience. Through short lectures and discussions of landmark studies, students will gain an understanding of how experimental design in fly genetics allows researchers to dissect complex biological processes such as development, learning, and memory. By the end of the course, students should be able to interpret genetic strategies used in the literature and design simple genetic experiments in Drosophila.
Level: Graduate, Undergraduate
Prerequisites: BIOL 1950 or BIOL 1520 or BIOL 1850
Grading: Main Campus (UGrad, Grad)

BIOL 4490 Proteins:Structure Function 1 Credit
Proteins are responsible for doing the work of the cell and regulating many cellular processes. Here we will focus on a few major groups of proteins as well as key methods used to study proteins. The foci will be on (1) disordered proteins and their roles in gene regulation; (2) kinases and their roles to regulate the activity of other “downstream” proteins; (3) channel proteins that move ions, water, and nutrients; and (4) proteins that behave as molecular motors.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4500 Evolution of Mammal Diversity 3 Credits
In this course, we will pursue scientific inquiry and communication about mammals, our closest living relatives. We will uncover their evolutionary history and survey the extraordinary diversity of the nearly 6,500 recognized mammalian species. By diving into the scientific literature and visiting the National Museum of Natural History and Smithsonian National Zoo, we will explore the fields of natural history, ecology, evolutionary biology, systematics, behavior, and conservation. Each student will become the community expert on a different mammalian lineage and is tasked with educating and inspiring others to care about the study and long-term wellbeing of mammals worldwide.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4501 Networks in Biology 3 Credits
From social networks and cities to ecosystems and evolution, methods from network science provide powerful tools for understanding and investigating natural and engineered systems. This course covers the properties of diverse biological networks and explores foundational computational methods for analyzing and visualizing networked data to generate biological insights. Based on a series of case-studies, the assignments in this course will focus on how to elucidate the structure and function of biological networks using empirical data. The course will be structured as lectures and computational labs, and evaluations will center around research projects. The lab assignments will be in Python, but no prior experience is required.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4502 Urban Foraging and Ecology 2 Credits
This 1 credit course is meant to introduce you to the useful and satisfying practice of urban foraging. You'll learn to identify and describe a range of edible, useful, and poisonous plants, and along the way will delve into relevant topics in botany and plant ecology.

The course sub-title – "from pawpaws to persimmons" -- describes the progression of fall fruit ripening in DC. The pawpaw fruits that have been ripening in my garden all summer usually start dropping the first week of class, right on schedule, and we'll be collecting ripe persimmons from local trees in November. We'll see our harvest shift over the course of the semester, from greens and late summer fruits in August to seeds, roots, and fall fruits in November. We'll also forage for a few non-food items that we can turn into useful products: dogbane fibers for twine, bayberry fruits for wax, milkweed seeds for pillow stuffing, and walnut husks for dye and ink.

In addition to these practical outcomes, I'm hoping that the course will also provide you with a sense of place and a different way to experience the passage of the seasons, an appreciation for the diversity, beauty, and utility of plants, and an excuse to spend a pleasant couple of hours each week exploring the outdoors.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4503 Advanced Topics in Evolution 1 Credit
This course will pose three questions and answer at least one of them. These are: # What exactly is an organism? # What is the paradox of the organism and how do we resolve it? # What are the consequences of internal conflicts for the notion of organismal agency? Loosely speaking, we probably all know what an organism is. We can likely even name a few. But what criteria do we use for borderline cases, such as chimeras, symbioses, and holobionts? Where and how do we draw the lines between one organism and the next, or between an organism and a non-organism? Our handling of this question will necessitate a tour of some unusual natural history and a dive into the philosophy of organismality and individuality. The paradox of the organism refers to the observation that despite internal conflicts —from both selfish genetic elements and selfish cell lineages— organisms manage not to be torn apart. But why not? How is it that organisms overcome these internal conflicts and, at least when viewed from a distance, maintain their unity of purpose? We'll look at some mechanistic and evolutionary resolutions of the paradox. And finally, we'll discuss what internal conflicts mean for the notion that organisms have agency. We'll first review where agency springs from and then see if that notion remains intact when confronted by internal conflicts. The course is divided into three units. Within each we'll first read some general reviews and survey the landscape of thought. Then we'll turn to focal readings for discussion, in which we'll be joined by a guest speaker who is part of the Paradox of the Organism working group (symposium dates TBA).
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4504 Biodiversity: Genes to Ecosyst 3 Credits
Earth's biota are currently experiencing a sixth mass extinction event that is largely due to human activities. However, understanding the factors that structure biodiversity has proven an exceptionally difficult task since these factors change dramatically across space and time. In this course, we explore classic and current thoery in community ecology, with an emphasis on the roles of molecular genetics and evolutionary theory in shaping community ecology and helping ecologists make sense out of chaos. Moreover, because biodiversity can in turn impact ecosystem function, we will examine the interplay between community and ecosystem dynamics to determine how population declines, species extinctions, and community reorganization may alter critical ecosystem properties.
Level: Graduate, Undergraduate
Prerequisites: BIOL 1800 or BIOL 1850
Grading: Main Campus (UGrad, Grad)

BIOL 4505 Topics in Behavioral Ecology 3 Credits
How have various theories in behavioral ecology changed in the last 50 years? The latter half of the 20th century brought major theoretical advances in our understanding of organismal biology and behavior. Although these classic works are cited all the time, how often do we read them carefully? At the same time, techniques (e.g., genomics, AI, remote sensing) have allowed scientists to tackle fundamental questions in new ways. Here we will survey a range of topics and how theories and hypotheses have been supported-revised-rejected based on research. We will also discuss what remains largely unresolved.

Each week we will read one or two 'classic' papers and one or two recent influential papers (or reviews) in the same area. Students will post comments and questions on the Monday before class. Two students present -with one focusing on the classic paper(s) and the other on the influential recent paper(s). Students present for two topics and come with a list of questions and problems for discussion. Each student also gives a short presentation on their desired review topic.

Students write a review paper or synthesis on a topic that could/ should be part of their dissertation and potentially publishable (i.e., an area that no one has synthesized). Reviews are highly cited, impactful and a great service to the academic community.
Level: Graduate, Undergraduate
Prerequisites: BIOL 1800 or BIOL 1850 or BIOL 3275
Grading: Main Campus (UGrad, Grad)

BIOL 4507 Game Theory for Biologists 1 Credit
Game theory was pioneered by mathematicians and economists in the 1940s and 1950s to study the strategic aspects of interactive decision making. At an abstract level, game theory studies settings in which the optimal action for an agent depends on which actions are taken by other agents. In the 1970s, prominent biologists such as John Maynard Smith, George Price, Robert Trivers, and Amotz Zahavi, began to integrate game theory with concepts from biology, which led (and continues to lead) to fruitful insights about biological phenomena. Today, game theory is an important tool in the toolkit of the theoretical biologist. This course provides a first introduction to game theory, with a focus on biological applications. We'll discuss reciprocal altruism in the context of repeated games, the Handicap Principle in the context of signaling games, social norms as correlated equilibria, and how our understanding of game theory is enhanced by an evolutionary perspective.
Level: Graduate, Undergraduate
Prerequisites: BIOL 1800 or BIOL 1850
Grading: Main Campus (UGrad, Grad)

BIOL 4510 Issues in Evolutionary Biology 1 Credit
This course offers the opportunity to read and discuss primary literature from contemporary research in evolutionary biology. The course will be divided into four or five units related to contemporary research themes such as adaptation to climate change, the paradox of genetic variation, or feedbacks between evolution and ecology. Each unit will have readings from the recent primary literature as well as background papers to help introduce the key concepts. The course will give insight into the questions, concepts, and predictions that motivate contemporary research in evolutionary biology. This course is designed for upper-level undergraduate and graduate students who have already completed at least one intermediate-level course in evolutionary biology.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4514 Deadly Freshwater Ecosystems 3 Credits
Dark Waters: Dangerous and Deadly Freshwater Ecosystems
"Thousands have lived without love, not one without water" (W.H. Auden) But the water that sustains us often becomes dangerous, even deadly. In this course, we will explore the physical, chemical, and biological dynamics of freshwater ecosystems, with an emphasis on understanding the factors that can lead to extreme or threatening conditions. We will analyze case studies about waves and swells, gas emissions from volcanic lakes, toxic algal blooms, contaminated sediments, vanishing drinking water supplies, and other perilous phenomena. The course uses a combination of lecture, discussion, readings, and interactive exercises, and emphasizes understanding and communicating about the science of freshwater threats.
Level: Graduate, Undergraduate
Prerequisites: BIOL 1800 or BIOL 1850
Grading: Main Campus (UGrad, Grad)

BIOL 4515 Biology of Sex 3 Credits
Birds do it. Bees do it. Bdelloid rotifers are famous because they don't do it. Sexual reproduction is expensive, risky, in many cases not necessary, and yet it is nearly ubiquitous. In this course we will explore the diversity of ways that individuals exchange genetic material, with a focus on how evolution shapes the nature and outcome of these interactions. We will consider topics such as sex determination, sex changing, sex ratios, mating systems, reproductive trade-offs, sexual selection, and the persistence of sexual reproduction itself. The goals of this course are to gain an appreciation for the tremendous variation in nature, become aware of current research about topics related to sexual reproduction, and to gain a greater understanding of experimental and theoretical approaches to testing evolutionary ideas.
Level: Graduate, Undergraduate
Prerequisites: (BIOL 180 or BIOL 1800) or (BIOL 185 or BIOL 1850) or BIOL 420
Grading: Main Campus (UGrad, Grad)

BIOL 4516 Introduction to Phylogenetics 3 Credits
The history of life is profoundly shaped by ancestor-descendant relationships found across a wide range of time and spatial scales. This course will help you understand ancestor-descendant relationships by learning how phylogenies are used as a powerful hypothesis testing tool, and by constructing and interpreting trees. We will start by introducing tree thinking - concepts in phylogenetic analysis, the patterns trees represent, and how to interpret trees. We will consider a range of data types, including DNA and protein sequence and the multiple sequence alignment process, as well as discrete and continuous phenotypes. The course will cover the range of methods for phylogenetic inference, including maximum likelihood and Bayesian approaches, and how to assess confidence in tree topologies. The course will include comparative methods including phylogenetic regression, and predictive models of character evolution over time. The course will combine lecture with hands-on exercises using R scripting and software packages. Each student will carry out an independent project developed over the course of the semester. Interest in coding and prior completion of BIOL 1850 or BIOL 4650 recommended.
Level: Graduate, Undergraduate
Prerequisites: BIOL 1800 or BIOL 1850 or BIOL 1910 or BIOL 1940
Grading: Main Campus (UGrad, Grad)
Equivalent to BIOL 5516

BIOL 4535 Population Genetics 3 Credits
Have you ever wondered why there is genetic variation among individuals? How is DNA used as forensic evidence in court cases? How do we know that all modern humans inherited a fraction of their genome from extinct Neanderthals? How do genotyping services like 23andMe determine ancestry or disease risk? Answers to these questions and many more are found in predictions for genotype frequencies, and the action of recombination, genetic drift, effective population size, gene flow, and natural selection that operate within all species. This class introduces foundational quantitative models that predict allele and genotype frequencies, often uses computer simulations, and will carry out a forensic DNA typing exercise. Students will emerge with stronger foundations in probability and computational biology as well as an understanding of hypothesis testing in evolutionary genetics. Prerequisites: BIOL 152 or BIOL 180 or BIOL 185 or BIOL 387 or BIOL 422.
Level: Graduate, Undergraduate
Prerequisites: BIOL 152 or BIOL 1520 or BIOL 180 or BIOL 1800 or BIOL 185 or BIOL 1850 or BIOL 387 or BIOL 3870 or BIOL 422 or BIOL 4220
Grading: Main Campus (UGrad, Grad)

BIOL 4550 Intro to Genome Analysis 1 Credit
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4615 Modeling Populations Diseases 4 Credits
Population biology is a quantitative science dealing with changes in the size and composition of populations, and population biologists often use mathematical models to infer population dynamics. These models use information about the properties of individuals and basic assumptions about their interactions to predict population size, gene frequency, and optimal behavioral strategies of individuals, forming an important conceptual framework. Junior and Seniors only. This course shows what kinds of insight mathematical techniques can give to about biological populations of individuals, communities, and cells. My expectation is that all of you have had a good foundation in biology and some mathematics, but you won't be expected to remember every detail. You will see a good deal of mathematics and biology in this course, and we won't be assuming a great deal of prior knowledge. However, you will be expected to grasp new knowledge conceptually and demonstrate knowledge through in-class computer lab exercises, homework assignments and projects.
Level: Graduate, Undergraduate
Prerequisites: (BIOL 103 or BIOL 1203 or BIOL 105 and (BIOL 104 or BIOL 1205) or BIOL 1204 or BIOL 106 and (MATH 035 or BIOL 1206) or MATH 1350 or CALC with a score of 2)
Grading: Main Campus (UGrad, Grad)

BIOL 4650 Intro to Programming 1 Credit
There is only one piece of scientific equipment that all biologists—cell biologists, evolutionary biologists, neurobiologists, physiologists, biochemists, immunologists, ecologists, developmental biologists, astrobiologists…seriously, all biologists—use in their research. Yet few of them are trained properly to use it to maximal effect: the computer. This course provides a brief introduction to computer programming with biological applications. It is aimed at students who have never dipped a toe in the programming waters. Students can expect to emerge from this course with the ability to write simple programs (e.g., simulations of population processes, scripts to process data and perform statistics) in one computer language and, more importantly, with an appreciation for computational thinking and the knowledge of basic computations performed in virtually all programming languages.
Level: Graduate, Undergraduate
Prerequisites: (BIOL 103 or BIOL 1203) or (BIOL 104 or BIOL 1204)
Grading: Main Campus (UGrad, Grad)

BIOL 4652 Bacterial Stress Responses 1 Credit
This course will explore how bacteria sense and adapt to environmental stimuli. Stress response mechanisms that will be discussed include two-component systems, sigma factors, signaling molecules, small RNAs, and phage defense systems.
Level: Graduate, Undergraduate
Prerequisites: BIOL 1520 or BIOL 152
Grading: Main Campus (UGrad, Grad)

BIOL 4654 The Biology of Stress 1 Credit
This short course tackles a topic very relevant to science students: stress. Its presence in daily life has become a constant companion for many, and we're all-too-familiar with its negative (and positive) consequences. But in this course, we'll narrow our focus to a particular kind of stress – the chronic biopsychosocial stressors of our society – and the astonishingly damaging long-term physiological and epigenetic consequences of this stress. To better understand this phenomenon, we'll build on basic principles of human physiology, central dogma, and epigenetics, using this foundational understanding to explore the primary scientific literature that is revolutionizing our understanding of the biology of stress. The course meets twice a week for 5 weeks for an intensive deep dive into these ideas.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4655 Communicating Science 1 Credit
This class is designed for graduate students and advanced undergraduates interested in any science career. We will spend our time discussing important concepts in science communication, exploring examples, and importantly, putting those ideas into practice. We will focus mostly on non-expert audiences. The goal of the course is to help you move through the process of drafting, editing, reviewing, and presenting a science communication product you're passionate about while refining your skills and learning about the broader world of scicomm. Whether you are a regular public speaker or avoidant of everything communication-related, this course is designed to support individual growth and interests.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4656 Evolving Life: Cells 1 Credit
Full course title: Evolving Life: Cells and Cell Processes. This short course seeks to bridge topics that too often remain separate in students' understanding of biology: the evolution of cells and their biochemical and molecular processes. Specific topics may vary from year to year, but possible topics include the evolution of: genetic material; the genetic code; cells; organelles; multicellular life; cell types; cellular energetics; etc. We'll pull from advanced textbook readings and reviews before we jump into the primary scientific literature to study both seminal papers from the historical scientific literature and cutting-edge discoveries. Through these readings, you'll have the opportunity to not only learn more about the evolution of life and life processes but also the evolution of scientific thought. The course will require active intellectual engagement – i.e., thinking, conversing, and writing. The course meets twice a week for 5 weeks for an intensive deep dive into these ideas.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4700 Genetic Interactions 1 Credit
This course discusses the genetic tools and logical framework underlying research into diverse cellular processes in all organisms. Principles of genetic interactions will be illustrated with examples from a major eukaryotic model organism, the budding yeast Saccharomyces cerevisiae. After a brief description of the basic biology and methods of classical yeast genetics, we will move on to an in-depth discussion of genetic interactions and how these are used to identify protein complexes, and construct detailed genetic pathways. In the last part of the course we will discuss high-throughput genomic approaches that attempt to identify all of the relevant genetic interactions, and then use that information to infer the function of all the genes in the genome.
Level: Graduate, Undergraduate
Prerequisites: BIOL 152 or BIOL 1520
Grading: Main Campus (UGrad, Grad)

BIOL 4701 Endocrinology 3 Credits
Level: Graduate, Undergraduate
Prerequisites: (BIOL 152 or BIOL 1520) or (BIOL 175 or BIOL 1750) or (BIOL 363 or BIOL 3630) or (BIOL 373 or BIOL 3730)
Grading: Main Campus (UGrad, Grad)

BIOL 4702 Advanced Cell Biology 3 Credits
Cells are the basic unit of life. Recent research has shown that mechanisms for regulation of cell functions are more complex than previously thought. In eukaryotic cells, moving molecules in and out of the nucleus, regulation of protein degradation, and regulation of organelle size and structure are but a few examples that illustrate this complexity. In this class, we will spend a portion of the time becoming familiar with the background and broad issues, and a portion of the time reading papers from the primary literature. Students will be responsible for several presentations throughout the semester as well as two short papers on topics of interest and a final exam that will involve scientific writing. For Fall 2013, we will examine mechanisms responsible for birth and death of organelles found in eukaryotic cells.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4703 Architecture Dynamics:Nucleus 3 Credits
It has been approximately two centuries since the term "nucleus" was coined by Robert Brown, who observed an opaque spot in each cell of the leaves of orchids. Only recently, we started to understand nuclear and chromosome architecture and dynamics: some regions of the chromosome are "open" and other regions are tightly condensed; the nuclear membrane breaks down and reassembles every time the cell undergoes cell division; lots of molecules are actively transported in and out of the nucleus. In addition, diverse molecules present in the nucleus allow for multiple layers of regulation of gene expression. In this course, we will delve into topics relevant to the nucleus, including nuclear import and export, nuclear-cytoskeletal connections, the nuclear membrane, nucleolus, and chromatin organization. Reflecting the rapid development of this exciting field, the lecture mostly consists of discussing primary literature and review papers. The main focus of the course is scientific questions and findings, not rote learning of facts. The lecture will be interspersed with small group discussions.
Level: Graduate, Undergraduate
Prerequisites: BIOL 103 and BIOL 104 and (BIOL 151 or BIOL 152)
Grading: Main Campus (UGrad, Grad)

BIOL 4704 The Dynamic Brain 3 Credits
The Dynamic Brain: Neuroplasticity of development and learning
Level: Graduate, Undergraduate
Prerequisites: (BIOL 103 or BIOL 1203) and (BIOL 195 or BIOL 1950)
Grading: Main Campus (UGrad, Grad)

BIOL 4705 Adv Microscopy for Biologists 1 Credit
The microscope offers views into beautiful worlds unseen by the naked eye. For biological research, microscopes have traditionally been used to examine static (fixed) cellular and subcellular structures. Over the past couple of decades, dramatic advances in microscope, camera, and molecular labeling techniques have led to a "perfect storm" for biological imaging technology and we are now able to view living specimens with unprecedented temporal and spatial resolution and can even visualize changes in cellular activity. In Advanced Microscopy for Biologists, we will dive into the principles and applications of modern biological imaging approaches.

The course will consist of a lecture-based introduction to a microscopy topic followed by interactive analyses of primary literature on each topic. Students will participate in dissecting current papers and building their own sense of scientific inquiry around imaging techniques. As able, we will interface the course content with students' research aims in order to enable students to achieve better mastery of the microscopy applications related to their own research. The primary goal of this course is to enhance students' current or future research endeavors that relate to microscopy.

The scope of this course will mainly involve questions and approaches from a biologist's perspective; physics and mathematical principles will be limited to overview.
Level: Graduate, Undergraduate
Prerequisites: (BIOL 191 or BIOL 1910) or BIOL 192 or (BIOL 194 or BIOL 1940) or (BIOL 195 or BIOL 19550)
Grading: Main Campus (UGrad, Grad)

BIOL 4706 Advanced Cell Biology 1 Credit
This short course will explore the research intersections between biochemistry and genetics that allow for a deeper understanding of eukaryotic cells and how they work.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4707 Unsung Receptors 3 Credits
Cellular signaling is at the basis of all biological functions. At the heart of this field are G protein-coupled receptors (GPCRs), membrane receptors that account for the largest gene family in the human genome. These receptors also represent the largest class of "druggable" proteins with ~30% of all currently approved FDA-drugs targeting GPCRs. Moreover, recent discoveries have unveiled novel functions for understudied GPCRs that have shed new light on important physiological processes ranging from blood pressure regulation to wound healing. Using seminal peer-reviewed scientific literature, students in this course will learn the principles of GPCR signaling and their novel functions in health and disease. Topics covered will include opioid receptors as targets for pain management, chemosensors that govern the sensory systems, frizzled receptors that modulate tissue development, and many others. Students enrolled in this course will be expected to utilize critical analytical skills to read, interpret, and present findings from the scientific literature. They will apply these research skills to case studies and learn to effectively communicate their scientific discoveries.
Level: Graduate, Undergraduate
Prerequisites: (HSCI 280 or HSCI 2800) or (BIOL 151 or BIOL 1510)
Grading: Main Campus (UGrad, Grad)

BIOL 4708 Advances in Epigenetics 1 Credit
In this one credit course, we will be exploring recent advances in the understanding of the roles of Epigenetics in regulation of gene expression.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4709 Data Analysis with R 1 Credit
This course is designed for upper-level undergraduate and graduate students who have had some introduction to R-programming and want to improve their skills in the management, analysis, and visualization of biological data. We will go through the process of designing an analytical pipeline from start (data cleaning) to finish (building a package). There will be a focus on creating reproducible code that is suitable for publication.

Course Requirements Course assessment will consist of four short take-home programming assignments (15% each) and a final project (40%). For the final project, students will create their own R package with several custom functions for the analysis of a dataset of their choice. Students may use any online resources for the assignments that they wish, and will be graded on the functionality, reproducibility, and documentation of their code.
Level: Graduate, Undergraduate
Prerequisites: (BIOL 103 or BIOL 1203) or (BIOL 105 or BIOL 1205) (BIOL 104 or BIOL 1204) or (BIOL 106 or BIOL 1206)
Grading: Main Campus (UGrad, Grad)

BIOL 4710 Life Droplets: New Cell Niche 1 Credit
This course explores how cells compartmentalize biological processes in space and time. We will examine a fundamental question in biology: why and how do cells organize to create the structures needed to promote specific functions? While traditional compartments like the Golgi apparatus and mitochondria are bounded by membranes, we will focus on a class of membraneless, self-organizing structures known as biomolecular condensates. These condensates form through phase separation in response to physicochemical changes, representing a novel mechanism of cellular organization. Integrating principles from physics, chemistry, and biology, this emerging field offers fresh insights into gene regulation, cellular stress, the origin of life, and the molecular underpinnings of diseases such as cancer and neurodegeneration.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4711 Advanced Molecular Biology 3 Credits
This is a seminar-based course where students will present and discuss recent papers on selected topics covering eukaryotic gene expression. Topics change yearly and may include understanding chromatin structure and its modification, transcriptional regulatory proteins and their interactions with RNA polymerase, regulation of transcription initiation, elongation, regulation of mRNA processing, nuclear export, and translational control mechanisms.

This course applies towards the Biology Major and the concentration in Biochemistry, Molecular and Cellular Biology with in it. This course applies to the Biology of Global Health Major.
Level: Graduate, Undergraduate
Prerequisites: (BIOL 151 or BIOL 1510) and (BIOL 152 or BIOL 1520)
Grading: Main Campus (UGrad, Grad)

BIOL 4712 Introduction to Immunology 1 Credit
This 1-credit course module will provide an overview of the immune system, providing a basic understanding of the cells and mechanisms involved in detecting and responding to infection.
Level: Graduate, Undergraduate
Prerequisites: (BIOL 151 or BIOL 1510) or (BIOL 152 or BIOL 1520)
Grading: Main Campus (UGrad, Grad)

BIOL 4714 Ecology of emerging disease 1 Credit
We live in an era of rapid global change. As humans continue to alter the environment at an unprecedented pace, ecosystems are rearranging themselves and altering the face of infectious disease. In this course, we will first discuss how facets of human development including urbanisation, climate change, and agricultural industrialisation are impacting infectious disease in wildlife and livestock populations. Second, we will examine how humans and animals interact and discuss the impacts of changing ecosystem health on human health. Taking examples from animal behaviour, ecoimmunology, disease ecology, and the study of natural disasters, this course will bring you to consider how global change, ecosystem health, and public health are intertwined. You will learn how ecological systems are structured, how we rely on them, what we can do to exist in harmony with them, and the consequences of doing otherwise.
Level: Graduate, Undergraduate
Prerequisites: BIOL 1203 or BIOL 1205 or BIOL 103 or BIOL 105 and BIOL 1204 or BIOL 1206 or BIOL 104 or BIOL 106
Grading: Main Campus (UGrad, Grad)

BIOL 4750 Cell Biology of Cancer 3 Credits
Topics relating to the molecular and cell biology of cancer will be discussed. This upper level undergraduate course builds on concepts introduced in foundational courses in cell biology and will emphasize experimental methods and design, as well as critical data analysis. Students will present papers from the primary literature each week individually or in groups. This course applies towards the concentration in Biochemistry, Molecular and Cellular Biology for Biology majors.
Level: Graduate, Undergraduate
Prerequisites: (BIOL 151 or BIOL 1510) or (BIOL 152 or BIOL 1520) or (BIOL 175 or BIOL 1750) or (BIOL 363 or BIOL 3630)
Grading: Main Campus (UGrad, Grad)

BIOL 4801 Issues in Evolutionary Biology 1 Credit
This course offers the opportunity to read and discuss primary literature from contemporary research in evolutionary biology. The course will be divided into four or five units related to contemporary research themes such as adaptation to climate change, the paradox of genetic variation, or feedbacks between evolution and ecology. Each unit will have readings from the recent primary literature as well as background papers to help introduce the key concepts. The course will give insight into the questions, concepts, and predictions that motivate contemporary research in evolutionary biology. This course is designed for upper-level undergraduate and graduate students who have already completed at least one intermediate-level course in evolutionary biology.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4802 Issues in Ecology 1 Credit
This course offers the opportunity to read and discuss primary literature from contemporary as well as classic research in ecology. The course will be divided into four or five units related to contemporary research themes such as feedbacks between ecology and evolution, tritrophic interactions, behavioral ecology, and ecological consequences of global change. Each unit will include readings from the recent primary literature as well as background papers to help introduce the key concepts. The course will provide insight into the questions, concepts, and predictions that motivate contemporary research in ecology. This course is designed for upper-level undergraduate and graduate students who have already completed at least one course in ecology.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4947 Microbiome Pop-Up Labs I 1 Credit
Welcome to Pop-Up Labs! In this course, we will follow the whole arc of scientific inquiry and engagement – from project design and sample collection through data generation, analysis, and interpretation. We will partner with university, governmental, and non-profit partners to tackle real-world research questions where answers lie in the microorganisms comprising host-associated and environmental microbiomes. Whether samples derive from salt marsh grasses, soils from our own organic garden, or swabs collected from island foxes, we'll enter the world of microbial ecology and discover something new. In the fall semester, we will design our project in collaboration with this year's partners, collect and inventory samples, extract DNA, and generate 16S rRNA amplicon sequencing data to address our questions of interest. The semester will culminate in a project proposal and presentation that motivates our research within the broader scientific literature and clearly explains our research questions and approach.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4948 Microbiome Pop-Up Labs II 1 Credit
Welcome to Pop-Up Labs! In this course, we will follow the whole arc of scientific inquiry and engagement – from project design and sample collection through data generation, analysis, and interpretation. We will partner with university, governmental, and non-profit partners to tackle real-world research questions where answers lie in the microorganisms comprising host-associated and environmental microbiomes. Whether samples derive from salt marsh grasses, soils from our own organic garden, or swabs collected from island foxes, we'll enter the world of microbial ecology and discover something new. In the spring semester, we will take a deep-dive into computational analysis to explore alpha and beta diversity, taxonomic composition, and differential abundance in QIIME2 and create publication-quality figures in RStudio. The semester will culminate in a final report and presentation that contextualizes results in the scientific literature and clearly communicates findings to our collaborating partners.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4949 Tutorial: Biology 0-3 Credits
Welcome to Pop-Up Labs! In this course, we will follow the whole arc of scientific inquiry and engagement – from project design and sample collection through data generation, analysis, and interpretation. We will partner with university, governmental, and non-profit partners to tackle real-world research questions where answers lie in the microorganisms comprising host-associated and environmental microbiomes. Whether samples derive from salt marsh grasses, soils from our own organic garden, or swabs collected from island foxes, we'll enter the world of microbial ecology and discover something new. In the spring semester, we will take a deep-dive into computational analysis to explore alpha and beta diversity, taxonomic composition, and differential abundance in QIIME2 and create publication-quality figures in RStudio. The semester will culminate in a final report and presentation that contextualizes results in the scientific literature and clearly communicates findings to our collaborating partners.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4950 Research Tutorial 0-3 Credits
Tutorial research is taken primarily by third year students who wish to begin a research project that may continue on to the senior year as RISE (Research Intensive Senior Experience). This course is available to students majoring in Biology, Biology of Global Health, Environmental Biology or Neurobiology, and to students obtaining a minor in Biology. This research project must be developed in conjunction with a faculty member. Faculty mentors can be from other departments (including the Medical Center), but students must then have a co-mentor of record from within the department and register using their section number. Weekly meetings with faculty members and a final paper are typically expected. There are separate section numbers for each faculty mentor (see list on Registrar's page). This course replaces BIOL-300; students may not take BIOL-340 if they have previously enrolled in BIOL-300. Enrollment requires the permission of the instructor and development of a syllabus tailored to the student and project. Fall and spring.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4951 RISE-I: Rsrch Intsv Sr Exprnce 0 or 3 Credits
Research Intensive Senior Experience (RISE) conducted under the mentorship of faculty in the Department of Biology, sometimes also in conjunction with faculty outside of the Department of Biology. Research may be conducted in the laboratory, in the field, computationally, in the classroom, or in conjunction with an approved internship. Open to students majoring in Biology, Biology of Global Health, Environmental Biology, or Neurobiology and credits will apply to these majors; for students in other majors these courses will count towards College electives. BIOL-4951 is the first course in a two-course series (the second course is BIOL-4952). Enrollment requires the permission of the instructor and development of a Learning Contract between the student and the mentor that states goals for the project (see the syllabus). Section information text: Registration in the class requires Instructor approval.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4952 Resrch Intnsive Sr. Experience 0 or 3 Credits
Research Intensive Senior Experience (RISE) conducted under the mentorship of faculty in the Department of Biology, sometimes also in conjunction with faculty outside of the Department of Biology. Research may be conducted in the laboratory, in the field, computationally, in the classroom, or in conjunction with an approved internship. Open to students majoring in Biology, Biology of Global Health, Environmental Biology, or Neurobiology and credits will apply to these majors; for students in other majors these courses will count towards College electives. BIOL-4952 is the second course in a two-course series (the first course is BIOL-4951). Enrollment requires the permission of the instructor and development of a Learning Contract between the student and the mentor that states goals for the project (see the syllabus).
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 4960 Neurobiology Senior Seminar 1 Credit
This seminar is required for all seniors majoring in Neurobiology. New for Fall 2019: Students may enroll in any of the sections; there are no longer restrictions on each section by major. Each section will be taught by a different professor at a different time for additional flexibility in scheduling. Topics will be advertised prior to registration. Note that if you plan to be abroad in Fall of senior year, you must take this course in the Fall of junior year.
Level: Graduate, Undergraduate
Prerequisites: BIOL 195 or BIOL 1950
Grading: Pass/Fail Default
Course registration restrictions:
Enrollment is limited to students with a major in Neurobiology, Neurobiology, Neurobiology or Neurobiology.

BIOL 4997 Continuing Research 1-3 Credits
Credits from this course are NOT applied to the biology major but do apply towards the College degree requirement (enroll in BIOL-300 for biology major credit). Students who enroll in this course would typically do so as a fourth semester of research-for-credit (beyond Tutorial and RISE) and are encouraged to instead consider GUROP as a means of designating research participation on their transcripts. Similar rules about registration for Tutorial apply.

Enrollment requires the permission of the instructor and development of a syllabus tailored to the student and project. There are separate section numbers for each faculty mentor (see list from the Registrar's office). Fall and spring.
Level: Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 5050 Graduate Survival Skills 3 Credits
BIOL 505 is a seminar-style graduate course that covers foundational professional skills necessary for success in graduate school and beyond. A major focus of the course is on communication in both written and oral form, with a special emphasis on grant proposal preparation. Additional topics include time management skills, strategies for effectively managing mentor-advisee relationships and research ethics.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 5060 Teaching in the Bio Sciences 1-2 Credits
This program is offered by CNDLS. To complete it, students will participate in the Introduction to Teaching Resources Workshop, five Core Workshops (Course Design, Syllabus Design, Effective Classroom Interaction, Assessment and Grading, and Reflective Teaching in Practice), and two elective workshops. Additionally, they will complete 6 authentic teaching tasks that align with the workshops.
Level: Graduate
Grading: Pass/Fail Default

BIOL 5080 Integrated Biology 3 Credits
This course will survey the faculty research programs of the Department of Biology with a focus on biological concepts that link subdisciplines. Faculty will provide an overview of the major theoretical questions that motivate their research and discuss on going projects that address these questions. Some of the major themes covered will include Communications and Behavior, Phenotypic Plasticity and Population Dynamics, and Community Dynamics. Students are expected to read primary literature and participate in class discussions. This course will address the following program learning goals: (1) displaying diversified knowledge of biological concepts, theories and research techniques, and (2) integration of new knowledge into existing scientific frameworks.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)
Course registration restrictions:
Enrollment is limited to students with a program in Biology, Biology, Biology or Biology.

Enrollment is limited to Graduate level students.

BIOL 5090 Introduction to Immunology 1 Credit
This 1-credit course module will provide an overview of the immune system, providing a basic understanding of the cells and mechanisms involved in detecting and responding to infection. Cannot also take BIOL-362 or GLID-562
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)
Mutual exclusion: BIOL 362, BIOL 3620, GLID 5562, GLID 562
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 5100 Advanced Ecology 3 Credits
Advance Ecology is a graduate level Ecology course.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 5120 Topics in Ecological Genetics 3 Credits
Ecological genetics concerns research at the interface of ecology, evolutionary biology and molecular genetics. Major goals are to determine the genetic basis of ecologically important traits and to elucidate processes of phenotypic evolution on a contemporary timescale. Current advances in DNA sequencing technology (NextGen sequencing) are opening up exciting new opportunities in this field. This upper-level seminar course will focus on recent primary literature that illustrates emerging approaches to topics in the field of ecological genetics based on NextGen sequencing. Students will be responsible for presenting primary literature, participating in classroom discussion and writing a “mini-review” paper on a topic related to their research interests.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 5140 Environmental Bio Reading 0 or 1 Credits
The various Critical Readings courses provide an intellectually stimulating environment for graduate students to research and present a journal article of their choosing to an audience of peers and professors. It serves as practice grounds for speaking to a scientific audience. Learning to critically read, write, and evaluate scientific papers is one of the most important long-term skills required for success in science, both during and after graduate school. Through analysis of published papers, we hope that students will gain an understanding of the different elements of theory, experimental design, analysis, and writing that are essential for scientific communication
Level: Graduate, Undergraduate
Grading: Pass/Fail Default
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 5150 Environ. Biology Journal Club
Journal Club provides a relaxed environment for graduate students to research and present a journal article of their choosing to an audience of peers and professors. It serves as practice grounds for speaking to a scientific audience. Learning to critically read, write, and evaluate scientific papers is one of the most important long-term skills required for success in science, both during and after graduate school. Through analysis of published papers, we hope that students will gain an understanding of the different elements of theory, experimental design, analysis, and writing that are essential for scientific communication and successful publication. Above all, journal club should be a forum for learning and for the expansion of scientific knowledge in ecology, evolution and behavior.
Level: Graduate, Undergraduate
Grading: Pass/Fail Default
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 5160 Molecular Cell Bio Reading 0 or 1 Credits
The various Critical Readings courses provide an intellectually stimulating environment for graduate students to research and present a journal article of their choosing to an audience of peers and professors. It serves as practice grounds for speaking to a scientific audience. Learning to critically read, write, and evaluate scientific papers is one of the most important long-term skills required for success in science, both during and after graduate school. Through analysis of published papers, we hope that students will gain an understanding of the different elements of theory, experimental design, analysis, and writing that are essential for scientific communication
Level: Graduate, Undergraduate
Grading: Pass/Fail Default
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 5170 Astrobiology Reading 0 or 1 Credits
The various Critical Readings courses provide an intellectually stimulating environment for graduate students to research and present a journal article of their choosing to an audience of peers and professors. It serves as practice grounds for speaking to a scientific audience. Learning to critically read, write, and evaluate scientific papers is one of the most important long-term skills required for success in science, both during and after graduate school. Through analysis of published papers, we hope that students will gain an understanding of the different elements of theory, experimental design, analysis, and writing that are essential for scientific communication
Level: Graduate, Undergraduate
Grading: Pass/Fail Default

BIOL 5180 Dev Neurobio Reading 0 or 1 Credits
The various Critical Readings courses provide an intellectually stimulating environment for graduate students to research and present a journal article of their choosing to an audience of peers and professors. It serves as practice grounds for speaking to a scientific audience. Learning to critically read, write, and evaluate scientific papers is one of the most important long-term skills required for success in science, both during and after graduate school. Through analysis of published papers, we hope that students will gain an understanding of the different elements of theory, experimental design, analysis, and writing that are essential for scientific communication
Level: Graduate, Undergraduate
Grading: Pass/Fail Default

BIOL 5200 Practicum in Proposal Writing 2 Credits
This course will focus on skills involved in experimental design, grantsmanship and proposal defense. Students will read primary literature in an area of their interest, identify gaps in knowledge, propose hypotheses, and design experiments to address those hypotheses. Students will prepare written proposals following NIH/NSF structures. Through discussion and peer review, students will hone critical thinking and writing skills. Students will practice oral defense of their ideas. This course supports the writing and defense of the qualifying exam.
Level: Graduate, Undergraduate
Grading: Pass/Fail Default
Course registration restrictions:
Enrollment is limited to students with a program in Biology, Biology, Biology or Biology.

Enrollment is limited to Graduate level students.

BIOL 5210 Seminar in Infectious Diseases 3 Credits
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 5250 Work-in-Progress seminar(WIPS)
The Work-in-Progress Seminar series (WIPS) consists of weekly seminars of thesis research progress by the graduate students in the Department of Biology. One or two meetings per semester consist of presentations delivered by Georgetown University affiliated or outside experts on professional development skills and opportunities.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)

BIOL 5300 Graduate Research Tutorial 1-6 Credits
This course allows graduate students to take a deep dive into relevant and current theory in their respective sub-discipline within biology, as well as the current experimental and statistical methods used to address gaps in theory. Graduate students often need specialized training in their respective sub-disciplines, but Georgetown may not offer the relevant courses to meet this need. While this course is administered by the Co-Director of Graduate Studies, each individual faculty mentor will guide the readings and discussions meant to bolster the background of a graduate student in their respective sub-discipline. Grades will be assessed by both the individual faculty mentor and the Co-Director of Graduate Studies.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 5515 Global Climate Change Ecology 4 Credits
Over the past century, the mean surface temperature of our planet has increased slightly less than 1°C. While this may seem like a small increment, global warming is already profoundly affecting Earth's organisms and ecological communities, and predictions for the impacts of continued change range from severe to catastrophic. In this class, we will explore the causes and biological consequences of climate change on Earth. Through lectures, discussion, films, critical reading of the literature, and examination of long-term data sets and resources from NASA's Earth Observatory, students will gain an understanding of: how Earth's climate system functions, how past climatic fluctuations compare to projected future changes, how human activities contribute to climate change, how climate change affects organisms, communities, and ecosystems, and how science is (or is not) translated into policy. Additionally, we will explore the direct effects of climate change on disease risk and resource shortage for the human population, as well as the possible economic impacts of such changes. Lastly, we will consider what changes would need to occur to stabilize or reverse current trends. We welcome lively discussion and debate that will further our understanding of the impacts of climate change on Earth's living resources.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)
Equivalent to BIOL 3515
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 5516 Molecular Evolution 3 Credits
Genetics teaches us that an organism's DNA serves as a recipe book: its sequence provides instruction for building and developing the body. For the student of molecular evolution, an organism's DNA serves more like a diary: there in its sequence lies the history of past evolutionary change. This course takes the latter view of DNA and will teach you how to read such a diary. Our two main foci will be molecular phylogenetics—i.e., how we may reveal the ancestry of a set of organisms—and the inference of evolutionary processes —i.e., how we detect selection, drift, mutation, and demographic changes in a population's past. Knowledge of genetics and familiarity with evolutionary biology are prerequisites, but to get the most out of the class, it is also necessary to have a handle on simple math (arithmetic, algebra, statistical reasoning). Students will learn the basics of molecular evolution through a combination of lectures, discussion of the primary literature, and analyses of real data.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)
Equivalent to BIOL 4516
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 5525 Graduate Research Seminar 0.5 Credits
The Graduate Student Research Seminar consists primarily of weekly seminars of research progress by graduate students in their 3rd year and above in the Biology Department. The graduate research seminar series provides an opportunity for students to hone their presentation skills, to obtain feedback from peers and faculty, and to build community. Additionally, ~two meetings per semester consist of presentations delivered by Georgetown University affiliated or outside experts on research ethics, mentorship, professional development skills and opportunities, and diversity, equity & inclusion. While all graduate students are expected to attend as members of the Biology Department community, 1st and 2nd year graduate students.
Level: Graduate, Undergraduate
Grading: Pass/Fail Default

BIOL 5535 Microbial Genomics 4 Credits
You're more them than you! The number of microorganisms found in and on your body far exceeds the number of human cells. This class will investigate aspects of the human microbiome, that is, the microorganisms associated with human body. The course will be oriented around hands-on projects that investigate these microorganisms – using both computer tools to investigate genomes and laboratory investigations to test hypotheses generated from the genome sequences. Although some prior understanding of microbiology, molecular biology, or biochemistry is helpful, the course is open to all biology majors. Computer science majors are also encouraged to apply.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)
Equivalent to BIOL 3535
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 5547 Adv Topics in Evolution II 2 Credits
Further investigations into this course will pose three questions and answer at least one of them. These are: # What exactly is an organism? # What is the paradox of the organism and how do we resolve it? # What are the consequences of internal conflicts for the notion of organismal agency? Loosely speaking, we probably all know what an organism is. We can likely even name a few. But what criteria do we use for borderline cases, such as chimeras, symbioses, and holobionts? Where and how do we draw the lines between one organism and the next, or between an organism and a non-organism? Our handling of this question will necessitate a tour of some unusual natural history and a dive into the philosophy of organismality and individuality. The paradox of the organism refers to the observation that despite internal conflicts—from both selfish genetic elements and selfish cell lineages—organisms manage not to be torn apart. But why not? How is it that organisms overcome these internal conflicts and, at least when viewed from a distance, maintain their unity of purpose? We'll look at some mechanistic and evolutionary resolutions of the paradox. And finally, we'll discuss what internal conflicts mean for the notion that organisms have agency. We'll first review where agency springs from and then see if that notion remains intact when confronted by internal conflicts. The course is divided into three units. Within each we'll first read some general reviews and survey the landscape of thought.
Level: Graduate, Undergraduate
Prerequisites: (BIOL 447 or BIOL 4470)
Grading: Main Campus (UGrad, Grad)

BIOL 5551 Dyn Proc in Biological Physics 3 Credits
The class combines basic knowledge of thermodynamics/statistical physics, nonlinear dynamics and biology to highlight physical processes that govern the dynamics of biological systems. The class will concentrate on dynamical aspects emerging on different temporal and spatial scales, random processes, Brownian motion and diffusion, thermodynamics of biological processes and the generation of membrane potentials.

This course serves as an approved course towards a concentration in Biochemistry, Molecular and Cellular Biology as well as the concentration in Ecology, Evolution and Behavioral Biology.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)
Equivalent to BIOL 3551

BIOL 5610 Science/Society:Global Challng 3 Credits
This seminar introduces students to some of the most significant and complex science and public interest challenges of our time including: managing a global pandemic, reducing carbon emissions, meeting growing global energy demand, and containing weapons of mass destruction. Guest speakers - including scientists, venture capitalists, congressional staff, and journalists - will examine the science, politics and public perceptions surrounding these challenges. Throughout the semester, students will break into groups and develop a report on one "Grand Challenge" that covers: the science, pending legislation, any Administration initiatives, relevant activity in the private sector, and the various policy options and barriers for solving the problem.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 5615 Genomics Bioinformatics 3 Credits
This course is an introduction to genomics and the use of computers to analyze genomic data. Genomics is the study of the structure, content and evolution of genomes, including functional analysis of genes and proteins. Students learn applications of genomics to biomedical and biological research by performing computational exercises using genomic databases. Topics include genome sequencing and annotation, gene and regulatory motif prediction, genetic variation, sequence database searching, multiple sequence alignment, phylogenetic tree construction, protein structure prediction, microarray analysis, proteomic analysis, interaction networks.

This course applies towards the concentration in Ecology, Evolution and Behavioral Biology as well as the concentration in Biochemistry, Molecular and Cellular Biology for Biology majors.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)
Equivalent to BIOL 3615
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 5620 Shaping National Science Polic 3 Credits
Shaping National Science Policy introduces students to science policy, science advocacy, and practical politics. The course is both a reading seminar, where students discuss assigned readings, and a project course. The readings explore issues in science policy and case studies at the intersection of science and politics. The readings are varied and include a play, court decisions, Congressional hearings and other materials. For the projects, students work in groups throughout the semester. Each group works on a science-related topic of its choosing and attempts to get Congress to take action on it, by dealing directly with Congressional offices, other public officials, advocacy groups, academic experts and others, as appropriate. Counts for Biology majors as a 2000-level interdisciplinary connections course, for Biology of Global Health majors as an Interdisciplinary Perspectives course, or for Environmental Biology majors as an upper-level elective. Physics students count the class as a restricted elective towards a degree.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 5701 Cell Biology 3 Credits
This course will focus on the major functions of the cell and its cellular components, the dynamic processes that occur within cells, interactions between cells and their environment, and how gene expression regulates cell function.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)
Equivalent to BIOL 3701
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 5702 Molecular Biology 3 Credits
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)
Equivalent to BIOL 3702
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 5703 Immunobiology 3 Credits
The purpose of this course is to provide a basic understanding of immunobiology. The course will focus on basic principles of innate and adaptive immunity and how they function in homeostasis. Students will learn the different cells and organs comprising the system and how these cells communicate. We will then go on to examine regulation and dysregulation of the immune system and how this impacts on resistance to infectious agents, cancer, transplantation and allergy. The application of immunological principles and methods to other areas of biomedical science will be central to our discussions.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 5704 Advanced Cell Biology 2 Credits
This advanced level course focuses on the major functions of cells and their components, the dynamic processes that occur within cells, and the interactions between cells and their environment. Topics include protein and vesicular transport, mitochondrial dynamics and autophagy, cell signaling from membrane to nucleus, and cell–cell interactions, and their relevance to homeostatic function and diseases. The course will involve lectures, primary literature reading and discussions. Students will gain experience in experimental design, methodology, data analysis, and figure interpretation and presentation within the context of key concepts in cell biology. Students should have completed a survey course such as Cell Biology (BIOL-3701) or equivalent. Undergraduate students can enroll with permission of instructor.
Level: Graduate
Grading: Main Campus (UGrad, Grad)

BIOL 5730 Developmental Biology 3 Credits
This course will introduce fundamental mechanisms in embryonic development including the processes of fertilization, gastrulation, cell fate determination and axis formation. In class we will discuss classical experiments as well as recent breakthroughs that have advanced the field of developmental biology. Unlike traditional lecture-based courses, the class time will serve as a platform for group discussions interspersed with short lectures.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)
Equivalent to BIOL 3730
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 5798 Synaptic Transmission 3 Credits
This course will examine how neurons communicate with each other through synaptic connections. It will begin with some basic information about human neuroanatomy, providing the groundwork for understanding how disruptions in specific systems result in specific outcomes. We will then examine the basic cell biology of synaptic transmission, focusing on the different types of neurotransmitters and their receptors. We will explore the molecular regulation of these systems, the effects of therapeutic and non-therapeutic drugs, and the transfer of information from outside the cell to inside.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)
Equivalent to BIOL 3798
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 5799 Developmental Neurobiology 3 Credits
This guided seminar course introduces upper level undergraduates to selected topics of the development of the nervous system of vertebrates and invertebrates. Students will read, present and discuss review articles and primary research literature investigating molecular, cellular, evolutionary and embryological aspects of neurodevelopment. Topics will include dorsal-ventral patterning, induction of the neural plate, neuronal differentiation, axon guidance, and synapse formation. Recent technological advances of each subject and the presentation by the media of these topics to the lay public will be discussed.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)
Equivalent to BIOL 3799
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 5800 Sensory Systems 3 Credits
BIOL 5800 is a course designed to investigate the sensory systems: olfaction, vision, somatosensation, audition, vestibular function, and gustation. Each sensory system will be addressed and will include: the cells that compose each pathway, the molecules underlying cellular function and development, the flow of information, plasticity within the processing stream, and the potential for renewal within each sense. This is a research-based course and there will be little in the way of rote memorization. The course will consist of short introduction of the framework of sensory systems followed by interactive analyses of primary literature on each topic. Students will participate in dissecting current and historical papers and building their own sense of scientific inquiry around sensory systems.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)
Equivalent to BIOL 3800
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 5801 Intro Virology Viral Disease 3 Credits
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)
Equivalent to BIOL 3801
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 7010 Department Activities
Informal discussions of topics of current interest to biologists.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 7030 Department Seminar 0.5 Credits
The Departmental Seminar consists primarily of weekly seminars given by faculty from outside of the Biology Department. In this course, students will be exposed to cutting-edge research from nationally and internationally recognized scholars and mentors in the biological sciences. In doing so, research will be contextualized into existing knowledge frameworks, and professional networks will be forged through formal and informal interactions with the speaker. While all graduate students are expected to attend as members of the Biology Department community, 1st and 2nd year graduate students earn credit through attendance, participation in a post-seminar discussion led by the seminar speaker, and two written reflections.
Level: Graduate
Grading: Pass/Fail Default
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 7949 Mentored Research 1-3 Credits
A critical piece of intellectual development for graduate students is in the development of their research skills. We formalize this through the Research Tutorial that students will enroll in for their first two years in the program. Through this tutorial, students are exposed to cutting-edge research fields of study as they participate in generating new knowledge. Students will learn the process of science, gaining new skills in experimental design, data acquisition, analysis, and interpretation, as well as data presentation. Students will also hone their presentation skills by leading laboratory group meetings. These are carefully mentored experiences that require weekly one-on-one meetings with their faculty mentor. The series of tutorials will culminate in a student's defense of their dissertation proposal at their comprehensive exam.
Level: Graduate, Undergraduate
Grading: Main Campus (UGrad, Grad)
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 9985 Biology Lab Rotation Summer
Level: Graduate
Grading: Main Campus (UGrad, Grad)
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 9986 Biology Lab Rotation Fall
Level: Graduate
Grading: Main Campus (UGrad, Grad)
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 9987 Biology Lab Rotation Spring
Level: Graduate
Grading: Main Campus (UGrad, Grad)
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 9991 Continuous Registration
Graduate Student Continuing Registration in Biology
Level: Graduate, Undergraduate
Grading: No Grade
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 9992 Continuous Registration
Continuing Registration for Graduate Students.
Level: Graduate, Undergraduate
Grading: No Grade
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 9993 Continuous Registration
Level: Graduate, Undergraduate
Grading: No Grade
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 9994 Continuous Registration
Level: Graduate
Grading: No Grade
Course registration restrictions:
Enrollment is limited to Graduate level students.

BIOL 9999 Thesis Research
Conduct research towards completion of the PhD or MS degrees under the guidance of a faculty member. Section 01: for students who are taking or have taken 16-cr or less of courses; Section 03: for students taking courses beyond the 16-cr required; Section 05: for students who are paid as teaching assistants.
Level: Graduate
Grading: No Grade
Course registration restrictions:
Enrollment is limited to Graduate level students.