

# BIOLOGY (BIOL)

## BIOL 1010 - Essentials of Biology

3 Credits

Essentials of Biology is a non-majors general biology course without a laboratory. The topics that will be covered include biological molecules, cell structure and function, cellular metabolism, cell division, genetics, evolution, the diversity of life, and ecology.

**Attributes:** Natural Science Req (A&S)

## BIOL 1020 - Genetics and Society

3 Credits

In this course, students will learn about modern topics in genetics, with an emphasis on topics that affect people and society. Topics will include inheritance of genetic traits, the storage and use of genetic information in cells, genetic variation and evolution, genetically modified organisms, genetic testing and its use in medicine, and the application of genetic technology in forensics and genealogy. This course is intended for non-science majors.

**Attributes:** Natural Science Req (A&S), UUC:Natural & Applied Science

## BIOL 1100 - Introduction to Biology

0 or 4 Credits

This course will examine an introduction to the biochemistry of life, cellular biology and energy metabolism, development, genetics, and evolution. These biological principles will be introduced with an emphasis on the inquiry nature of the scientific process and the relevance of biology to students lives.

**Attributes:** Natural Science Req (A&S)

## BIOL 1111 - Biological Principles 1

4 Credits

The course explores basic principles of biology with a focus on those features shared by all living organisms and seen through the lens of evolutionary theory. Through lectures, readings and discussion, offers students an opportunity to understand how the scientific method has been and is used to address biological questions. Central topics include recent advances in cell anatomy and physiology, including the interplay between organelles, membrane transport, and cell-signaling; energy transfer through cells and through the biosphere; cellular reproduction and cancer; heredity and human genetic disorders; and protein synthesis and biotechnology. Explores the societal implications of such topics as biopharmaceuticals, ocean acidification, climate change, human diseases, epigenetics, cancer, and cloning.

**Corequisite(s):** BIOL 1112

## BIOL 1112 - Biological Principles 1 Laboratory

1 Credit

This course offers students an opportunity to collect quantitative data through hands-on experimentation as well as simulations. Data is analyzed statistically and presented in written form.

**Corequisite(s):** BIOL 1111

## BIOL 1200 - Ecological Issues and Society

3 Credits

This SLU Inquiry course provides scientific insights into a variety of popular press topics and everyday decisions about ecological issues. Topics include population harvesting, lawn and garden decisions, and global warming. For non-science majors.

**Attributes:** Catholic Studies-Elective, International Studies, International Studies-Health, Natural Science Req (A&S), UUC:Natural & Applied Science

## BIOL 1240 - General Biology: Information Flow and Evolution

3 Credits

This course is part of the two-semester General Biology sequence, and is primarily focused on the core concepts of information flow and storage as well as evolution. Students will learn about the chemical and molecular basis of life, cell structure and function, gene structure, expression and heredity, reproduction, development, and evolution. As they learn concepts in biology, students will practice reasoning scientifically about real-world problems and applications.

**Attributes:** CVNG Science Elec w/ Lab, Natural Science Req (A&S), UUC:Natural & Applied Science

## BIOL 1245 - Principles of Biology I Laboratory

1 Credit

This course covers experimental approaches used in molecular and cellular biology, genetics, and animal physiology. Students will learn to use scientific instruments and techniques implemented in these fields. Students will propose and test hypotheses, collect and analyze data, represent data visually, and practice written and oral scientific communication skills.

**Attributes:** CVNG Science Elec w/ Lab, Natural Science Req (A&S)

## BIOL 1260 - General Biology: Transformations of Energy and Matter

3 Credits

This course is part of the two-semester General Biology sequence, and is primarily focused on the core concept of transformations of energy and matter in a diversity of biological systems at all levels of organization. Students will learn about the chemical and molecular basis of life, cell structure and function, cellular metabolism, metabolism of multicellular organisms, homeostasis, regulation, and energy and matter transfer in ecosystems. As they learn concepts in biology, students will practice reasoning scientifically about real-world problems and applications.

**Attributes:** CVNG Science Elec w/ Lab, Natural Science Req (A&S)

## BIOL 1265 - Principles of Biology II Laboratory

1 Credit

This course covers the basic experimental approaches used in studying evolution, ecology, and community biology. Students will be taught how to use scientific instruments and laboratory techniques implemented in these fields. Students will learn to propose and test hypotheses and to collect, analyze and present data. In addition, they will gain experience in written and oral scientific communication skills.

**Attributes:** CVNG Science Elec w/ Lab, Natural Science Req (A&S)

## BIOL 1340 - Diversity of Life

3 Credits

This course will provide an overview of the diversity of life on Earth, as well as the diversity of the human species. Important local, national, and international issues and policies related to biodiversity and conservation will be discussed. For non-science majors.

**Attributes:** Catholic Studies-Elective, International Studies-Health, Natural Science Req (A&S), UUC:Natural & Applied Science

## BIOL 1460 - Exercise and Health

3 Credits

The course will explore exercise metabolism, how the body responds and adapts to exercise, and the health implications of physically active and sedentary lifestyles. For non-science majors.

**Attributes:** International Studies, International Studies-Health, Nutrition, Health, Well Fndation, Natural Science Req (A&S), UUC:Natural & Applied Science

**BIOL 1500 - Plants and People**

3 Credits

This course will give students an appreciation of the importance of plants in human society. An overview of plant form and function, investigates economic and social aspects of plants, and cultural aspects of human plant use. For non-science majors.

**Attributes:** Natural Science Req (A&S)

**BIOL 1550 - Biology: Self and Community**

1 Credit

This course will prepare first-year biology students for a successful transition to college, the SLU community, and the biology major. The course introduces students to the Jesuit mission of Saint Louis University; issues of diversity, equity, and inclusion; health and wellness resources, and exposure to St. Louis history and the city itself. The course also builds community among biology majors by introducing them to skills to help them be successful in their introductory science courses, learning about engagement opportunities within the biology department, career opportunities in biology, and the biology curriculum.

**Restrictions:**

Enrollment limited to students in the Biology department.

**Attributes:** UUC:Self in Community

**BIOL 1600 - Microbiology for Nursing**

3 Credits

Microbiology for Nursing is an overview of important groups of human pathogenic microorganisms to include structure, pathogenicity, epidemiology, diagnosis, and laboratory identification. Modes of action of selected antibiotics and chemotherapeutic agents are also discussed. Essential concepts for nurses to recognize infection, prevent the spread of infection, collect specimens, and ensure integrity of the specimens, communicate with the laboratory, and interpret laboratory reporting are also emphasized.

**Restrictions:**

Enrollment limited to students in the Valentine School of Nursing college.

**Attributes:** Natural Science Req (A&S)

**BIOL 1930 - Special Topics**

1-4 Credits (Repeatable for credit)

**Attributes:** Natural Science Req (A&S)

**BIOL 1931 - Special Topics**

3 Credits

**BIOL 1980 - Independent Study**

1-3 Credits (Repeatable for credit)

**Attributes:** Natural Science Req (A&S)

**BIOL 2600 - Human Physiology**

3 Credits

**Restrictions:**

Enrollment is limited to students with a program in Biomedical Engineering.

**Attributes:** Natural Science Req (A&S)

**BIOL 2800 - Biology for Education Majors**

0 or 4 Credits

This course is offered for elementary education majors. A variety of teaching methods will be used so that students with different learning styles may master the material. Curiosity and creativity are encouraged.

**Attributes:** Natural Science Req (A&S)

**BIOL 2930 - Special Topics**

3 Credits (Repeatable for credit)

**Attributes:** Natural Science Req (A&S)

**BIOL 2980 - Independent Study**

1-3 Credits (Repeatable for credit)

**Attributes:** Natural Science Req (A&S)

**BIOL 3010 - Evolutionary Biology**

0 or 3 Credits

This course explores the principles of evolutionary biology through a discussion/lecture format. Topics covered include the theory of evolution, origin of new species, genetics of populations, relative roles of selection, drift, mutation, and migration in the evolutionary process, evolutionary rates, and pre-biotic evolution.

**Prerequisite(s):** BIOL 1240, BIOL 1245, BIOL 1260, and BIOL 1265

**Attributes:** Biology Minor Elective, Forensic Science Bio/Chem Elec, Neuroscience - Biology, Natural Science Req (A&S)

**BIOL 3020 - Biochemistry and Molecular Biology**

0 or 3 Credits

This course on cellular/molecular biochemistry includes the synthetic flow of genetic information from DNA to RNA to protein (replication, transcription and translation), RNA and protein structure and function, enzymology, and energy flow (metabolism). It is designed as a foundation course for subsequent upper division cellular/molecular biology courses.

**Prerequisite(s):** (BIOL 1240, BIOL 1245, BIOL 1260, and BIOL 1265); (CHEM 1110 or CHEM 1130); (CHEM 1120 or CHEM 1140)

**Attributes:** Biology Minor Elective, Forensic Science Bio/Chem Elec, Natural Science Req (A&S)

**BIOL 3030 - Principles of Genetics**

0 or 3 Credits

This course covers the basic principles of genetics, including transmission genetics, molecular genetics, gene regulation, recombinant DNA technology and genomics. Throughout the course, there is an emphasis on the application of genetics to experimental and problem-solving situations. Though not a pre-requisite, completion of BIOL 3020 is recommended.

**Prerequisite(s):** BIOL 1240, BIOL 1245, BIOL 1260, BIOL 1265, CHEM 1110, CHEM 1115, CHEM 1120, and CHEM 1125

**Attributes:** Biology Minor Elective, Bio-Chemical Biology Elective, Chemical Biology Elective, Forensic Science Bio/Chem Elec, Neuroscience - Biology, Natural Science Req (A&S)

**BIOL 3040 - Cell Structure & Function**

3 Credits

This course explores how specific proteins, lipids, sugars and nucleic acids contribute to cellular processes and structure. The material covered here provides a good foundation for upper-level courses in Development, Physiology, Microbiology and Immunology.

**Prerequisite(s):** ((BIOL 1240, BIOL 1245, BIOL 1260, BIOL 1265, CHEM 1115, and CHEM 1125<sup>\*</sup>); (CHEM 1110 or CHEM 1130); (CHEM 1120<sup>\*</sup> or CHEM 1140<sup>\*</sup>))

<sup>\*</sup> Concurrent enrollment allowed.

**Attributes:** Biology Minor Elective, Bio-Chemical Biology Elective, Chemical Biology Elective, Bio-CM&DB Elective, Forensic Science Bio/Chem Elec, Natural Science Req (A&S)

**BIOL 3060 - Cell Structure & Function Laboratory**

1 Credit

A laboratory to teach basic techniques used in cell biology research. The course emphasizes foundational concepts in cell biology. Techniques taught may include: use of bright-field and fluorescence microscopy to visualize cells and subcellular structures, SDS-PAGE gels and western blots to analyze cell protein content, basic cell culture techniques, and flow cytometry to measure cell death and cell proliferation.

**Prerequisite(s):** BIOL 3040<sup>\*</sup>; CHEM 1120

<sup>\*</sup> Concurrent enrollment allowed.

**Attributes:** Bio-Chem/Molecular Lab, Biology Minor Elective, Bio-CB&P-Cell Biology Lab, Bio-CM&DB Elective, Bio-CM&DB Lab, Forensic Science Bio/Chem Lab, Neuroscience - Biology, Neuroscience - Biology Lab, Natural Science Req (A&S)

**BIOL 3070 - General Ecology**

3 Credits

An introduction to the science of ecology: study of general theories, models, and problems in population, community, and ecosystem levels.

**Prerequisite(s):** BIOL 1240; BIOL 1245; BIOL 1260; BIOL 1265

**Attributes:** Biology Minor Elective, Bio-EE&C-Eco & Evo Elective, Bio-EE&OB Elective, Forensic Science Bio/Chem Elec, Natural Science Req (A&S), UUC:Global Interdependence

**BIOL 3100 - Experiments in Genetics Lab**

1 Credit

Advanced experiments in classical and molecular genetics will be conducted by the students. Data will be collected, analyzed, and reported.

**Prerequisite(s):** BIOL 3030<sup>\*</sup>

<sup>\*</sup> Concurrent enrollment allowed.

**Attributes:** Bio-Chem/Molecular Lab, Biology Minor Elective, Bio-CM&DB Elective, Bio-CM&DB Lab, Forensic Science Bio/Chem Lab, Neuroscience - Biology, Neuroscience - Biology Lab, Natural Science Req (A&S)

**BIOL 3220 - Biology of Invertebrates**

4 Credits

This course surveys the invertebrate phyla with emphases on evolution, comparative morphology, life cycles, physiology, and ecology.

**Prerequisite(s):** BIOL 1240; BIOL 1260; BIOL 1265; BIOL 1245

**Attributes:** Biology Minor Elective, Bio-EE&C-Organismal Elective, Bio-EE&OB Elective, Bio-Ecol, Evol & Orga Elective, Natural Science Req (A&S)

**BIOL 3260 - Biology of Plants & Fungi**

0 or 4 Credits

An introduction to algae, fungi, and true plants comparing life cycles (alternation of generations) and functional anatomy/morphology. Half of the course emphasizes the four developmental stages in the life of seed plants: germination, establishment, maturation, and reproduction.

**Prerequisite(s):** BIOL 1240; BIOL 1260; BIOL 1265; CHEM 1120; BIOL 1245

**Attributes:** Biology Minor Elective, Bio-EE&C-Organismal Elective, Bio-EE&OB Elective, Bio-Ecol, Evol & Orga Elective, Bio-EE&OB Lab, Forensic Science Bio/Chem Elec, Forensic Science Bio/Chem Lab, Natural Science Req (A&S), Plant Science

**BIOL 3280 - Ethnobotany**

3 Credits

A modern synthesis of plant biology and the principles of cultural anthropology to compare the use of domesticated and wild plants. A comparison of tropical and temperate zone 'cases' requires field trips to the Missouri Botanical Garden.

**Prerequisite(s):** BIOL 1240; BIOL 1260; BIOL 1265; CHEM 1120; BIOL 1245

**Attributes:** Biology Minor Elective, Bio-EE&C-Organismal Elective, Bio-EE&OB Elective, Global Citizenship (CAS), International Studies-Health, Natural Science Req (A&S), Plant Science

**BIOL 3400X - Introduction to Neuroscience 1: Cellular, Molecular and Systemic**

3 Credits

This course teaches the fundamental anatomy and physiology of the nervous system. Clinical cases and neuroscience technologies will be discussed. The course covers cellular, molecular and organ-systemic aspects of the nervous system and relevant neuronal disorders.

**Prerequisite(s):** BIOL 3040<sup>\*</sup>

<sup>\*</sup> Concurrent enrollment allowed.

**BIOL 3420 - Comparative Anatomy of the Vertebrates**

0 or 5 Credits

Evolution of chordate morphology. Laboratory consists of the study of the structures of each major group of chordates with emphases on the dogfish shark and cat.

**Prerequisite(s):** BIOL 1240; BIOL 1260; BIOL 1265; CHEM 1120; BIOL 1245

**Restrictions:**

Enrollment limited to students in the Biology department.

**Attributes:** Biology Minor Elective, Bio-Cell Bio/Phys Elective, Bio-CB&P-Physiology Lab, Bio-CM&DB Elective, Bio-CM&DB Lab, Bio-EE&C-Eco & Evo Elective, Bio-EE&C-Evolution Elective, Bio-EE&OB Elective, Bio-Ecol, Evol & Orga Elective, Bio-EE&OB Lab, Forensic Science Bio/Chem Elec, Forensic Science Bio/Chem Lab, Neuroscience - Biology, Neuroscience - Biology Lab, Natural Science Req (A&S)

**BIOL 3450 - Economic Botany**

3 Credits

Overview of plant form and function, followed by investigations into economic and social aspects of plants, including origin of important crops and health impacts. Learn how foods and spices drove world exploration, and develop your ability to critically assess modern agricultural practices, including ethics of bioprospecting and genetically modified foods. Satisfies upper-division plant biology requirement.

**Prerequisite(s):** BIOL 1260, BIOL 1265, BIOL 1240, and BIOL 1245

**Attributes:** Biology Minor Elective, Bio-EE&C-Ecology Elective, Bio-EE&C-Organismal Elective, Bio-EE&OB Elective, Bio-Ecol, Evol & Orga Elective, Forensic Science Bio/Chem Elec, Natural Science Req (A&S), Plant Science

**BIOL 3470 - General Physiology Laboratory**

1 Credit

This stand-alone laboratory course is designated to supplement and reinforce material presented in the BIOL-4540, but also covers topics beyond the scope of that syllabus, largely through computer-based interactive physiology programs, and the acquisition and analysis of cardiovascular, neuromuscular, and respiratory systems data using the PowerLab human physiology teaching system. Problems involving inquiry-based learning are also assigned.

**Prerequisite(s):** (BIOL 4540\* or BIOL 4460\*)

\* Concurrent enrollment allowed.

**Attributes:** Biology Minor Elective, Bio-CB&P-Physiology Lab, Bio-CM&DB Elective, Bio-CM&DB Lab, Forensic Science Bio/Chem Lab, Neuroscience - Biology, Neuroscience - Biology Lab, Natural Science Req (A&S)

**BIOL 3490 - Plant Physiology**

3 Credits

Principles of plant physiology: growth, phytohormones, flowering, photosynthesis, water relations, mineral nutrition, translocation in higher plants.

**Prerequisite(s):** BIOL 1240; BIOL 1260; BIOL 1265; CHEM 1120; BIOL 1245

**Attributes:** Biology Minor Elective, Bio-Chemical Biology Elective, Chemical Biology Elective, Bio-Cell Bio/Phys Elective, Bio-CM&DB Elective, Forensic Science Bio/Chem Elec, Natural Science Req (A&S), Plant Science

**BIOL 3550X - Neuroscience Laboratory**

1 Credit

This course introduces to students basic neuroanatomy, as well as cellular and molecular neuroscience through hands-on laboratory exercises using a variety of techniques such as electrophysiology, computational neuroscience, immunohistochemistry, pharmacology, and cell culture. Students will design and conduct their own group projects.

**Prerequisite(s):** (NEUR 3400, BIOL 3400, or BIOL 3400X)

**BIOL 3910 - Internship**

1-6 Credits (Repeatable for credit)

**Prerequisite(s):** CORE 1500\*; (CORE 1000 or UIS with a minimum score of S)

\* Concurrent enrollment allowed.

**Attributes:** UUC:Reflection-in-Action

**BIOL 3930 - Special Topics**

1-3 Credits (Repeatable for credit)

**Restrictions:**

Enrollment is limited to students with a major in Biology.

**Attributes:** Natural Science Req (A&S)

**BIOL 3970 - Independent Research in Biology**

1-3 Credits (Repeatable for credit)

Biology research under the direction of a faculty member of the department.

**Attributes:** Natural Science Req (A&S)

**BIOL 3980 - Independent Study**

1-3 Credits (Repeatable for credit)

**Attributes:** Natural Science Req (A&S)

**BIOL 4010 - Sex, Evolution, and Behavior**

3 Credits

This course is an in-depth examination of evolutionary theories concerning the sexual reproduction, parthenogenesis, mate choice, sexual selection, life history strategies, and sex allocation. Specialized topics such as pheromone communication will also be covered.

**Prerequisite(s):** BIOL 3010

**Attributes:** Biology Minor Elective, Bio-EE&C-Ecology Elective, Bio-EE&C-Evolution Elective, Bio-EE&OB Elective, Bio-Ecol, Evol & Orga Elective, Neuroscience - Biology, Natural Science Req (A&S)

**BIOL 4030 - Introduction to Genomics**

3 Credits

This course introduces core concepts, techniques and analytical methods of genomics. The topics of this course include: genome projects; structure, components and evolutionary dynamics of genomes; sequencing, mapping and assembly techniques; online resources, databases and analytical methods for genomic studies.

**Prerequisite(s):** BIOL 3020; BIOL 3030

**Attributes:** Bio-Chem/Molecular Elective, Biology Minor Elective, Bio-CM&DB Elective, Bio-EE&C-Tools Elective, Forensic Science Bio/Chem Elec, Neuroscience - Biology, Natural Science Req (A&S)

**BIOL 4050 - Molecular Techniques Lab**

2 Credits

This course will provide students with experience in the theory and practice of molecular biology techniques. Topics to be covered include DNA isolation, cloning, PCR, DNA sequencing, and bioinformatics.

**Prerequisite(s):** (BIOL 3020 or BIOL 3030)

**Attributes:** Bio-Chem/Molecular Lab, Biology Minor Elective, Bio-CB&P-Cell Biology Lab, Bio-CM&DB Elective, Bio-CM&DB Lab, Bio-EE&C-Tools Elective, Forensic Science Bio/Chem Lab, Neuroscience - Biology, Neuroscience - Biology Lab, Natural Science Req (A&S)

**BIOL 4070 - Advanced Biological Chemistry**

3 Credits

This course is designed to increase students' understanding of biochemical principles, current research questions, and biochemical strategies to answer these questions. Topics covered will include protein structure and function, enzymology, protein engineering, experimental design and interpretation of results.

**Prerequisite(s):** BIOL 3020; BIOL 3040

**Attributes:** Bio-Chem/Molecular Elective, Biology Minor Elective, Bio-CM&DB Elective, Neuroscience - Biology, Natural Science Req (A&S)

**BIOL 4090 - Plant Ecology**

0-4 Credits

In this course we will explore big questions in plant ecology, through conducting our own ecological research, exploring local plant communities, and reading general background materials and scientific literature.

**Prerequisite(s):** BIOL 1240; BIOL 1260; BIOL 1265; CHEM 1120; BIOL 1245

**Attributes:** Bio-EE&C-Eco & Evo Elective, Natural Science Req (A&S), Plant Science

**BIOL 4100 - Natural History of Vertebrates**

0 or 4 Credits

Prominent morphological, behavioral, physiological and ecological features of fishes, amphibia, reptiles, birds, and mammals. Week-end field trips are required.

**Prerequisite(s):** BIOL 1240; BIOL 1260; BIOL 1265; CHEM 1120; BIOL 1245

**Attributes:** Biology Graduate Elective, Biology Minor Elective, Bio-EE&C-Organismal Elective, Bio-EE&OB Elective, Bio-Ecol, Evol & Orga Elective, Bio-EE&OB Lab, Forensic Science Bio/Chem Elec, Forensic Science Bio/Chem Lab, Natural Science Req (A&S)

**BIOL 4115 - Forest Park Living Lab Field Ecology Techniques**

1 Credit

A one credit field-based course designed to introduce students to some of the fundamental research concepts and techniques used in Ecology and conservation. These include following the scientific method to develop research questions and testable hypotheses, designing robust experiments and surveys, basic navigation and orienteering skills, sampling techniques in terrestrial and aquatic ecosystems, data analysis, and reporting of results and conclusions. Technical themes of the course will focus on techniques for estimating the abundance of populations, the biological diversity of communities and ecological interactions.

**Prerequisite(s):** BIOL 1240; BIOL 1260; BIOL 1265; BIOL 1245

**Attributes:** Biology Minor Elective, Bio-EE&C-Tools Elective, Bio-EE&OB Lab, Natural Science Req (A&S)

**BIOL 4120 - Field Botany**

5 Credits

This field-based course introduces students to the diversity of plant communities in the Ozark Mountain region of Missouri and to the tools scientists use to quantify that diversity. Class and laboratory activities will be conducted at Reis Biological Field Station and at nearby parks and natural areas.

**Prerequisite(s):** BIOL 1240; BIOL 1260; BIOL 1265; BIOL 1245

**Corequisite(s):** BIOL 4130, BIOL 4140, BIOL 4980

**Attributes:** Biology Graduate Elective, Biology Minor Elective, Bio-EE&C-Evolution Elective, Bio-EE&OB Elective, Bio-Ecol, Evol & Orga Elective, Bio-EE&OB Lab, Natural Science Req (A&S), Plant Science

**BIOL 4130 - Field Mammalogy**

5 Credits

This course examines the evolution, physiology, ecology and behavior of mammals. Emphasis on field identification and field methods used to study the behavior and ecology of mammals. The course is taught at the Reis Biological Field station. Students cannot receive credit for this course and Biology of Mammals (BIOL-4380).

**Prerequisite(s):** BIOL 1240; BIOL 1260; BIOL 1265; BIOL 1245

**Corequisite(s):** BIOL 4120, BIOL 4140, BIOL 4980

**Attributes:** Biology Graduate Elective, Biology Minor Elective, Bio-EE&C-Organismal Elective, Bio-EE&OB Elective, Bio-Ecol, Evol & Orga Elective, Bio-EE&OB Lab, Natural Science Req (A&S)

**BIOL 4140 - Field Ornithology**

5 Credits

This course examines the evolution, physiology, ecology and behavior of birds. Emphasis on field identification and field methods used to study bird behavior and ecology. The course is taught at the Reis Biological Field station. Students cannot receive credit for this course and Biology of Birds (BIOL-4310).

**Prerequisite(s):** BIOL 1240; BIOL 1260; BIOL 1265; BIOL 1245

**Corequisite(s):** BIOL 4120, BIOL 4130, BIOL 4980

**Attributes:** Biology Graduate Elective, Biology Minor Elective, Bio-EE&C-Ecology Elective, Bio-EE&C-Organismal Elective, Bio-EE&OB Elective, Bio-Ecol, Evol & Orga Elective, Bio-EE&OB Lab, Natural Science Req (A&S)

**BIOL 4160 - Microbial Ecology and Molecular Evolution**

4 Credits

In this course-based undergraduate research experience (CURE) course, students will learn cutting-edge topics in microbial ecology and molecular evolution and will engage in the scientific process – the scientific method. The course is centered around two questions in microbial ecology and molecular evolution: “What is the extent of bacterial diversity in terrestrial ecosystems?” and “What are the primary roles of microbes living in terrestrial ecosystems?”. In groups, students will design and carryout experimental plans to test two hypotheses for two chosen soil systems: biodiversity hypothesis (who is there?) and an organismal activity hypothesis (what are they doing?). As a culminating exercise, the students prepare a poster presentation and present to each other and the instructor.

**Prerequisite(s):** (BIOL 3020\* or BIOL 3070\*)

\* Concurrent enrollment allowed.

**Attributes:** Bio-Chem/Molecular Lab, Biology Graduate Elective, Biology Minor Elective, Bio-CB&P-Cell Biology Lab, Bio-Cell Bio/Phys Elective, Bio-CM&DB Elective, Bio-CM&DB Lab, Bio-EE&C-Tools Elective, Bio-EE&OB Elective, Bio-EE&OB Lab, Forensic Science Bio/Chem Elec, Forensic Science Bio/Chem Lab, Natural Science Req (A&S)

**BIOL 4190 - GIS in Biology**

3 Credits

This course provides an introduction to the application of Geographic Information System (GIS) techniques to research in organismal biology. The goal of this course is to provide training in the spatial analysis of biodiversity using GIS software. The course will involve an integration of lectures, group discussions, and computer exercises.

**Restrictions:**

Enrollment limited to students in the Biology department.

**Attributes:** Biology Minor Elective, Bio-EE&C-Tools Elective, Bio-EE&OB Elective, Natural Science Req (A&S), Public Health Major Elective

**BIOL 4200 - Aquatic Ecology**

0 or 4 Credits

An exploration of freshwater ecosystems in Missouri including springs, rivers, and lakes. The course will explore the diversity of living organisms, both animals and plants, found in these ecosystems. A major goal will be to understand how the physical and chemical properties of water affect the abundance and diversity of aquatic organisms. Week-end field trips are required. This course is also taught during the summer at the Reis Field Station.

**Prerequisite(s):** BIOL 1240; BIOL 1260; BIOL 1265; BIOL 1245

**Attributes:** Biology Graduate Elective, Biology Minor Elective, Bio-EE&C-Ecology Elective, Bio-EE&OB Elective, Bio-Ecol, Evol & Orga Elective, Bio-EE&OB Lab, Natural Science Req (A&S)

**BIOL 4240 - General and Medical Entomology**

0 or 4 Credits

This course is a survey of the natural history, classification, and phylogeny of insects, with an emphasis on common insects. The course also covers the role of insects in human and animal health, ecosystem processes and food production.

**Attributes:** Biology Minor Elective, Bio-EE&OB Elective, Bio-Ecol, Evol & Orga Elective, Bio-EE&OB Lab, Natural Science Req (A&S)

**BIOL 4250 - Neurobiology of Disease**

3 Credits

This course takes a problem-based learning approach to study fundamental aspects of diseases affecting the nervous system. Students will gain an understanding of basic cellular and molecular concepts related to neurobiological disorders and the experimental approaches used to investigate them.

**Prerequisite(s):** BIOL 3040; BIOL 3020

**Attributes:** Bio-Cell Bio/Phys Elective, Bio-CM&DB Elective, Forensic Science Bio/Chem Elec, Neuroscience - Biology, Natural Science Req (A&S)

**BIOL 4260 - Biology of Amphibians and Reptiles**

0 or 4 Credits

Lecture three hours, laboratory four hours per week. This course is a survey of the diversity, natural history, evolution, and biology of amphibians and reptiles. Week-end field trips are required.

**Prerequisite(s):** BIOL 1240; BIOL 1260; BIOL 1265; CHEM 1120; BIOL 1245

**Attributes:** Biology Graduate Elective, Biology Minor Elective, Bio-EE&C-Organismal Elective, Bio-EE&OB Elective, Bio-Ecol, Evol & Orga Elective, Bio-EE&OB Lab, Natural Science Req (A&S)

**BIOL 4280 - Biology of Fishes**

0 or 4 Credits

Introduction of the study of fishes: systematics, ecology, behavior, evolution, and the economic importance of freshwater and marine fishes. Laboratory acquaints students with 80 of the 400 fish families. Week-end field trips are required to study the Missouri fish fauna.

**Prerequisite(s):** BIOL 1240; BIOL 1260; BIOL 1265; CHEM 1120; BIOL 1245

**Attributes:** Biology Graduate Elective, Biology Minor Elective, Bio-EE&C-Organismal Elective, Bio-EE&OB Elective, Bio-Ecol, Evol & Orga Elective, Bio-EE&OB Lab, Natural Science Req (A&S)

**BIOL 4320 - Cave Biology**

4 Credits

An introduction to the study of caves. Emphasis will be placed on the systematics of cave organisms and on the adaptations that cave organisms possess to exist in an energy poor environment. Field work will involve studying cave systems in the Ozarks of Missouri. This course is taught during the summer at the Reis Field Station.

**Prerequisite(s):** BIOL 1240; BIOL 1260; BIOL 1265; CHEM 1120; BIOL 1245

**Attributes:** Biology Graduate Elective, Biology Minor Elective, Bio-EE&OB Elective, Bio-EE&OB Lab, Natural Science Req (A&S)

**BIOL 4330 - Spring Flora of the Ozarks**

4 Credits

A field-based course designed to acquaint students with the spring flora of the Ozarks. Students will learn to recognize common Missouri plant families and to identify plant species using taxonomic keys. Includes discussion of the major phytogeographic areas of Missouri and the biotic and abiotic factors that define them. Course is offered in May and is based at the Reis Field Station, but also includes off-site trips to state parks and conservation areas.

**Prerequisite(s):** BIOL 1240; BIOL 1260; BIOL 1265; CHEM 1120; BIOL 1245

**Attributes:** Biology Graduate Elective, Biology Minor Elective, Bio-EE&C-Organismal Elective, Bio-EE&OB Elective, Bio-Ecol, Evol & Orga Elective, Bio-EE&OB Lab, Natural Science Req (A&S), Plant Science

**BIOL 4360 - Animal Behavior**

3 Credits

This course surveys the vast diversity of behaviors among all taxa of animals, including humans. Topics covered: the mechanisms that produce and modify behavior at the genetic, endocrine, and neural levels; and how the environment interacts with the biology of species in order to modify behaviors that lead to optimized evolutionary fitness.

**Prerequisite(s):** BIOL 1260; BIOL 1265; BIOL 1240; BIOL 1245

**Attributes:** Biology Graduate Elective, Biology Minor Elective, Bio-EE&C-Ecology Elective, Bio-EE&OB Elective, Bio-Ecol, Evol & Orga Elective, Forensic Science Bio/Chem Elec, Neuroscience - Biology, Natural Science Req (A&S)

**BIOL 4370 - Animal Behavior Lab**

1 Credit

This laboratory course will introduce hypothesis testing, techniques, designing protocols, and statistical analyses used in the study of animal behavior in the laboratory and in the field.

**Prerequisite(s):** BIOL 1240; BIOL 1260; BIOL 1265; BIOL 4360\*; BIOL 1245; BIOL 3020; BIOL 3040

\* Concurrent enrollment allowed.

**Attributes:** Biology Graduate Elective, Biology Minor Elective, Bio-EE&OB Elective, Bio-EE&OB Lab, Forensic Science Bio/Chem Lab, Neuroscience - Biology, Neuroscience - Biology Lab, Natural Science Req (A&S)

**BIOL 4410 - Comparative Animal Physiology**

3 Credits

Functional adaptations of vertebrates and invertebrates to their environment (e.g. desert, arctic, high altitude, etc.).

**Prerequisite(s):** BIOL 3020

**Attributes:** Biology Graduate Elective, Biology Minor Elective, Bio-Cell Bio/Phys Elective, Bio-CM&DB Elective, Bio-EE&C-Organismal Elective, Bio-EE&C-Evolution Elective, Bio-Ecol, Evol & Orga Elective, Forensic Science Bio/Chem Elec, Neuroscience - Biology, Natural Science Req (A&S)

**BIOL 4420 - Antibiotic Resistance and Antibiotic Discovery**

2 Credits

This course-based undergraduate research experience (CURE) is designed to actively engage students in the creative process of scientific inquiry, provide skills necessary for success in the modern research laboratory, and foster excitement about the drug discovery process. This course is designed to integrate curiosity, connections, and value while actively engaging in the process of science, in the backdrop of addressing one of the most pressing global health challenges of our century—the diminishing supply of effective antibiotics. This course aims to actively answer questions addressing the antibiotic crisis: “What is the prevalence of antibiotic resistance in soil microbes?”, “Are there novel antibiotics left to be discovered in diverse soil microorganisms?”, “What combination(s) of natural products could be used as antibiotics?”. As a culminating exercise, the students prepare and present a poster presentation describing their results from their authentic research experience.

**Prerequisite(s):** (BIOL 1240, BIOL 1245, BIOL 1260, or BIOL 1265)

**Attributes:** Bio-Chem/Molecular Elective, Bio-Chem/Molecular Lab, Biology Minor Elective, Bio-CB&P-Cell Biology Lab, Bio-CM&DB Elective, Bio-CM&DB Lab, Cellular/Molecular Lab, Bio-EE&C-Eco & Evo Elective, Natural Science Req (A&S)

**BIOL 4430 - Principles of Virology**

3 Credits

This class will explore the principles of: viral replication, viral spread within a host, viral maintenance within populations, viral pathogenesis, viral control by the immune system, and viral evolution. Students will learn the experimental and model systems that have been used to study viruses.

**Prerequisite(s):** BIOL 3040; BIOL 3020

**Attributes:** Bio-Chem/Molecular Elective, Biology Minor Elective, Bio-Cell Bio/Phys Elective, Bio-CM&DB Elective, Forensic Science Bio/Chem Elec, Natural Science Req (A&S)

**BIOL 4440 - Vertebrate Histology: Structure and Function of Tissues**

0 or 4 Credits

Function and microscopic morphology of vertebrate tissues.

**Prerequisite(s):** BIOL 1240; BIOL 1260; BIOL 1265; CHEM 1120; BIOL 1245

**Attributes:** Biology Graduate Elective, Biology Minor Elective, Bio-Cell Bio/Phys Elective, Bio-CB&P-Physiology Lab, Bio-CM&DB Elective, Bio-CM&DB Lab, Forensic Science Bio/Chem Elec, Forensic Science Bio/Chem Lab, Neuroscience - Biology, Neuroscience - Biology Lab, Natural Science Req (A&S)

**BIOL 4460 - Exercise Physiology**

3 Credits

Using exercise biochemistry as a foundation, this course will examine the responses and adaptations to physical exercise and /or inactivity, with special emphases on health, energy metabolism, and endocrinology.

**Prerequisite(s):** BIOL 3040

**Attributes:** Biology Minor Elective, Bio-Cell Bio/Phys Elective, Bio-CM&DB Elective, Natural Science Req (A&S)

**BIOL 4480 - Conservation Biology**

3 Credits

Fundamental principles of biodiversity maintenance through the management of ecosystems and populations. This course will examine conservation at the level of species, population, and ecosystems.

**Prerequisite(s):** BIOL 1240; BIOL 1260; BIOL 1265; BIOL 1245

**Attributes:** Biology Graduate Elective, Biology Minor Elective, Bio-EE&C-Ecology Elective, Bio-EE&OB Elective, Bio-Ecol, Evol & Orga Elective, Forensic Science Bio/Chem Elec, Natural Science Req (A&S)

**BIOL 4520 - Biochemical Pharmacology**

3 Credits

This course is designed to give students a good understanding of fundamental principles of pharmacology. Specifically, the course will focus on how drugs interact with various targets in the body and how body affects these compounds. The course begins with basic principles of pharmacology, pharmacokinetics and pharmacodynamics such as sites of drug action, agonists and antagonists, receptor theories and dose response relationships, drug absorption, distribution, metabolism, and elimination. It also covers GPCR, cell excitation, nitric oxide, eicosanoid mediators and related drugs, intermediate metabolism and related drugs, chemotherapy of infectious diseases and tumor, RNA as new drug targets, and pharmacogenomics. (Offered every Spring)

**Prerequisite(s):** BIOL 3040; BIOL 3020

**Attributes:** Bio-Chem/Molecular Elective, Biology Minor Elective, Chemical Biology Elective, Bio-Cell Bio/Phys Elective, Bio-CM&DB Elective, Forensic Science Bio/Chem Elec, Neuroscience - Biology, Natural Science Req (A&S)

**BIOL 4540 - Human Systemic Physiology**

3 Credits

This course examines the mechanisms of organ system function in humans, including the general principles of homeostasis as they relate to basic endocrine, neural, muscle, cardiovascular, pulmonary and renal physiology.

**Prerequisite(s):** BIOL 3020\*

\* Concurrent enrollment allowed.

**Restrictions:**

Students in the Madrid Campus department may **not** enroll.

**Attributes:** Biology Graduate Elective, Biology Minor Elective, Bio-CM&DB Elective, Forensic Science Bio/Chem Elec, Neuroscience - Biology, Natural Science Req (A&S)

**BIOL 4580 - Applied Population Genetics**

3 Credits

Population genetics is the study of the origin, amount, and distribution of genetic variation in populations, and the fate of this variation over time and across space. This course integrates population genetic theory, empirical studies derived from contemporary literature, and hands-on experience with software applications.

**Prerequisite(s):** BIOL 3010; BIOL 3030

**Attributes:** Biology Minor Elective, Bio-EE&C-Evolution Elective, Bio-EE&OB Elective, Bio-Ecol, Evol & Orga Elective, Forensic Science Bio/Chem Elec, Natural Science Req (A&S)

**BIOL 4600 - Developmental Biology**

3 Credits

This course investigates cellular and molecular mechanisms responsible for building multicellular organisms. Topics include fertilization, cleavage, gastrulation, axis specification, and organogenesis, with particular attention devoted to the experimental basis for current models. The connections between developmental biology and medical and environmental issues will also be considered. Textbook reading assignments will be supplemented by selected articles from the scientific literature.

**Prerequisite(s):** BIOL 3020; BIOL 3040

**Attributes:** Biology Minor Elective, Bio-Cell Bio/Phys Elective, Bio-CM&DB Elective, Neuroscience - Biology, Natural Science Req (A&S)

**BIOL 4610 - Developmental Biology Lab**

2 Credits

This laboratory course is designed to supplement and reinforce material presented in BIOL-4600 through observation and experimental manipulation of developing organisms. Living invertebrate and vertebrate model organisms will be used. Approximately two hours for observations will be required outside of scheduled lab times to be arranged at the mutual convenience of each student and the instructor.

**Prerequisite(s):** BIOL 4600\*

\* Concurrent enrollment allowed.

**Restrictions:**

Enrollment is limited to students with a major in Biology.

**Attributes:** Bio-CB&P-Cell Biology Lab, Bio-CM&DB Elective, Bio-CM&DB Lab, Neuroscience - Biology, Neuroscience - Biology Lab, Natural Science Req (A&S)

**BIOL 4630 - Foundations of Immunobiology**

3 Credits

The cellular and molecular basis of immune function. Topics include receptors on T, B, and antigen presenting cells, cytokine networking, complement, function of the major histocompatibility complex, hypersensitivity of the immune system, and infection by HIV.

**Prerequisite(s):** BIOL 3040; BIOL 3020

**Attributes:** Biology Minor Elective, Bio-Chemical Biology Elective, Chemical Biology Elective, Bio-Cell Bio/Phys Elective, Bio-CM&DB Elective, Forensic Science Bio/Chem Elec, Neuroscience - Biology, Natural Science Req (A&S)

**BIOL 4635 - Immunobiology Lab**

1 Credit

This course is intended as an introduction to immunological methods for advanced undergraduate biology students & other scientists from diverse fields who want to know more about the immune system. Students will learn the theory and application of immunological methods including flow cytometry.

**Prerequisite(s):** (BIOL 3020, BIOL 3040, or BIOL 4630\*)

\* Concurrent enrollment allowed.

**Attributes:** Biology Graduate Elective, Biology Minor Elective, Bio-CB&P-Cell Biology Lab, Bio-CM&DB Lab, Cellular/Molecular Lab, Natural Science Req (A&S)

**BIOL 4640 - General Microbiology**

3 Credits

General introduction to the diversity, bioenergetics, growth, genetics, and ecology of microorganisms. Special emphasis will be placed on molecular and genomic methods used in the characterization of microorganisms.

**Prerequisite(s):** BIOL 3020; BIOL 3040

**Attributes:** Biology Graduate Elective, Biology Minor Elective, Bio-Chemical Biology Elective, Chemical Biology Elective, Bio-Cell Bio/Phys Elective, Bio-CM&DB Elective, Bio-EE&C-Organismal Elective, Bio-Ecol, Evol & Orga Elective, Forensic Science Bio/Chem Elec, Natural Science Req (A&S)

**BIOL 4650 - General Microbiology Laboratory**

2 Credits

Basic techniques in handling bacteria, identifying microorganisms and investigating microbial growth and metabolism.

**Prerequisite(s):** BIOL 3020; BIOL 3040; BIOL 4640\*

\* Concurrent enrollment allowed.

**Attributes:** Bio-Chem/Molecular Lab, Biology Graduate Elective, Biology Minor Elective, Bio-CB&P-Cell Biology Lab, Bio-CM&DB Elective, Bio-CM&DB Lab, Forensic Science Bio/Chem Lab, Natural Science Req (A&S)

**BIOL 4670 - Population Biology**

3 Credits

This course covers theoretical and empirical investigations at the population level. Major topics include population and growth dynamics, population regulation, the evolution of life, histones, ecological interactions between populations, and the evolutionary ecology of populations.

**Prerequisite(s):** BIOL 1240; BIOL 1260; BIOL 1265; CHEM 1120; BIOL 1245

**Attributes:** Biology Minor Elective, Bio-EE&OB Elective, Bio-Ecol, Evol & Orga Elective, Natural Science Req (A&S)

**BIOL 4700 - Molecular Biology**

3 Credits

A study of genes and genomes, and the processes that control their expression. Special emphasis will be placed on techniques used to analyze and manipulate nucleic acids and proteins, including bioinformatics approaches.

**Prerequisite(s):** BIOL 3020; BIOL 3030

**Attributes:** Bio-Chem/Molecular Elective, Biology Minor Elective, Bio-Chemical Biology Elective, Chemical Biology Elective, Bio-CM&DB Elective, Forensic Science Bio/Chem Elec, Neuroscience - Biology, Natural Science Req (A&S)

**BIOL 4720 - Cancer Biology**

3 Credits

This course focuses on the molecular, cellular, and genetic characteristics of cancerous tissues; cancer epidemiology, diagnosis, and therapies will also be discussed. The course is in lecture format with some classes reserved for student presentations and discussion of primary research articles.

**Prerequisite(s):** BIOL 3020; BIOL 3040

**Restrictions:**

Enrollment limited to students in the Biology department.

**Attributes:** Bio-Chem/Molecular Elective, Biology Graduate Elective, Biology Minor Elective, Bio-Cell Bio/Phys Elective, Bio-CM&DB Elective, Forensic Science Bio/Chem Elec, Neuroscience - Biology, Natural Science Req (A&S)

**BIOL 4760 - General Ecology Laboratory**

1 Credit

This is a field based lab involving exposure to natural settings and interacting with plants and animals (mostly insects). Students should become familiar with some general methods commonly used in field studies and how to collect data, set up sampling protocols, and execute field experiments. Small groups will explore an ecological question and conduct an independent research project.

**Prerequisite(s):** BIOL 1240; BIOL 1260; BIOL 1265; BIOL 1245

**Corequisite(s):** BIOL 3070

**Attributes:** Bio-CM&DB Elective, Bio-EE&OB Elective, Bio-EE&OB Lab, Forensic Science Bio/Chem Lab

**BIOL 4780 - Ecosystems Ecology**

3 Credits

This course covers structures, processes, and theories that encompass the field of ecology. Life on Earth is dependent on the flow of energy, nutrient cycling, and ecological organization. Human civilization is especially dependent on ecosystem services provided by plants, animals and microbes around the world. Global change is resulting in rapid loss of biodiversity jeopardizing the provisioning of nature's benefits to people. At the same time, we are facing two major existential challenges, global biodiversity loss and global change. This course will cover the necessary information for students to engage in scientific work and contribute to environmental justice and equity.

**Prerequisite(s):** BIOL 1260; BIOL 1265; BIOL 3070

**Attributes:** Biology Minor Elective, Bio-EE&C-Ecology Elective, Bio-EE&OB Elective, Natural Science Req (A&S)

**BIOL 4790 - Biometry**

0 or 4 Credits

This course is intended for students pursuing a biology major or minor. College-level algebra and general biology are required. The course will cover biological distributions and probabilities; the application of hypothesis testing; the relationship between biological and statistical hypothesis; the nature of biological data and sampling regimes, and how these fit within the scientific method.

**Prerequisite(s):** BIOL 1240; BIOL 1260; BIOL 1265; CHEM 1120; BIOL 1245

**Restrictions:**

Enrollment limited to students in the Biology department.

**Attributes:** Biology Minor Elective, Bio-Chemical Biology Elective, Chemical Biology Elective, Forensic Science Bio/Chem Elec, Natural Science Req (A&S)

**BIOL 4890 - Senior Inquiry: Comprehensive Examination**

1 Credit

Permission of department chairperson required.

**Prerequisite(s):** BIOL 1240; BIOL 1260; BIOL 1265; CHEM 1120; BIOL 1245

**Attributes:** Neuroscience - Capstone, Natural Science Req (A&S)

**BIOL 4910 - Internship in Conservation**

1-6 Credits (Repeatable for credit)

Students will work with professional conservation/environmental biologists to get practical experience. Students may work with conservation biologists associated with the EPA, Missouri Conservation Department, Corps of Engineers, or private environmental consulting firms. Environmental problems treated within the framework of fundamental ecological principles.

**Prerequisite(s):** BIOL 4480; (CORE 1000 or UIS with a minimum score of S); CORE 1500\*

\* Concurrent enrollment allowed.

**Attributes:** Biology Graduate Elective, Natural Science Req (A&S), UUC:Reflection-in-Action

**BIOL 4911 - Integrated Bioinformatics Internship**

1-3 Credits

Students will work with laboratories conducting molecular biology/bioinformatics research to gain practical experience. Internships will include research and development laboratories of local biotechnology companies, and in the departments of Biology, Chemistry, Mathematics, Statistics or Computer Science.

**Prerequisite(s):** BIOL 1240; BIOL 1260; BIOL 1265; CHEM 1120; BIOL 1245; CORE 1500\*; (CORE 1000 or UIS with a minimum score of S)

\* Concurrent enrollment allowed.

**Attributes:** Natural Science Req (A&S), UUC:Reflection-in-Action

**BIOL 4912 - Internship in Plant Science**

1-3 Credits (Repeatable for credit)

Students work with professional plant scientists to gain practical experience. Students may work with scientists at botanical gardens or arboreta, the EPA, Missouri Department of Conservation, the Donald Danforth Plant Sciences Center, Monsanto, or other biotech firms.

**Prerequisite(s):** BIOL 1240; BIOL 1260; BIOL 1265; CHEM 1120; BIOL 1245; CORE 1500\*; (CORE 1000 or UIS with a minimum score of S)

\* Concurrent enrollment allowed.

**Attributes:** Biology Graduate Elective, Natural Science Req (A&S), UUC:Reflection-in-Action

**BIOL 4930 - Special Topics**

1-4 Credits (Repeatable for credit)

**Prerequisite(s):** BIOL 3020; BIOL 3030; BIOL 3040

**Attributes:** Natural Science Req (A&S)

**BIOL 4960 - Independent Research**

1-3 Credits (Repeatable for credit)

This course provides an opportunity for first and second year students to carry out independent study and research. Permission of the Instructor required. Course goals, content and meeting times to be determined by the instructor.

**Attributes:** Natural Science Req (A&S)

**BIOL 4970 - Advanced Independent Research**

1-4 Credits (Repeatable for credit)

Advanced Independent Research.

**Prerequisite(s):** 6 Credits from BIOL3000-4999

**Attributes:** Neuroscience - Capstone, Natural Science Req (A&S)

**BIOL 4980 - Advanced Independent Study**

1-3 Credits (Repeatable for credit)

Advanced Independent Study.

**Attributes:** Neuroscience - Capstone, Natural Science Req (A&S)

**BIOL 5000 - Problems in Vertebrate Morphology**

2-5 Credits

Studies of the gross and microscope anatomy of the organs and organ systems of vertebrates. Gross dissection and histological preparation of selected structures in typical vertebrates of different classes.

**Attributes:** Biology Graduate Elective

**BIOL 5030 - Genomics**

3 Credits

This course introduces core concepts, techniques and analytical methods of genomics. The topics of this course include: genome projects; structure, components and evolutionary dynamics of genomes; sequencing, mapping and assembly techniques; online resources, databases and analytical methods for genomic studies.

**Prerequisite(s):** BIOL 3030**Attributes:** Biology Graduate Elective**BIOL 5050 - Molecular Techniques Lab**

2 Credits

Students will learn principles of molecular biology and recombinant DNA technology, and will gain hands-on experience with nucleic acid isolation, cloning, sequencing, and analysis.

**Attributes:** Bioinformatics & Comp Bio Elec, Biology Graduate Elective**BIOL 5070 - Advanced Biological Chemistry**

3 Credits

An in-depth analysis of selected topics in biological chemistry. Topics may include for example, protein structure and function, and nucleotides and nucleic acids.

**Attributes:** Bioinformatics & Comp Bio Elec, Biology Graduate Elective**BIOL 5080 - Advanced Cell Biology**

3 Credits

This course is designed to deepen students' understanding of cell biology principles, experimental strategies, and current research questions. Topics covered will include how different categories of molecules regulate cellular activity and literature, experimental design and interpretation of results.

**Attributes:** Bioinformatics & Comp Bio Elec, Biology Graduate Elective, BME Graduate Elective**BIOL 5090 - Biometry**

0 or 4 Credits

This course is intended for graduate students in biology. The course will cover the description of biological distributions and probabilities; the application of hypothesis testing, including the relationship between biological and statistical hypothesis; the nature of biological data, samples and sampling regimes, and how these fit within the scientific method. Central to the course is the use of biological models and experiments.

**Attributes:** Bioinformatics & Comp Bio Elec, Biology Graduate Elective**BIOL 5110 - Advanced Sex, Evolution and Behavior**

0 or 3 Credits

This course explores the patterns and processes of evolutionary reproductive and mating biology through a lecture/group interaction format. We will explore the theory, mechanisms, and outcomes of the evolution of sexual reproduction. Over the course of the class, you will also gain skills in formulating and testing hypotheses, connecting observations with theory, reading and interpreting scientific literature, understanding graphical representation of data, and judging the quality of popular science articles.

**BIOL 5190 - Geographic Information Systems in Biology**

3 Credits

**Attributes:** Bioinformatics & Comp Bio Elec, Biology Graduate Elective**BIOL 5350 - Current Topics in Cell Biology**

2 Credits (Repeatable for credit)

**Prerequisite(s):** BIOL 5080**Attributes:** Biology Graduate Elective**BIOL 5400 - Problems in Genetics**

1-4 Credits

Advanced experimental work in selected areas of genetics.

**Attributes:** Biology Graduate Elective**BIOL 5430 - Advanced Principles of Virology**

3 Credits

This course is intended as an introduction to virology for the graduate biology student & other scientists who want to know more about viruses. This class will explore the basic principles of: viral replication, viral spread within a host, viral maintenance within populations, viral pathogenesis, viral control by the immune system, and viral evolution. We will examine the experimental and model systems that have been used to study viruses. The lectures will include videos, in-class activities relating to experimental design and analysis, and case study discussions. Students will also present primary journal articles in the field of virology.

**Attributes:** Bioinformatics & Comp Bio Elec, BME Graduate Elective**BIOL 5461 - Exercise Physiology**

4 Credits

Using exercise biochemistry as a foundation, this course will examine the responses and adaptations to physical exercise and /or inactivity, with special emphases on health, energy metabolism, and endocrinology.

**Attributes:** Cellular/Molecular Biol, Morph/Physiology/Dev. Biol**BIOL 5470 - Advanced Comparative Physiology**

3 Credits

This course focuses on the central principles of homeostasis, physiological adaptation, and the evolution of organismal design and function, mostly in vertebrates. We will explore these principles in various physiological systems, including the endocrine, nervous, musculoskeletal, cardiovascular, respiratory, digestive, reproductive and renal systems. We will examine each system at the organ and tissue levels as well as many of the cellular and molecular mechanisms that underlie their function, as well as the best practices to study them.

**Attributes:** Biology Graduate Elective**BIOL 5480 - Conservation Biology**

3 Credits

Fundamental principles of biodiversity maintenance through the management of ecosystems and populations are explored. Begins with the philosophical underpinnings of the conservation movement as developed in the writings of Leopold and moves on to extensive treatment of modern conservation practices directed toward preservation of imperiled systems.

**Attributes:** Biology Graduate Elective**BIOL 5520 - Biochemical Pharmacology**

3 Credits

This course is designed to give students a good understanding of fundamental principles of pharmacology. Specifically, the course will focus on how drugs interact with various targets in the body and how body affects these compounds. The course begins with basic principles of pharmacology, pharmacokinetics and pharmacodynamics such as sites of drug action, agonists and antagonists, receptor theories and dose response relationships, drug absorption, distribution, metabolism, and elimination. It also covers GPCR, cell excitation, nitric oxide, eicosanoid mediators and related drugs, intermediate metabolism and related drugs, chemotherapy of infectious diseases and tumor, RNA as new drug targets, and pharmacogenomics.

**Attributes:** Bioinformatics & Comp Bio Elec, Biology Graduate Elective

**BIOL 5550 - Advanced Ecology**

3 Credits

An in-depth treatment of the relationships between organisms and their environment via lecture, discussion and seminar formats plus occasional laboratory and field exercises.

**Attributes:** Biology Graduate Elective

**BIOL 5560 - Advanced Evolution**

3 Credits

This course explores aspects of natural selection, adaptation, gene flow, speciation, and evolutionary hypothesis testing at a level consistent with a modern graduate education containing a component of evolutionary theory. The format of the course includes both lecture and discussion of the topics outlined in the topical syllabus. Each week will include a set of readings from both historical/seminal writings in an area as well as current papers that treat the topics.

**Attributes:** Biology Graduate Elective

**BIOL 5610 - Principles of Develop Biology**

3 Credits

This course investigates cellular and molecular mechanisms responsible for building multicellular organisms. Topics include fertilization, cleavage, gastrulation, axis specification, and organogenesis, with particular attention devoted to the experimental basis for current models. The connections between developmental biology and medical and environmental issues will also be considered.

**Attributes:** Biology Graduate Elective

**BIOL 5630 - Concepts of Immunobiology**

3 Credits

Cellular and molecular basis of immune function. Topics include receptors on T, B and antigen presenting cells, cytokine networking, complement, function of the major histocompatibility complex, hypersensitivity of the immune system, and infection by HIV.

**Attributes:** Bioinformatics & Comp Bio Elec, Biology Graduate Elective, BME Graduate Elective

**BIOL 5640 - Advanced Microbiology**

3 Credits

The course reviews the diversity, bioenergetics, growth, genetics and ecology of microorganisms. Special emphasis will be placed on contemporary issues and techniques used in the field of microbiology.

**Attributes:** Bioinformatics & Comp Bio Elec, Biology Graduate Elective, BME Graduate Elective

**BIOL 5670 - Advanced Population Biology**

3 Credits

This course covers the theoretical and empirical investigations of population ecology and genetics. Major topics will include population growth and dynamics, population regulation, evolution of life histories, ecological interactions between populations, and evolutionary ecology of populations.

**Attributes:** Biology Graduate Elective

**BIOL 5700 - Advanced Molecular Biology**

3 Credits

A study of genes and genomes, and the processes that control their expression. Special emphasis will be placed on techniques used to analyze and manipulate nucleic acids and proteins, including bioinformatics approaches.

**Attributes:** Bioinformatics & Comp Bio Elec, Bio-Chem/Molecular Elective, Biology Graduate Elective, BME Graduate Elective

**BIOL 5720 - Advanced Cancer Biology**

3 Credits

Cancer occurs when the normal mechanisms that control cell proliferation, differentiation, adhesion, and death are disrupted. Cancer can be caused by accumulated mutations in the genes that regulate these processes, by environmental influences, or by viral infections that hijack normal cellular signaling pathways. In this course we will explore the molecular, cellular, and genetic characteristics of cancer; we will also examine cancer epidemiology, diagnosis, and therapies. (Offered in Fall)

**Attributes:** BME Graduate Elective

**BIOL 5780 - Molecular Phylogenetic Analysis**

3 Credits

This course is designed to give students the knowledge and technical competence necessary for working with molecular phylogenetic data. Students will learn how to edit and align sequence data, and will explore how alternative alignments affect phylogenetic reconstructions. They will learn how to access and download data from online databases such as Genbank and Tree Base. Differing analytical approaches will be presented and discussed, including current and ongoing controversies in the primary literature. Students will gain experience using numerous software packages for analyzing data, testing constraints, choosing likelihood models, assessing support and exploring character evolution.

**Attributes:** Bioinformatics & Comp Bio Elec, Biology Graduate Elective

**BIOL 5800 - Research Colloquium**

0-1 Credits (Repeatable for credit)

The course is designed to provide practice with oral communication of scientific studies. The format involves the design and execution of an oral presentation and students will be assessed by the instructor and classmates. Presentations on student research projects and proposals will be open to all members of the department.

**BIOL 5810 - Department Seminar**

0-1 Credits (Repeatable for credit)

Selected topics in Biology. Attendance and participation required for all M.S. students in Biology.

**BIOL 5820 - Graduate Seminar in Cell and Molecular Regulation**

1-2 Credits (Repeatable for credit)

In depth analysis of one or two topics of current importance to cellular and molecular biology and the regulation of biological processes will be developed each semester. Students will present a lecture building on some aspect of the topic being analyzed. The focus is on skills of literature analysis, lecture organization, and oral presentation as well as on learning about a specific discipline related topic.

**Attributes:** Biology Graduate Elective

**BIOL 5840 - Graduate Seminar in Ecology, Evolution and Systematics**

2 Credits (Repeatable for credit)

Readings and discussions of current literature in areas related to ecology, evolution, and systematics. Students are encouraged to present research plans and report on research progress. Each semester several topics will be examined in depth.

**Attributes:** Biology Graduate Elective

**BIOL 5850 - Floristic Taxonomy**

1 Credit

This weekly seminar provides an overview of Vascular Plants. The seminar will cover several crown orders of the monocots, including grasses and relatives, and begin the Eudicots. Weekly presentations include a summary of all relevant information (molecular, chemical, anatomical, embryological, morphological, ecological, geographical, historical/paleontological, etc.) about the plant group under consideration, review of the classification/phylogeny of the group, examination of fresh and/or preserved specimens, and discussion of relationships, human uses, and other relevant aspects of the biology of that group.

**BIOL 5860 - Scientific Communication**

1 Credit

The course is designed to provide practice with written communication of scientific studies. The course includes assignments of documents that are commonly used in scientific discourse. The objectives of each assignment will be discussed in group meetings, and students will meet with the instructor individually to review the documents.

**BIOL 5865 - Neurophysiology Laboratory Course**

1 Credit

This is a one credit neurophysiology lab course that is designed to provide authentic hands-on experience for graduate students to conduct electrophysiology experiments and learn about neuronal electrical properties and physiological functions. Specifically, students will learn electrophysiological techniques and carry out experiments on model cells and live nervous tissues to test research hypotheses, conduct data analysis, and write up research findings.

**Attributes:** Cellular/Molecular Lab, Natural Science Req (A&S)

**BIOL 5930 - Special Topics**

1-4 Credits (Repeatable for credit)

**Attributes:** Biology Graduate Elective

**BIOL 5950 - Qualifying Exam**

0 Credits (Repeatable for credit)

**BIOL 5970 - Research Topics**

1-3 Credits (Repeatable for credit)

Prior permission of guiding professor and department/program chairperson required.

**BIOL 5980 - Graduate Independent Study in Biology**

1-3 Credits (Repeatable for credit)

Prior permission of guiding professor and department/program chairperson required.

**Attributes:** Biology Graduate Elective

**BIOL 5990 - Thesis Research**

0-6 Credits (Repeatable for credit)

**BIOL 6150 - Neural Basis of Behavior**

3 Credits

Topics to be discussed include molecular biology and genetic analysis of channels, electrophysiology of synapses and transmitter amines, second messenger systems, molecular genetics of color vision, color blindness, sensory transduction, and development of neural circuitry.

**Attributes:** Biology Graduate Elective

**BIOL 6810 - Departmental Seminar**

0-1 Credits (Repeatable for credit)

Selected topics in biology. Attendance and participation required for all Ph.D. students in Biology.

**BIOL 6930 - Special Topics**

1-3 Credits (Repeatable for credit)

**Attributes:** Biology Graduate Elective

**BIOL 6970 - Advanced Research Topics in Biology**

1-3 Credits (Repeatable for credit)

Prior permission of guiding professor and department/program chair required. Offered every semester.

**BIOL 6980 - Graduate Independent Study in Biology**

1-3 Credits (Repeatable for credit)

Prior permission of guiding professor and department/program chair required.

**BIOL 6990 - Dissertation Research**

0-6 Credits (Repeatable for credit)