# Biology (BIO) Courses

**BIO1011 General Biology - Cellular**
This course provides an introduction to the structure, function and genetics of living organisms. It is designed to be a first course for biology majors and to provide a foundation for more advanced courses in the biological sciences. Topics include the chemistry of biological molecules, cell structure and function, photosynthesis and cellular respiration, the cell cycle, mitosis, meiosis and sexual reproduction, and genetics. This course is taken concurrently with General Biology Laboratory - Cellular.
Prerequisite(s): Corequisite: BIO1016.
Offered at Charlotte, Providence
3 Semester Credits

**BIO1016 General Biology Laboratory - Cellular**
This is a laboratory companion course coordinated with BIO1011 that introduces students to techniques and equipment used in experimental biology. Students take an inquiry-based, self-guided learning approach to the discovery of cell structure and function, photosynthesis and cellular respiration, the cell cycle, and genetics. Additionally, this laboratory course provides students with the opportunity to practice laboratory safety, design experimental procedures, collect data, analyze results and discuss conclusions.
Prerequisite(s): Corequisite: BIO1011.
Offered at Charlotte, Providence
1 Semester Credit

**BIO1022 General Biology - Organismal**
This course provides an introduction to evolution, the diversity of life on earth, plant and animal form, function, growth, development and reproduction, ecology and ecosystems. This course is taken concurrently with General Biology Laboratory - Organismal.
Prerequisite(s): Corequisite: BIO1026.
Offered at Charlotte, Providence
3 Semester Credits

**BIO1026 General Biology Laboratory - Organismal**
This is a laboratory companion course coordinated with BIO1022 that introduces students to techniques and equipment used in experimental biology. Students take an inquiry-based, self-guided learning approach to the discovery of the mechanisms of evolution, plant and animal development, and growth, ecology and ecosystems. Additionally, this laboratory course provides students with the opportunity to practice laboratory safety, design experimental procedures, collect data, analyze results and discuss conclusions.
Prerequisite(s): Corequisite: BIO1022.
Offered at Charlotte, Providence
1 Semester Credit

**BIO2001 Genetics**
This course provides students with the knowledge and analytical skills necessary to understand the principles of modern genetics. The nature of genes, genomes and chromosomes; mechanisms of recombination and mutation; Mendelian inheritance patterns; and genetic mechanisms underlying evolution are studied. Genetic studies performed on model organisms (such as bacteria, yeast and mold) are discussed to illustrate and reinforce genetic principles relating to human genetics and diseases.
Prerequisite(s): BIO1011, BIO1016, BIO1022, BIO1026.
Offered at Charlotte, Providence
3 Semester Credits

**BIO2003 Human Anatomy and Physiology I**
This course is the first course of a two-semester sequence in which human A&P are examined through a systems approach to the human body, where systems are examined based on the interaction between form and function from the organismal level to the microscopic components of the tissues. The topics covered in this first course are body plan and organization, homeostasis, chemistry and cellular biology, histology, integumentary system, skeletal system and articulations, muscular system, nervous system, general and special senses, and endocrine system.
Prerequisite(s): BIO1011 and BIO1016, or SCI1015, CHM1000 and CHM1006 or CHM1022 and CHM1026, Corequisite: BIO2006.
Offered at Charlotte, Providence
3 Semester Credits

**BIO2006 Human Anatomy and Physiology I Laboratory**
In this laboratory course, students examine the macroscopic and microscopic structure of the human body using anatomical models, histology preparations, and dissection. Students collect, analyze and apply data to examine and understand human physiologic processes. Activities include experiments, computer simulations and measurement of physiologic activity in human subjects. Topics covered in this first course of the two course sequence are anatomical terminology, homeostasis and cellular transport mechanisms, histology, skeletal system and articulations, muscular system and movement, nervous system structure and physiology, general and special senses, endocrine system structures and physiology. Equipment commonly found in a medical setting is used. A&P I (lecture and laboratory) is designed to meet prerequisites for graduate programs in the health sciences.
Prerequisite(s): BIO1011 and BIO1016, or SCI1015, CHM1000 and CHM1006 or CHM1022 and CHM1026, Corequisite: BIO2003.
Offered at Charlotte, Providence
1 Semester Credit

**BIO2013 Human Anatomy and Physiology II**
This course is the second course of a two-semester sequence in which human A&P are examined through a systems approach to the human body, where systems are examined based on the interaction between form and function from the organismal level to the microscopic components of the tissues. The topics covered in this second course are cardiovascular system, lymphatic system and immunity, respiratory system, digestive system, nutrients and metabolism, urinary system, fluid/electrolytes and acid-base balance, and reproductive system.
Prerequisite(s): BIO2003, BIO2006, Corequisite: BIO2016.
Offered at Charlotte, Providence
3 Semester Credits

**BIO2016 Human Anatomy and Physiology II Laboratory**
In this laboratory course, students examine the macroscopic and microscopic structure of the human body using anatomical models, histology preparations, and dissection. Students collect, analyze and apply data to examine and understand human physiologic processes. Activities include experiments, computer simulations and measurement of physiologic activity in human subjects. The topics covered in this second course of the two course sequence are cardiovascular system, respiratory system, digestive system, nutrients and metabolism, urinary system, fluid/electrolytes and acid-base balance, and reproductive system. Equipment commonly found in a medical setting is used. A&P II (lecture and laboratory) is designed to meet prerequisites for graduate programs in the health sciences.
Prerequisite(s): BIO2003, BIO2006, Corequisite: BIO2013.
Offered at Charlotte, Providence
1 Semester Credit

**BIO2041 Human Physiology**
This course examines the molecular, cellular and tissue-level processes involved in the function of human organ systems. Emphasis is on maintenance of internal homeostasis, organ system integration and components of human disease. Concurrent enrollment in BIO2046 Human Physiology Laboratory is required. Human Physiology (lecture and laboratory) is designed to meet prerequisites for graduate programs in the health sciences.
Prerequisite(s): BIO1011 and BIO1016, or SCI1015, CHM1022 and CHM1026 or CHM1000 and CHM1006, Corequisite: BIO2046.
Offered at Charlotte, Providence
3 Semester Credits

**BIO2046 Human Physiology Laboratory**
This laboratory course allows students to collect, analyze and apply data to examine and understand human physiologic processes. Activities include experiments, computer simulations and measurement of physiologic activity in human subjects. Equipment commonly found in a medical setting is used. Human Physiology (lecture and laboratory) is designed to meet prerequisites for graduate programs in the health sciences.
Prerequisite(s): BIO1011 and BIO1016, or SCI1015, CHM1022 and CHM1026 or CHM1000 and CHM1006, Corequisite: BIO2041.
Offered at Charlotte, Providence
1 Semester Credit

**BIO2201 General Microbiology**
This course introduces the basic morphological, physiological and genetic aspects of various microbes, and explores the application of this information in medical, agricultural and industrial settings. Key topics include structure/function relationships, factors affecting the growth and control of microorganisms, microbial genetics and evolutionary mechanisms, host-microbe interactions, microbial ecosystems, and applied microbiology. Emphasis is on the relationship between developments in the field of microbiology and various aspects of modern society.
Prerequisite(s): (BIO1011/BIO1016 or SCI1015) and (CHM1000/CHM1006 or CHM1022/CHM1026 or CHM2040), Corequisite: BIO2206.
Offered at Charlotte, Providence
3 Semester Credits

**BIO2206 General Microbiology Laboratory**
This is a laboratory companion course to be taken concurrently with General Microbiology. Students examine the properties of various microbes and factors affecting the growth and control of microbial agents. Throughout the term, students gain experience in light microscopy, pure culture and enrichment techniques, microbial identification, and enumeration. Emphasis is on appropriate and safe use of standard microbiological and molecular lab equipment and methods, as well as the ability to apply the scientific process.
Prerequisite(s): (BIO1011/BIO1016 or SCI1015) and (CHM1000/CHM1006 or CHM1022/CHM1026 or CHM2040), Corequisite: BIO2201.
Offered at Charlotte, Providence
1 Semester Credit

**BIO2510 Plant Cultivation I: Soil, Soil Substitutes, and Disease Management**
This course provides an overview of the cultivation of select species of plants, from seeds to mature reproductive plants. This course introduces concepts related to the organization of the plant body at the tissue, organ and system level and the related abiotic factors necessary for plant cultivation. Students study the structure and function of the root and shoot systems with an emphasis on environmental, physical and cellular physiological factors required for successful plant cultivation, and disease and pest management. This course is taken concurrently with Plant Cultivation I: Soil, Soil Substitutes, and Disease Management Laboratory.
Prerequisite(s): BIO1022 and BIO1026, Co-requisite: BIO2516.
Offered at Providence
3 Semester Credits

**BIO2516 Plant Cultivation I: Soil, Soil Substitutes, and Disease Management Laboratory**
This laboratory course provides an overview of the cultivation of select species of plants, from seeds to mature reproductive plants. This course introduces concepts related to the organization of the plant body at the tissue, organ and system level and the related abiotic factors necessary for plant cultivation in soil and soil substitute growing medium. Students study the structure and function of the root and shoot systems with an emphasis on environmental, physical and cellular physiological factors required for successful plant cultivation, and disease and pest management. This course is taken concurrently with Plant Cultivation I: Soil, Soil Substitutes, and Disease Management Lecture.
Prerequisite(s): BIO1022 and BIO1026, Co-requisite: BIO2510.
Offered at Providence
1 Semester Credit

**BIO3040 Molecular Biology**
This course provides students with the opportunity to study current topics related to DNA replication, mutation, recombination and gene expression in prokaryotes, eukaryotes and their viruses. Students analyze primary journal articles that focus on the application of molecular biology in the health sciences, such as nutrigenomics, RNAi and epigenetic regulation. Additionally, students debate the ethics behind cloning and the genetic modification of organisms.
Prerequisite(s): BIO2001.
Offered at Providence
3 Semester Credits

**BIO3046 Molecular Biology Laboratory**
This course uses select technologies to probe the central dogma of biology: DNA-->RNA-->Protein. Students carry out experiments to extract, purify and modify DNA, RNA and proteins within a model organism. Students use bioinformatic techniques in the design of their experiments. This course helps students to identify appropriate technologies to use when performing molecular biology procedures and prepares students seeking an entry position in the field of biotechnology and/or entry into a graduate research lab.
Prerequisite(s): BIO2001, Corequisite: BIO3040.
Offered at Providence
1 Semester Credit

**BIO3070 Evolution**
This course provides a background into the mechanisms of evolution including natural and other forms of selection and the role of genetic variation, mutations and genetic drift in these processes. Problems associated with classification and inferring phylogenetic relationships between organisms are also examined. Other topics include a history of life on earth, causes of speciation and extinction, coevolution, human evolution and cultural evolution.
Prerequisite(s): BIO1011, BIO1016, BIO1022, BIO1026.
Offered at Providence
3 Semester Credits

**BIO3080 Epigenetics**
"Nature vs. Nurture: Are organisms a product of their DNA or their environment?" This question has plagued scientists and philosophers throughout the ages; in recent years, the field of epigenetics has begun to answer that question at the molecular level. Epigenetics explains the complex interplay between one's environment and the expression of their genes, affected by chemical variations along chromosomes. Even more influential is the fact that some of these alterations are passed on to subsequent generations, thus beginning to explain the long-term implications of "good" vs. "bad" environment on health outcomes. This course first discusses the organization of chromosomes and how DNA methylation, histone modifications, chromatin remodeling, and the association of non-coding RNA molecules affect gene expression; it also explores how these complex statuses are determined by scientists. Finally, students explore specific epigenetic examples in scientific literature—namely, in relation to nutrition, trauma, cancer, neurological disorders, and development.
Prerequisite(s): BIO1011, BIO1016, BIO1022, BIO1026.
Offered at Providence
3 Semester Credits

**BIO3100 Coastal Ecology**
This course examines the characteristics of coastal marine habitats, the flora and fauna of these habitats, and their ecological relationships. Anthropogenic effects on coastal habitats are also examined.
Prerequisite(s): BIO1022 and BIO1026, Corequisite: BIO3106.
Offered at Providence
3 Semester Credits

**BIO3106 Coastal Ecology Laboratory**
This laboratory companion course coordinates with BIO3100. This course uses an inquiry-based learning approach to reinforce fundamental ecological concepts and introduce students to methods of data collection and analysis commonly used in ecology. Students are required to organize, analyze, interpret and present ecological data collected using various laboratory and field methods. Additionally, this laboratory course provides students with the opportunity to practice laboratory and field safety procedures. Special consideration is given to concepts and methods relevant to research conducted in the coastal environment.
Prerequisite(s): BIO1022 and BIO1026, Corequisite: BIO3100.
Offered at Providence
1 Semester Credit

**BIO3400 Fundamentals of Pharmacology**
This course integrates knowledge from core science courses including physiology, biochemistry and cellular and molecular biology to ascertain the relationship between biological processes and therapeutic agents. An understanding of pharmacology basics, including pharmacokinetics, pharmacodynamics and a systematic cognizance of pharmacotherapy is emphasized. Course content brings an awareness of the adverse effects of pharmacologic agents on humans, animals, microorganisms and ecosystems.
Prerequisite(s): (SCI1015 or (BIO1011 and BIO1016)) and (SCI2031 or (BIO2003 and BIO2006) or (BIO2041 and BIO2046)), sophomore status.
Offered at Online, Providence
3 Semester Credits

**BIO3510 Plant Cultivation II: Hydroponics, Aquaponics, Tissue Culture, Genetics and Extraction**
This course builds upon the major concepts introduced in BIO2510: Plant Cultivation I: Soil, Soil Substitutes, and Disease Management. Students learn how to propagate plants from cells, seeds, and mature vegetative cuttings, via hydroponic, aquaponics and tissue culture systems. The application of biotechnology to optimize and create economically valuable plants is discussed. Students are introduced to harvesting of targeted parts of the plant and chemical extraction techniques to isolate bioactive compounds for medicinal purposes. This course is taken concurrently with Plant Cultivation II: Hydroponics, Aquaponics, Tissue Culture, Genetic Manipulation and Extractions Laboratory.
Prerequisite(s): BIO2510, BIO2516 and (CHM1000/CHM1006 or CHM1022/CHM1026), Corequisite: BIO3516.
Offered at Providence
3 Semester Credits

**BIO3516 Plant Cultivation II: Hydroponics, Aquaponics, Tissue Culture, Genetics and Extraction Laboratory**
This laboratory companion course coordinates with BIO3510. Students have the opportunity to implement the techniques and equipment used to propagate plants from cells, seeds, and mature vegetative cuttings, via hydroponic, aquaponics and tissue culture systems. The application of biotechnology to optimize and create economically valuable plants are discussed and applied. Students learn how to harvest targeted parts of the plant and are introduced to chemical extraction techniques used to isolate bioactive compounds for medicinal purposes.
Prerequisite(s): BIO2510, BIO2516 and (CHM1000/CHM1006 or CHM1022/CHM1026), Corequisite: BIO3510.
Offered at Providence
1 Semester Credit

**BIO3620 Comparative Vertebrate Anatomy**
What features do you share with fish? Birds are dinosaurs? When and how did mammals evolve? In this course, these and other questions are addressed using a multidisciplinary approach incorporating anatomy, physiology, development, ecology and environment to trace the evolution of vertebrate life. Through this approach, students gain a deeper understanding of the basis of human anatomical form and function.
Prerequisite(s): BIO1022, BIO1026, Corequisite: BIO3626.
Offered at Providence
3 Semester Credits

**BIO3626 Comparative Vertebrate Anatomy Laboratory**
Dissection and study of representative species illustrating the evolution of vertebrate design form the foundation of this laboratory experience. Specimens to be studied include amphioxus, lamprey, shark, amphibian (Necturus), and cat or rabbit. Through this approach, students gain a deeper understanding of the basis of mammalian (and human) anatomical form and function.
Prerequisite(s): BIO1022, BIO1026, Corequisite: BIO3620.
Offered at Providence
1 Semester Credit

**BIO4020 Integrative Biology**
Integrative biology is a capstone biology course that applies the fundamental biological concepts of genetics, molecular biology, biochemistry, evolution and ecology to explain biological systems from molecules to communities. This course uses primary literature and bioinformatics to explore microbial interactions, personalized medicine, and biomics. This course is paired with BIO4026 Integrative Biology Laboratory, which allows students to complete a senior research project tied to one of the major topic areas.
Prerequisite(s): BIO3040, Corequisite: BIO4026.
Offered at Providence
3 Semester Credits

**BIO4026 Integrative Biology Laboratory**
This course is a thematic laboratory experience associated with BIO4020 Integrative Biology. This course requires students to investigate a scientific problem through a laboratory, in silico, and/or field research study in one of the following areas: microbial host interactions, personalized medicine, or biomics. Students develop skills essential for becoming an active member of the scientific community and workforce, such as scientific literacy, experimental design, modern research techniques, data collection and analysis, and scientific oral and written communication.
Prerequisite(s): BIO3040, Corequisite: BIO4020.
Offered at Providence
1 Semester Credit

**BIO4030 Advanced Anatomy**
This upper-level anatomy course expands on the content from prerequisite courses through cadaver-based dissection to explore the structure of the human body from functional, developmental and clinical perspectives. All organ systems are studied using prosection and team-based dissection of human cadavers.
Prerequisite(s): BIO2013, BIO2016.
Offered at Providence
3 Semester Credits

**BIO4040 Functional Histology**
This course focuses on the relationship between structure and function of the microscopic aspects of mammalian cells, tissues, and organ systems. It begins with examination of the four basic tissue types. This background is then applied to the histological examination of human organ systems. Functional relationships are emphasized by contrasting normal and pathological specimens.
Prerequisite(s): BIO2013, BIO2016 or BIO2021, BIO2026, Corequisite: BIO4046.
Offered at Providence
3 Semester Credits

**BIO4046 Functional Histology Laboratory**
This course supplements BIO4040, giving students a hands-on experience with microscopic investigation of the histological structure of mammalian tissues with a specific focus on human histology. The laboratory includes experience preparing tissue and making slides of animal tissue.
Prerequisite(s): BIO2013, BIO2016 or BIO2021, BIO2026, Corequisite: BIO4040.
Offered at Providence
1 Semester Credit

**BIO4070 Fundamentals of Immunology**
This is a survey course that introduces students to basic concepts of immunology and fosters an understanding of the immunological processes that underlie human disease pathogenesis.
Prerequisite(s): BIO1011, BIO1016, BIO3010 or CHM3040.
Offered at Charlotte, Providence
3 Semester Credits

**BIO4100 Senior Seminar in Biology**
This is a capstone biology course that allows students to integrate all previous coursework to examine relevant topics in biology. Each term the course focuses on one such topic, and students are charged with finding, analyzing and critically discussing relevant primary journal articles related to that theme. Additionally, students are assigned a research project, for which they must complete a written report and oral presentation.
Prerequisite(s): BIO1011, BIO1016, BIO1022, BIO1026, CHM1022, CHM1026, MATH2010, senior status.
Offered at Providence
3 Semester Credits

**BIO4510 Applications of Plants & Fungi**
This course presents an in-depth look at the evolution of plants and fungi and their respective uses in our society. Students immerse themselves in the structure, function and life cycle of representative members of the Kingdom Plantae and Fungi. Students explore how plants and fungi contribute to all aspects of modern society, such as food, medicine, industrial application, clothing, biotechnology, energy, etc.
Prerequisite(s): BIO3510, BIO3516, Corequisite: BIO4516.
Offered at Providence
3 Semester Credits

**BIO4516 Applications of Plants & Fungi Laboratory**
This laboratory companion course coordinates with BIO4510. This course uses hands-on experiences to reinforce the major concepts associated with the evolution of plants and fungi and their respective uses in our society. Students immerse themselves in the structure, function and life cycle of representative members of the Kingdom Plantae and Fungi. Students explore how plants and fungi contribute to all aspects of modern society, such as food, medicine, industrial application, clothing, biotechnology, energy, etc.
Prerequisite(s): BIO3510, BIO3516, Corequisite: BIO4510.
Offered at Providence
1 Semester Credit