

BIOLOGY (BIOL)

BIOL 501

Graduate Laboratory Techniques

This course will provide training in biological laboratory techniques. This will include basic laboratory protocols, safety, record keeping, proper use of equipment, and fundamental techniques common to many sub-specializations.

Lecture: 0 Lab: 3 Credits: 2

BIOL 503

Virology

This course will cover topics related to animal viruses including the life cycles of major viral classes, viral pathogenesis, emergence, and control. Recent advances in these areas will be discussed in conjunction with readings from the original literature.

Prerequisite(s): BIOL 445 with min. grade of C or BIOL 515 with min. grade of C

Lecture: 3 Lab: 0 Credits: 3

BIOL 504

Biochemistry

Molecules of biological significance; reaction thermodynamics and kinetics; metabolism; cellular localization of biochemical function; proteins; nucleic acids; transcription; translation.

Lecture: 3 Lab: 0 Credits: 3

BIOL 510

Medical Microbiology

Properties of pathogenic bacteria, fungi, viruses, and parasites and their mechanisms of pathogenesis with a focus on organisms that cause human disease, including current trends in infectious disease. Credits cannot be granted for both BIOL 510 and BIOL 410.

Lecture: 3 Lab: 0 Credits: 3

BIOL 511

Project Management: Business Principles

Introduction to concepts and techniques used to design and/or analyze a project to develop a set of tasks to accomplish the project, to coordinate and to monitor the work involved in the tasks, and to deliver a final product or service. Budgetary considerations will also be discussed.

Lecture: 2 Lab: 0 Credits: 2

BIOL 512

Advanced Biochemistry

This course provides an advanced view of modern biochemistry building on studies done in BIOL 504 of metabolism, enzyme mechanisms, and kinetics, as well as theoretical aspects of various laboratory techniques used in biochemistry. Instructor permission required.

Prerequisite(s): BIOL 504 with min. grade of C

Lecture: 3 Lab: 0 Credits: 3

BIOL 514

Toxicology

Initial lectures cover basic principles in chemical toxicity, such as dose response, indices of numerical toxicity, metabolism and factors influencing toxicity. Mechanisms of organic toxicity will be presented to include central nervous system, liver, kidney, respiratory system, reproductive system and the hematological system. Special topic lectures will emphasize the mechanism of toxicity for specific metals, pesticides, solvents and substances of abuse.

Lecture: 3 Lab: 0 Credits: 3

BIOL 515

Molecular Biology

A survey of topics including structure of nucleic acids, translation, transcription, replication, organization of DNA, RNA processing, genomics, and control of gene expression.

Lecture: 3 Lab: 0 Credits: 3

BIOL 520

Laboratory Rotation

Independent study in the research laboratory of a faculty member.

Lecture: 0 Lab: 9 Credits: 3

BIOL 521

Population Genetics

The study of genetic variation in natural populations is the foundation for modern evolutionary biology. Population genetics covers both the theoretical study of the effects of various forces on genetic diversity and the empirical analysis of genetic variation observed in real populations. Throughout the course, students' understanding of population genetics theory will be reinforced with examples of applications. Topics will include genetic drift, genealogical approaches and coalescence, structured populations and migration mutation and natural selection.

Lecture: 3 Lab: 0 Credits: 3

BIOL 522

Research Techniques in the Biological Sciences I

Experimental techniques in biochemistry, cell Biology, biotechnology, and microbiology are offered as discreet modules. Students select appropriate modules to complement other laboratory courses. Thus a student who has completed, for example, BIOL 533, (Laboratory in Cell and Molecular Biology) would select two modules chosen from cell biology, biotechnology, or microbiology. A written report is required at the completion of each module. Instructor permission required.

Lecture: 1 Lab: 6 Credits: 3

BIOL 523

Research Techniques in Biological Sciences II

This course is a continuation of BIOL 522 where students have to complete the research project started in BIOL 522 and a write a report in the form of a scientific paper.

Lecture: 0 Lab: 3 Credits: 3

BIOL 524**Science and Law: An Introduction to Intellectual Property Law and Patents**

"This course focuses on the interaction of science and law, specifically intellectual property and regulatory law. Topics will include patents, the ethical and legal issues involved with patenting biological inventions, inventorship and collaborations, trade secrets, Food and Drug regulatory law, generic drugs and the legal system as it relates to scientific issues."

Lecture: 3 Lab: 0 Credits: 3

BIOL 526**Developmental Biology**

This course covers the cellular and molecular processes involved in generating an embryo, in creating various tissues and organs, and the effect of external stimuli on development. Topics include: genome structure, gene expression and regulation, cell cycle control, pattern formation, signal transduction, gametogenesis, organogenesis, and methods used in studying developmental biology. In addition to studies of model organisms, examples relevant to human diseases are covered.

Lecture: 3 Lab: 0 Credits: 3

BIOL 527**Immunology and Immunochemistry**

Basic concepts of immunology, immunochemistry, both biological and molecular.

Lecture: 3 Lab: 0 Credits: 3

BIOL 530**Human Physiology**

This course is designed to provide the students with comprehensive knowledge about how the human body functions. It will cover cell physiology, autonomic nervous system, neurophysiology, acid base physiology, cardiovascular physiology, respiratory physiology, renal physiology, gastrointestinal physiology, endocrine physiology, and reproductive physiology. Credits cannot be earned to both BIOL 430 and BIOL 530.

Lecture: 3 Lab: 0 Credits: 3

BIOL 533**Advanced Graduate Laboratory Techniques**

This course covers a number of essential techniques in cell and molecular biology, biochemistry, and structural biology with emphases on both the methodologies and the experimental details. Laboratory procedures include cell culture skills and relevant laboratory procedures. This course is arranged modules from which students choose according to their areas of specialization.

Prerequisite(s): BIOL 501 with min. grade of B

Lecture: 0 Lab: 6 Credits: 3

BIOL 540**Human neurological diseases**

This 3-credit graduate course will focus on the neurological mechanisms related to nervous system diseases in human. In the first half of the semester, the students will learn nerve cell structures, cell-cell communication, neural signaling transmission, and to some extent, higher-order cognitive brain functions. In the second half of the semester, the students will discuss the scientific basis underlying the symptoms of common neurological diseases, and present papers from clinical researches for up-to-date treatment for human neurological diseases.

Lecture: 3 Lab: 3 Credits: 3

BIOL 542**Advanced Microbiology**

Advanced Microbiology (BIOL 542) is a lecture course designed to review concepts of contemporary microbiology and the diversity of the microbial world with an emphasis on the biochemical and molecular strategies used to survive in different environments. The course will cover diverse microbiological topics such as metabolism, growth, production of foods, agriculture, biotechnology, fuel production, bioremediation, environment, etc.

Prerequisite(s): BIOL 544 with min. grade of C and BIOL 504 with min. grade of C

Lecture: 3 Lab: 0 Credits: 3

BIOL 543**Advanced Microbiology and Immunology Laboratory**

This course provides hands-on experience on the main techniques used in microbiology and immunology. The course allows graduate and undergraduate students to acquire the necessary experience to continue their careers in academy or in industry. Focus on implementing aseptic technique, identification of microorganisms by several methods and Biotechnology procedures such as bacterial genome editing and yeast fermentation. Antibody properties will be explored and exploited, including antigen-antibody reaction, immunodetection of microorganisms, co-immunoprecipitation of proteins and ELISA. Properties of immune cells will be studied, such as phagocytosis and macrophage migration.

Prerequisite(s): BIOL 225 or BIOL 533 with min. grade of C

Lecture: 0 Lab: 6 Credits: 3

BIOL 544**Molecular Biology of Cells**

This is a graduate-level cell biology course. The course contains two parts: initial lectures cover cellular structure and function emphasizing the molecular components, organelles, and regulation of cellular processes; the second part covers special topics emphasizing experimental approaches and molecular mechanisms of cellular regulation.

Lecture: 3 Lab: 0 Credits: 3

BIOL 545**Advanced Cell Biology**

This course is a continuation of BIOL 544 and focuses on recent advances in the area of cell biology. The course covers, in depth, eukaryotic cellular processes, structure-function relationships, and cellular signaling networks in response to physiological and pathological stimuli. The course will also cover frontier topics in the area of cell biology. Emphasis will be on experimental approaches. Instructor permission required.

Prerequisite(s): (BIOL 445 with min. grade of C and BIOL 446 with min. grade of C) or (BIOL 533 with min. grade of C and BIOL 544 with min. grade of C)

Lecture: 3 Lab: 0 Credits: 3

BIOL 550**Bioinformatics**

This course is tailored for life science graduates having little to no prior knowledge of Unix/Linux-like operating systems. Topics covered will include Linux/UNIX-like operating systems, the Bash shell, Perl programming, collecting and storing sequences in the lab, multiple sequence alignments, database searching for similar sequences, gene prediction, genome analysis, and phylogenetic prediction.

Lecture: 3 Lab: 0 Credits: 3

BIOL 551**Microbial Genomics**

Microbes and associated microbiomes are highly relevant to human health and environmental issues. Advances in DNA sequencing technologies enabled investigations of microbes and microbiomes at an unprecedented depth. In this lab course, students will use a combination of wet lab approaches including high-throughput sequencing technologies and dry lab computational techniques to investigate various microbial genomes, metagenomes and biomes.

Prerequisite(s): BIOL 501 with min. grade of C and BIOL 550 with min. grade of B and BIOL 515 with min. grade of C

Lecture: 0 Lab: 6 Credits: 3

BIOL 555**Macromolecular Structure**

Macromolecular crystallographic methods, including crystallization, data processing, phasing, and structure refinement, multi-dimensional NMR techniques, spectroscopic techniques, structural comparisons and characterizations, fiber diffraction, and solution scattering. Instructor permission required.

Lecture: 3 Lab: 0 Credits: 3

BIOL 561**Radiation Biophysics**

Energy loss by ionizing radiation. Target theory. Direct and indirect action. Radiation inactivation of proteins, nucleic acids, microorganisms, and humans. Role of DNA repair in mitigating damage. Stochastic and non-stochastic damage. Radiation effects in vivo. Radiation therapy. Effects of non-ionizing radiation. Same as PHYS 561.

Lecture: 3 Lab: 0 Credits: 3

BIOL 562**Current Topics in Functional Genomics**

This course is designed to give students a foundation in advanced theoretical and applied methods in modern molecular research. It will emphasize both established and novel approaches to solving problems of functional and comparative genomics, and systems biology. It will also focus on applications of advanced molecular techniques in areas of significant economic and biomedical importance.

Lecture: 3 Lab: 0 Credits: 3

BIOL 572**Literature in Biochemistry**

A topic from the current literature in biochemistry is selected by students for preparation of a paper. Instructor permission required.

Lecture: 0 Lab: 3 Credits: 3

BIOL 574**Literature in Biotechnology**

A topic from the current literature in biotechnology is selected by students for preparation of a paper. Instructor permission required.

Lecture: 0 Lab: 3 Credits: 3

BIOL 576**Literature in Cell and Molecular Biology**

A topic from the current literature in cell and molecular biology is selected by students for preparation of a paper. Instructor permission required.

Lecture: 0 Lab: 3 Credits: 3

BIOL 578**Literature in Microbiology**

A topic from the current literature in microbiology is selected by students for preparation of a paper. Instructor permission required.

Lecture: 0 Lab: 3 Credits: 3

BIOL 581**Capstone**

In this course, students will be provided with the opportunity to perform a research project that is the culmination of their Master's education. This course involves the research and preparation of a group project. Students will develop a formal work reflecting integration of the scientific knowledge and technical skills learned in the Master's programs through a project chosen by the group. The course will explore online collaboration tools to allow participation of online students. Each group will present its Capstone project at the end of the class. Instructor consent is required.

Lecture: 3 Lab: 0 Credits: 3

BIOL 584**Graduate Seminar in Biology**

To foster scientific communication skills, students are required to present seminars based on the scientific literature.

Lecture: 0 Lab: 1 Credits: 1

BIOL 591**Research and Thesis M.S.**

Instructor permission required.

Credit: Variable

BIOL 594

Research Problems

Instructor permission required.

Credit: Variable

BIOL 595

Biology Colloquium

Lectures by invited scientists in areas of biology generally not covered in the department.

Lecture: 0 **Lab:** 1 **Credits:** 1

BIOL 597

Special Problems

Special problems in biology. Instructor permission required.

Credit: Variable

BIOL 600

Continuation of Residence

Lecture: 0 **Lab:** 1 **Credits:** 1

BIOL 691

Research and Thesis PHD

Research and Thesis for Ph. D. students.

Credit: Variable