

# BIOLOGY (BIOL)

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## BIOL 100

### Introduction to the Profession

Introduction to the biological sciences, scientific method, computing tools, and critical thinking.

**Lecture: 2 Lab: 0 Credits: 2**

**Satisfies:** Communications (C)

## BIOL 104

### Linux and Perl Programming

Introductory class on Linux and Perl programming. Topics include Linux/UNIX operating systems, Bash and other command line shells, remote terminals, the basics of Perl programming, and examples of Perl programming for biological data.

**Lecture: 1 Lab: 2 Credits: 3**

## BIOL 105

### Introduction to Biology

This course, designed for non-majors, considers basic concepts and selected topics in biology beginning at the molecular level and ending with the biosphere. Topics include the following: the chemistry and structure of cells in plants and animals; how cells obtain and use energy; basic genetics and the role of biotechnology in agriculture and medicine; evolution, natural selection, and species formation; the origin and diversity of microbial, plant, and animal life; ecology, organisms, and their environments; and the impact of human population growth and human activity on the systems and resources of our planet. This course is not available to those students for whom BIOL 107 is a required course, including students majoring in Biology, Biochemistry, Chemical and Biological Engineering, Molecular Biochemistry and Biophysics, or any pre-health professional major or minor. BIOL 105 and BIOL 114 constitute a one-year sequence in biology. Acceptable as part of the science component of the General Education Program. Course does not satisfy graduation requirements for Biology, Biochemistry, Chemical and Biological Engineering, Molecular Biochemistry and Biophysics majors.

**Lecture: 3 Lab: 0 Credits: 3**

**Satisfies:** Natural Science (N)

## BIOL 107

### General Biology Lectures

This course emphasizes biology at the organismal level. It provides an introduction to the study of the structure and function of plants and animals, their origin and evolution, their reproduction and genetics, and their diversity and ecological relations. BIOL 107 plus BIOL 115 constitutes a one-year sequence in biology. Acceptable as part of the science component of the General Education Program.

**Lecture: 3 Lab: 0 Credits: 3**

## BIOL 109

### General Biology Laboratory

A laboratory course to accompany BIOL 107. An introduction to laboratory techniques and their application to the understanding of general biological concepts.

**Prerequisite(s):** BIOL 105\* or BIOL 107\*, An asterisk (\*) designates a course which may be taken concurrently.

**Lecture: 0 Lab: 3 Credits: 1**

**Satisfies:** Communications (C)

## BIOL 114

### Introduction to Human Biology

This course, designed for non-majors in biology, covers selected topics in biology of particular relevance to humans and to human health and disease. Topics include: Introductory biochemistry and cell structure, organization, and regulation of body systems; human genetics; human development; biotechnology; introduction to human pathogens and infectious diseases including sexually-transmitted diseases and immunologic diseases such as AIDS; human ecology; and human evolution. This course is not available to those students for whom BIOL 115 is a required course, including students majoring in Biology, Biochemistry, Molecular Biochemistry and Biophysics, Chemical Engineering, or Biomedical Engineering, and students in any pre-health profession major or minor. BIOL 107 and BIOL 114 constitutes a one-year sequence in biology. Acceptable as part of science component of the General Education Program.

**Lecture: 3 Lab: 0 Credits: 3**

## BIOL 115

### Human Biology

This course covers selected topics in biology of particular relevance to humans and to human health and disease. Topics include biology of human cells and selected organ systems; neurobiology including psychoactive drugs and drug addiction; development and birth defects; genetics and genetic diseases; toxicology; the immune system and immunologic diseases such as AIDS; human nutrition and nutritional effects; microbial human diseases. BIOL 107 plus BIOL 115 constitutes a one-year sequence in biology. Acceptable as part of science component of the General Education Program.

**Lecture: 3 Lab: 0 Credits: 3**

## BIOL 117

### Human Biology Laboratory

A biology laboratory course to accompany BIOL 114 or BIOL 115. A cellular approach to the functional organization of organs and organ systems. Laboratories will include the application of experimental methods and techniques for understanding the relationship between cell structure and function.

**Prerequisite(s):** BIOL 114\* or BIOL 115\*, An asterisk (\*) designates a course which may be taken concurrently.

**Lecture: 0 Lab: 3 Credits: 1**

**Satisfies:** Communications (C)

## BIOL 210

### Microbiology

This course covers basics of microbiology including structure, genetics, growth, and metabolic diversity of microorganisms. Topics relating to the importance of microorganisms in health, ecosystems, industry, and water and food safety are also covered.

**Prerequisite(s):** BIOL 107 or BIOL 114 or BIOL 115

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 214****Genetics**

An introduction to transmission and molecular genetics designed for both biology and other science and engineering majors. Applications of genetics to solution of various practical problems will also be discussed.

**Prerequisite(s):** BIOL 107 or BIOL 114 or BIOL 115

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 225****Microbiology Laboratory**

Exercises focus on sterile technique, growth requirements of microorganisms, identification of microorganisms using biochemical activities, food, and water microbiology.

**Prerequisite(s):** BIOL 210\*. An asterisk (\*) designates a course which may be taken concurrently.

**Lecture: 0 Lab: 6 Credits: 2**

**Satisfies:** Communications (C)

**BIOL 305****Human Anatomy**

This course will provide a comprehensive overview of the structural, functional, and developmental anatomy of the human body.

Particular consideration will be given to the bony structures, vasculature, innervation, musculature, and relationships of the various structures to one another.

**Prerequisite(s):** BIOL 107 or BIOL 114 or BIOL 115

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 327****Introduction to Immunology**

Covers general principles of innate and adaptive immunity including structure and function of immune system components, T and B cell development, responses of the immune system to infection, and consequences of immune system failure.

**Prerequisite(s):** BIOL 107 or BIOL 115

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 401****Introductory Biochemistry**

The first part of a one-year Biochemistry series. This semester covers the basic principles of biological chemistry with particular focus on: proteins, nucleic acids, carbohydrates, and lipids; their molecular structure, chemical reactions, and practical methods in characterization; and enzymes and enzyme-catalyzed reactions.

**Prerequisite(s):** (BIOL 107 or BIOL 115 or Graduate standing) and (CHEM 237 or Graduate standing)

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 402****Metabolic Biochemistry**

The second part of a one-year Biochemistry series. This semester deals with biochemistry of metabolism, focusing on: glycolysis, the citric acid cycle, gluconeogenesis, electron transport, and the synthesis and breakdown of biomolecules (amino acids, nucleic acids, lipids, and carbohydrates), blood chemistry, lipid transportation, and metabolic control.

**Prerequisite(s):** BIOL 401 and (CHEM 239 or Graduate standing)

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 403****Biochemistry**

Molecular organization of cell structures and cell membranes. Proteins, nucleic acids, carbohydrates and lipids, their molecular structure, characterization and chemical reactions. Enzymes and enzyme-catalyzed reactions and metabolism. Does not satisfy biochemistry requirement for Biology, Biochemistry, or Molecular Biochemistry and Biophysics majors.

**Prerequisite(s):** (BIOL 107 or BIOL 115 or CHE 311) and CHEM 237

**Lecture: 4 Lab: 0 Credits: 4**

**BIOL 404****Biochemistry Laboratory**

Analytical methods in the chemistry and metabolism of proteins, amino acids, and nucleic acids, including chromatography, spectrophotometry, and electrophoresis. Enzyme reactions.

**Prerequisite(s):** BIOL 401\* or BIOL 402\* or BIOL 403\*. An asterisk (\*) designates a course which may be taken concurrently.

**Lecture: 0 Lab: 6 Credits: 3**

**Satisfies:** Communications (C)

**BIOL 410****Medical Microbiology**

Properties of pathogenic bacteria, fungi, viruses, and parasites and their mechanisms of pathogenesis with a focus on organisms that cause human disease.

**Prerequisite(s):** BIOL 210 or Graduate standing

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 413****Genomics and Transcriptomics**

Modern nucleic acid sequencing technology has revolutionized the analysis of genes and genomes. In this course, students will learn to use sequence data to analyze the structure and function of genomes. Topics will include sequencing technologies and data, genome assembly, genome annotation and gene expression analysis. Classes will consist of a mixture of lecture and hands-on exercises. A laptop is required.

**Prerequisite(s):** BIOL 214 or Graduate standing

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 414****Genetics for Engineering Scientists**

A course in genetics designed for advanced students in engineering and related disciplines. The course will cover transmission and molecular genetics and their application to the solution of various practical problems. A term paper will be required in addition to in-class examinations. \*\*Instructor permission required.\*\*

**Lecture: 3 Lab: 0 Credits: 3**

**Satisfies:** Communications (C)

**BIOL 415****Advanced Human Genetics**

Emphasis on formal genetics and molecular approaches to human genetics. Topics include analysis of Mendelian inheritance, chromosome mapping of disease genes, mutational analysis, and epigenetic s. Coverage of genomics, methods of gene manipulation, genetic databases, and regulation of gene expression. The origin and consequences of genetic variation in populations and the role of natural selection in evolution will also be discussed.

**Prerequisite(s):** BIOL 214 or Graduate standing

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 420****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.

**Prerequisite(s):** (BIOL 214 and MATH 148) or (BIOL 214 and MATH 151) or Graduate standing

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 426****Concepts of Cancer Biology**

The course is designed to provide a complete overview of cancer as a disease. It will cover normal and abnormal cell signaling pathways, cancer genes and their regulation, experimental chemical carcinogenesis, metastasis, cancer prevention and therapy, drug development for cancer treatment, cancers of individual organ sites and application of biotechnology for cancer detection and treatment.

**Prerequisite(s):** (BIOL 107 and BIOL 115 and CHEM 237 and BIOL 445\* and BIOL 401\*) or Graduate standing, An asterisk (\*) designates a course which may be taken concurrently.

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 430****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.

**Prerequisite(s):** BIOL 114 or BIOL 115 or Graduate standing

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 431****Animal Physiology Laboratory**

This course provides an introduction to some of the basic concepts of physiology through experimental procedures involving laboratory animals and humans. Experiments include EKG, producing and measuring nerve action potential, muscle contraction generation and its mechanism, human blood pressure measurement, human lung capacity measurement, and some other human noninvasive experiments.

**Prerequisite(s):** BIOL 430\*, An asterisk (\*) designates a course which may be taken concurrently.

**Lecture: 0 Lab: 6 Credits: 3**

**Satisfies:** Communications (C)

**BIOL 440****Neurobiology**

This course will focus on identification of the anatomical and functional organization of the nervous system and the understanding of the principles of inter-neuronal communication and the integrative functions of the nervous system. Failures in brain functions that can lead to a disease will also be discussed.

**Prerequisite(s):** BIOL 445

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 445****Cell Biology**

Modern studies of cell structure and function at the cellular, subcellular, and molecular levels. Topics include molecular components of cells, membranes, membrane-bound organelles, microtubular and cytoskeletal components and principles of bioenergetics.

**Prerequisite(s):** (BIOL 107 and CHEM 237) or (BIOL 115 and CHEM 237) or Graduate standing

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 446****Cell Biology Laboratory**

A laboratory course in cell biology to accompany BIOL 445.

**Prerequisite(s):** BIOL 445\*, An asterisk (\*) designates a course which may be taken concurrently.

**Lecture: 0 Lab: 6 Credits: 3**

**Satisfies:** Communications (C)

**BIOL 451****Biological Literature**

Library research on advanced topics in biology followed by oral presentations of this research.

**Prerequisite(s):** BIOL 400-499

**Lecture: 2 Lab: 0 Credits: 2**

**Satisfies:** Communications (C)

**BIOL 455****Macromolecular Techniques**

Advanced laboratory course in physical biochemistry and biophysical techniques, providing a broad, hands-on, experimental background reinforcing key biophysical concepts; many experiments use expertise and equipment available in our departments or otherwise available to Molecular Biochemistry and Biophysics faculty members through affiliations with the Advanced Photon Source at Argonne National Laboratory.

**Prerequisite(s):** BIOL 401\* or BIOL 403\* or CHEM 321\* or CHEM 343\* or CHEM 348\* or PHYS 304\* or PHYS 410\*, An asterisk (\*) designates a course which may be taken concurrently.

**Lecture: 0 Lab: 6 Credits: 3**

**BIOL 475****Health and Disease in Modern Society**

The course will discuss biological and medical aspects related to the diseases commonly seen in the modern society such as diabetes, depression, cancer, Alzheimer's, and autism. The goal of the course is to provoke students' interest in health-related issues and link the life-style to health problems in the modern society. Course will cover basic clinical and molecular aspects of the diseases, and raise awareness of latest discoveries and challenge in the treatment and prevention of the diseases.

**Prerequisite(s):** BIOL 115

**Lecture: 3 Lab: 0 Credits: 3**

**Satisfies:** Communications (C)

**BIOL 490****Individual Study**

Individual study. Consent of instructor required.

**Credit:** Variable

**BIOL 491****Biology Research Project**

An opportunity for advanced undergraduates to participate in research. A written report covering the procedures, data, and conclusion of the problem is required. \*\*Instructor permission required.\*\*

**Credit:** Variable

**BIOL 495****Biology Colloquium**

Lectures by prominent scientists. This course exposes students to current and active research in biology both within and outside the IIT community. It helps prepare students for a career in research. It is complementary to our academic courses and provides examples of professional/scientific presentations. This course may not be used to satisfy the natural science general education requirement.

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

**Satisfies:** Communications (C)

**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 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**