BIOLOGY (BIO)

BIO 101 Bio I: Cells (4 credits)
The study of the structure and function of representative prokaryotic and eukaryotic cells. Chemical makeup, organelle interactions, energy producing and biosynthetic reactions will be stressed. Three lecture periods, one three-hour laboratory period (BIO 101L or BIO 150L). First of three courses in the core program.
Attributes: CCC: Natural Science, GEP. Natural Science, GEP. Science Course w/Lab, Undergraduate

BIO 101L Bio I: Cells Lab (0 credits)
Students who register for BIO 101 must also register for a BIO 101 laboratory. For example, if you register for BIO 101 you must, at the same time, register for a section of BIO 101L.
Attributes: CCC: Natural Science, GEP. Natural Science, Undergraduate

BIO 102 Bio II: Genetics (4 credits)
The study of heredity and the mechanism of transmission of genetic information in biological systems. The course material is approached from the population, organismic, and biochemical perspectives. Three lecture periods, one three-hour laboratory period (BIO 102L or BIO 151L).
Prerequisites: BIO 101
Attributes: GEP. Science Course w/Lab, Undergraduate

BIO 102L Bio II: Genetics Lab (0 credits)
Students who register for BIO 102 must also register for a BIO 102 laboratory. For example, if you register for BIO 102 you must, at the same time, register for a section of BIO 102L.
Attributes: Undergraduate

BIO 105 Human Biology (3 credits)
This course is an introductory study of the biology of the human body. Topics include overviews of the circulatory, digestive, respiratory, nervous, reproductive, excretory, and musculoskeletal systems. Laboratory activities will provide the student with practical experiences in understanding how the human body is organized and how it functions. Students will also address current ethical concerns in the field of biology as they apply to the human body. Students who register for BIO 105 must also register for a BIO 105 laboratory. For example, if you register for BIO 105 you must, at the same time, register for a section of BIO 105L.
Attributes: Undergraduate

BIO 105L Human Biology Lab (0 credits)
Students who register for BIO 105 must also register for a BIO 105 laboratory. For example, if you register for BIO 105 you must, at the same time, register for a section of BIO 105L.

BIO 150L Bio I: Cells Lab Phage (0 credits)
A research-based laboratory for first year students accompanying BIO 101 involving isolation, purification, and preliminary genomic characterization of bacteriophages, viruses that infect bacteria. Open to first year students majoring in Biology, Biomedical Science, Biochemistry, Chemical Biology, Environmental Science, or Medical Laboratory Science. Admission by application. Students are expected to continue with BIO 151L in the spring. Two 120-minute lab periods.
Attributes: CCC: Natural Science, First-Year Seminar, GEP. Natural Science, Undergraduate

BIO 151L Phage Lab (0 credits)
A research-based laboratory for first year students accompanying BIO 102. Students work "in silico" (using computers) to annotate bacteriophage genomes isolated the previous year by students in BIO 150L. Complete annotated genomes will be submitted to GenBank. Open to first year students majoring in Biology, Biomedical Science, Biochemistry, Chemical Biology, Environmental Science, or Medical Laboratory Science. Admission by application. Students are expected to continue with BIO 150L in the spring. Two 75- minute lab periods.
Prerequisites: BIO 150L
Attributes: First-Year Seminar, Undergraduate

BIO 160 Heredity and Evolution (3 credits)
A study of human genetics at three levels: human heredity and the inheritance of disease, genes and DNA, and human evolution. Includes discussion of how a cell uses its genetic information and how scientists study genes using genetic engineering techniques. Open to all students except those who have credit for BIO 102 or BIO 462 or BS 462.
Attributes: GEP. Natural Science, Undergraduate

BIO 161 Human Organism (3 credits)
A study of the basic principles of human anatomy, physiology, and genetics. The organization and function of the human body will be described with an appreciation of underlying genetic and evolutionary concepts. Open to all students except those who have credit for BIO 201 or BIO 202 or BIO 260 or BIO 310 or BS 201 or BS 310.
Attributes: GEP. Natural Science, Undergraduate

BIO 162 Plants and Civilization (3 credits)
This course will examine plants in the context of their importance to people. Plants used for food, fiber, medicine, and recreation will be included. Open to all students. Biology majors need permission of the Biology Chair to take this course.
Restrictions: Students cannot enroll who have a major in Biochemistry, Biology, Biomedical Sciences, Chemistry, Chemical Biology, Environmental Science, Medical Laboratory Science or Physics.
Attributes: GEP. Natural Science, Undergraduate

BIO 165 Exploring the Living World (4 credits)
Students in this course will learn about the scientific world view and experience the methods of science in the context of the life sciences. This course is designed for students not planning to major in science. The course includes a survey of plant and animal life, an overview of bioenergetics, and selected topics in genetics and evolutionary biology. Three lecture periods, one three-hour laboratory period (BIO 165).
Attributes: CCC: Natural Science, GEP. Natural Science, GEP. Science Course w/Lab, Undergraduate

BIO 165L Exp. Living World Lab (0 credits)
Students who register for BIO 165 must also register for a BIO 165 laboratory. For example, if you register for BIO 165 you must, at the same time, register for a section of BIO 165L.
Attributes: CCC: Natural Science, GEP. Natural Science, Undergraduate

BIO 175 A&P for Nursing &Allied Health (4 credits)
This course studies the fundamental elements of human structure and function including cellular physiology, tissue organization, integumentary system, skeletal system, muscular system, nervous system and senses. Unifying themes, such as homeostasis, will be covered. Students who register for BIO 175 must also register for a BIO 175 laboratory. For example, if you register for BIO 175 you must, at the same time, register for a section of BIO 175L.
Restrictions: Enrollment is limited to students with a major in Cardiac Sonography, Cardiovascular Technology, Diagnostic Medical Sonography, Nuclear Medical Technology, Nursing, Radiography, Respiratory Care, Surgical Technology or Vascular Sonography.

BIO 175L A&P Nursing& Allied Health Lab (0 credits)
The laboratory component provides hands-on experiences, which encourage critical thinking, the understanding of scientific methodology and the application of scientific principles as presented in the lecture component of Human Anatomy & Physiology I. Students who register for BIO 175 must also register for a BIO 175 laboratory. For example, if you register for BIO 175 you must, at the same time, register for a section of BIO 175L.

BIO 176 A&P Nursing & Allied Health II (4 credits)
This course is a continuation of Human Anatomy & Physiology I (BIO 175) and includes the cardiovascular system, lymphatic system and immunity, respiratory system, digestive system and metabolism, renal system, fluid/electrolyte and acid/base balance and reproductive system. Unifying themes, such as homeostasis, will be expanded upon. Students who register for BIO 176 must also register for a BIO 176 laboratory. For example, if you register for BIO 176 you must, at the same time, register for a section of BIO 176L.
Prerequisites: BIO 175

BIO 176L A&P Nursing&Allied Hlth II Lab (0 credits)
The laboratory component provides hands-on experiences, which encourage critical thinking, the understanding of scientific methodology and the application of scientific principles as presented in the lecture component of Human Anatomy & Physiology II. Students who register for BIO 176 must also register for a BIO 176 laboratory. For example, if you register for BIO 176 you must, at the same time, register for a section of BIO 176L.

BIO 185 Microbio Nursing&Allied Health (4 credits)
This course provides an introduction to microbiology with an emphasis on the basic principles and concepts including anatomy, classification, physiology and practical uses of microorganisms. Students will develop an understanding of how microorganisms affect our lives by causing disease, destroying things that we consider important or contributing to improving our quality of life. The importance of the prevention of the transmission of infections will be emphasized. Students who register for BIO 185 must also register for a BIO 185 laboratory. For example, if you register for BIO 185 you must, at the same time, register for a section of BIO 185L.
Prerequisites: BIO 105 or BIO 175
Restrictions: Enrollment is limited to students with a major in Nursing.
Attributes: CCC: Natural Science, Undergraduate

BIO 185L Microbio Nursing & Allied Lab (0 credits)
Students who register for BIO 185 must also register for a BIO 185 laboratory. For example, if you register for BIO 185 you must, at the same time, register for a section of BIO 185L.
Attributes: CCC: Natural Science, Undergraduate

BIO 201 Bio III: Organismic Biology (4 credits)
A survey of all living things followed by more detailed study of plants and animals. Topics include development, nutrition, locomotion, transport, and homeostatic controls. Three lecture periods, one three-hour laboratory period (BIO 201L). This course is NOT required for legacy University of the Sciences students.
Prerequisites: BIO 102
Attributes: GEP. Science Course w/Lab, Undergraduate

BIO 201L Bio III: Organismic Biol Lab (0 credits)
Students who register for BIO 201 must also register for a BIO 201 laboratory. For example, if you register for BIO 201 you must, at the same time, register for a section of BIO 201L.
Attributes: Undergraduate

BIO 218 Hematology (3 credits)
Study of the blood and blood-forming tissues with emphasis on the cellular morphology and hematopoietic mechanisms of the red blood cells, white blood cells, and platelets. Also covers a wide variety of clinical disorders, particularly those involving abnormally formed cellular elements and coagulation. Students who register for BIO 218 must also register for a BIO 218 lab section. For example, if you register for BIO 218 you must, at the same time, register for a section of BIO 218L.
Prerequisites: BS 119 or BIO 102 or BIO 119 or BS 133 or BIO 133
Restrictions: Enrollment is limited to Undergraduate Division level students.
Attributes: Undergraduate

BIO 218L Hematology Lab (1 credit)
Students who register for BIO 218 must also register for a BIO 218 lab section. For example, if you register for BIO 218 you must, at the same time, register for a section of BIO 218L.
Restrictions: Enrollment is limited to Undergraduate Division level students.
Attributes: Undergraduate

BIO 219 Nutrition (3 credits)
A basic course in understanding nutrition and its implications in the maintenance of good health.
Prerequisites: BS 119 or BIO 102 or BIO 119 or BS 133 or BIO 133
Attributes: Undergraduate

BIO 230 Basic Concepts & Proc MLS (4 credits)
Fundamentals in medical laboratory sciences. Students who register for BIO 230 must also register for BIO 230 lab section. For example, if you register for BIO 230 you must, at the same time, register for a section of BIO 230L.
Prerequisites: BS 119 or BIO 102 or BIO 119 or BS 133 or BIO 133
Attributes: Undergraduate

BIO 230L Basic Concepts Med Lab Sci Lab (0 credits)
Students who register for BIO 230 must also register for BIO 230 lab section. For example, if you register for BIO 230 you must, at the same time, register for a section of BIO 230L.
Restrictions: Enrollment is limited to Undergraduate Division level students.
Attributes: Undergraduate

BIO 240 Introduction to Immunology (3 credits)
This course will cover principles of immunology, both at the molecular and cellular level, and will address aspects of cell mediated immunity in health and disease. Emphasis will be placed on specific and non-specific immunity and how the systems interact with each other. Other aspects of immunology, such as cancer, autoimmunity, immunology tools and the mechanisms pathogens use to avoid the immune system, will be covered.
Prerequisites: BIO 105 or BIO 185 or BIO 176

BIO 260 Anat&Physiol for Al Hlth I (4 credits)
This course is designed for students needing preparation in human anatomy and physiology for allied health programs. Students may count either BIO 175 plus BIO 176, or BIO 260 plus BIO 261, or BIO 202 plus BIO 203, or BIO 310 plus BIO 311, or BIO 417 toward graduation, but not more than one such combination. Three 50-minute lecture periods and one three-hour lab period (BIO 260L).
Prerequisites: BIO 102 (may be taken concurrently) or BIO 119 or BIO 133 or BS 119 or BS 133
Attributes: Undergraduate

BIO 260L Anatomy & Physiology Lab I (0 credits)
Students who register for BIO 260 must also register for a BIO 260 lab section. For example, if you register for BIO 260 you must, at the same time, register for a section of BIO 260L.
Attributes: Undergraduate

BIO 261 Anat&Physiol for Al Hlth II (4 credits)
Continuation of BIO 260. This course is designed for students needing preparation in human anatomy and physiology for allied health programs. Students may count either BIO 175 plus BIO 176, or BIO 260 plus BIO 261, or BIO 202 plus BIO 203, or BIO 310 plus BIO 311, or BIO 417 toward graduation, but not more than one such combination. Three 50-minute lecture periods and one three-hour lab period (BIO 261L).
Prerequisites: BIO 260
Attributes: Undergraduate

BIO 261L Anatomy & Physiology Lab II (0 credits)
Students who register for BIO 261 must also register for a BIO 261L lab section. For example, if you register for BIO 261 you must, at the same time, register for a section of BIO 261L.
Attributes: Undergraduate

BIO 270 Clinical Micro (4 credits)
This course is designed for students needing preparation in microbiology as required for allied health programs. Not open to students who have taken BIO 185 or BIO 243 or BIO 348 or BIO 416 or BIO 422 or BIO 425 or BIO 453 or BS 244 or BS 342 or BS 343 or BS 347 or BS 348 or BS 350 or BS 375 or BS 453. Three 50-minute lecture periods and one three-hour lab period (BIO 270L).
Prerequisites: BIO 102 or BIO 119 or BS 119 or BIO 133 or BS 133
Attributes: Undergraduate

BIO 270L Clinical Microbiology Lab (0 credits)
Students who register for BIO 270 must also register for a BIO 270L lab section. For example, if you register for BIO 270 you must, at the same time, register for a section of BIO 270L.
Attributes: Undergraduate

BIO 290 Career Development Seminar (0 credits)
This seminar course is designed to enhance students' professional development, knowledge about careers, and practical career skills. By the end of the seminar, students will be able to identify career paths of interest and have the necessary tools to pursue them. This course is taken in the fall of the sophomore year for Biology and Biomedical Sciences majors.
Attributes: Undergraduate

BIO 310 Anatomy and Physiology I (3 credits)
A systemic approach to the structure and function of the human. Organ systems studied include the integumentary, skeletal, muscular, and nervous systems. Three lecture periods. Students may also take the BIO 202L Human Structure & Function I Lab (1 credit) concurrently with this lecture. Students may count either BIO 175 plus BIO 176, or BIO 202 plus BIO 203, or BIO 260 plus BIO 261, or BIO 310 plus BIO 311, or BIO 417 toward graduation, but not more than one such combination.
Prerequisites: (BIO 201 or BIO 243 or BS 243) and (CH 102 or CHM 125 or CH 112)
Restrictions: Enrollment is limited to Undergraduate Division level students.
Attributes: Undergraduate

BIO 311 Anatomy and Physiology II (3 credits)
Continuation of BIO 310; systemic approach to the structure and function of the human. Organ systems studied include endocrine, circulatory, respiratory, digestive, and excretory systems. Three lecture periods. Students may also take the BIO 203L Human Structure & Function II Lab (1 credit) concurrently with this lecture. Students may count either BIO 175 plus BIO 176, or BIO 202 plus BIO 203, or BIO 260 plus BIO 261, or BIO 310 plus BIO 311, or BIO 417 toward graduation, but not more than one such combination.
Prerequisites: BIO 260 or BIO 310 or BIO 202 or BS 205 or BS 310
Attributes: Undergraduate

BIO 320 Science Communication&Outreach (1 credit)
Optional Service Learning course can be taken in conjunction with any Biology course. Guided experience in preparing and presenting hands-on science lessons to K-12 children. Time commitment is 3 hrs per week.
Attributes: Undergraduate

BIO 335 Virology (3 credits)
The study of bacterial, plant, and animal viruses is presented with an emphasis on animal virology. Viral taxonomy, mechanisms of viral reproduction and replication, and the pathology of selected viral families are presented.
Prerequisites: (BIO 201 or BIO 119 or BS 119 or BIO 133 or BS 133) and (CHM 125 or CHM 126 or CH 102 or CH 112)
Attributes: Undergraduate

BIO 337 Pharmacogosy (3 credits)
This course aims to provide an in-depth perspective about the use of natural product as drugs. The course will cover the fundamentals of pharmacognosy, details on the phytomedicines used in pharmacy, chemistry of secondary metabolites of organisms used in drug therapies, characterization and standardization of phytomedicines and nutraceuticals and the use of natural products as complementary or alternative medicine.
Restrictions: Enrollment is limited to students with a major in Biological Studies, Biology, Biomedical Sciences, Chemical Biology, Environmental Science or Medical Laboratory Science.
Attributes: Undergraduate

BIO 348 Applied Clinical Microbiology (4 credits)
A survey of the various bacteria that cause human infections. The type of infection caused, portal of entry, molecular basis of the infection process, treatment, and laboratory identification are discussed for each group of organisms. Three hours of lecture and three hours of lab (BIO 348L). Students may count only one of the following courses towards their graduation requirements: BIO 348, BIO 270, BIO 416, BIO 422, BIO 425, BIO 453, BS 244, BS 342, BS 343, BS 347, BS 348, BS 350, BS 375, or BS 453.
Prerequisites: (BIO 201 or BIO 243 or BS 243) and (CHM 125 or CHM 126 or CH 102 or CH 112)
Restrictions: Enrollment is limited to students with a major in Microbiology or Medical Laboratory Science.
Attributes: Undergraduate

BIO 348L Adv Clinical Microbio Lab (0 credits)
Students who register for BIO 348 must also register for a BIO 348L lab section. For example, if you register for BIO 348 you must, at the same time, register for a section of BIO 348L.
Restrictions: Enrollment is limited to students with a major in Microbiology or Medical Laboratory Science.
Attributes: Undergraduate

BIO 358 Principals &App of Immunology (3 credits)
Study of the principles and mechanisms of immunology and their applications to infection, hypersensitivity, autoimmunity, transplantation, cancer and AIDS. Students may count BIO 358 or BIO 415 towards their graduation requirements, but not both.
Prerequisites: (BIO 201 or BIO 243 or BS 243) and (CHM 125 or CHM 126 or CH 102 or CH 112)
Restrictions: Enrollment is limited to Undergraduate Division level students.
Attributes: Undergraduate

BIO 360 God and Evolution (3 credits)
This course considers a major topic in academic discourse and society at large, the relationship between religion/theology and biological evolution. This course explores the thesis that the two can be compatible- including from an informed scientific point of view. Students in this course learn evolutionary biology, theological account of creation, and how they can be compatible. This course does not fulfill requirements for a Biology, Biomedical Science, or Medical Laboratory Science major or minor.
Prerequisites: (THE 153 or THE 154 or THE 155 or THE 221)
Attributes: GEP. Faith-Reason Course, Undergraduate

BIO 372 Aquatic Biology (4 credits)
A lecture and field course concerning the biological, physical, and chemical aspects of freshwater ecosystems. Includes collection, preservation, and recognition of aquatic organisms other than vertebrates and the study of those aspects of their biology that are important adaptations to aquatic life. Students who register for BIO 372 must also register for BIO 372L lab section. For example, if you register for BIO 372 you must, at the same time, register for a section of BIO 372L.
Prerequisites: (BIO 201 or BIO 243 or BS 243) and (CH 102 or CHM 125 or CHM 126 or CH 112)
Attributes: Undergraduate

BIO 372L Aquatic Biology Lab (0 credits)
Students who register for BIO 372 must also register for BIO 372L lab section. For example, if you register for BIO 372 you must, at the same time, register for a section of BIO 372L.
Restrictions: Enrollment is limited to Undergraduate Division level students.
Attributes: Undergraduate

BIO 376 Pathophysiology (3 credits)
This course examines the etiology, signs, symptoms, diagnosis, therapy, and prognosis of common disease states. Organized by system, the course will review the normal physiology then explore common pathologies within those systems. In addition, students will examine how disease affects the body as a whole.

BIO 380 Epidemiology (3 credits)
This course introduces the basic principles of epidemiology and the methods used to address public health problems. Descriptive and analytic epidemiology techniques used to investigate outbreaks will be covered.
Prerequisites: BIO 185 or BIO 240

BIO 390 Biology Seminar (0 credits)
Attendance at three seminars is required each semester during sophomore, junior, and senior years. Approved seminars are posted in the Department.
Restrictions: Enrollment is limited to students with a major in Biology or Biomedical Sciences.
Attributes: Undergraduate

BIO 400 Developmental Genetics (3 credits)
Students will learn about the principles governing plant and animal development and the underlying cellular and genetic mechanisms. This includes: gametogenesis and fertilization, sex determination, embryogenesis and early development, ectoderm development (nervous systems, skin and appendages), mesoderm development (muscle, bone, blood and cardiovascular), endoderm development (organogenesis, tube formation and reproduction) and an introduction to common developmental disorders. Students will read primary literature and learn about the techniques employed in developmental genetics research using model systems.
Prerequisites: (BIO 201 or BIO 119 or BS 119 or BIO 133 or BS 133) and (CHM 125 or CHM 126 or CH 102 or CH 112)
Attributes: Undergraduate

BIO 401 Animal Behavior (4 credits)
The study of animals and their behaviors, with a strong emphasis on evolutionary relationships and ecology. Live animals will be studied in the classroom, laboratory, and field. Two 50-minute lecture periods, one four- hour laboratory period (BIO 41L). Students may only count one of the following courses towards their graduation requirements: BS 305 or BIO 305, or BIO 401.
Prerequisites: (BIO 201 or BIO 119 or BS 119 or BIO 133 or BS 133) and (CHM 125 or CHM 126 or CH 102 or CH 112)
Attributes: Undergraduate

BIO 401L Animal Behavior Lab (0 credits)
Students who register for BIO 401 must also register for a BIO 401 laboratory. For example, if you register for BIO 401 you must, at the same time, register for a section of BIO 401L.
Attributes: Undergraduate

BIO 402 Advanced Cell Biology (4 credits)
An in-depth analysis of eukaryotic cell structure and function, including membrane structure and transport, cellular organelles, the cytoskeleton, and cell communication. Emphasis will be on experimental approaches to understanding concepts in cell biology. Two 50-minute lecture periods, one four-hour laboratory period (BIO 402L). Students may count only one of the following courses towards their graduation requirements: BIO 306, or BS 306, or BIO 402.
Prerequisites: (BIO 201 or BIO 119 or BS 119 or BIO 133 or BS 133) and (CHM 125 or CH 102 or CH 112 or CHM 126)
Attributes: Undergraduate

BIO 402L Advanced Cell Biology Lab (0 credits)
Students who register for BIO 402 must also register for a BIO 402 laboratory. For example, if you register for BIO 402 you must, at the same time, register for a section of BIO 402L.
Attributes: Undergraduate

BIO 404 Biochemistry (3 credits)
An introduction to the chemistry of living systems. The study of important molecules, metabolic pathways, and control systems will be emphasized. Students may count only one of the following courses towards their graduation requirements: BIO 404, or CHM 340, or CHM 335, or CHM 341, or CHM 343, or CHM 346.
Prerequisites: (BIO 201 or BIO 119 or BIO 133 or BS 119 or BS 133) and (CHM 215 (may be taken concurrently) or CH 202 or CH 212) and (CHM 125 or CH 102 or CH 112 or CHM 126)
Attributes: Undergraduate

BIO 405 Biomechanics (4 credits)
The role of physics in biological systems and the organismal and super-organismal level. Lectures will cover a range of biomechanics disciplines, presenting underlying physical principles and their biological ramifications. Laboratories will provide experience with the experimental techniques available to measure forces relevant to biological systems. Two 75-minute lecture periods, one three-hour laboratory period (BIO 405L).
Prerequisites: (BIO 201 or BIO 119 or BS 119 or BIO 133 or BS 133) and (CHM 125 or CHM 126 or CH 102 or CH 112) and (PHY 101 or PHY 105 or PY 212 or PY 202)
Attributes: Undergraduate

BIO 405L Biomechanics Lab (0 credits)
Students who register for BIO 405 must also register for a BIO 405 laboratory. For example, if you register for BIO 405 you must, at the same time, register for a section of BIO 405L.
Attributes: Undergraduate

BIO 406 Human Anatomy (4 credits)
An in depth look into anatomic and histological features of the human body, with correlation to clinical significance where applicable. This one semester course will focus on the major body systems, including but not limited to, integumentary, skeletal, muscular, nervous systems, cardiovascular, respiratory, digestive, urinary, and reproductive systems. The associated lab (BIO 406L) will reinforce the lecture content with the use of models, cat dissection, and dissection of select organs. Students may count either BIO 175 plus BIO 176, BIO 260 plus BIO 261, or BIO 406 plus BIO 417 but not more than one of these combinations.
Prerequisites: (BIO 201 or BIO 119 or BIO 133 or BS 119 or BS 133) and (CHM 125 or CHM 126 or CH 102 or CH 112)
Attributes: Undergraduate

BIO 406L Human Anatomy Lab (0 credits)
Laboratory associated with BIO 406, an in depth look into anatomic and histological features of the human body, with correlation to clinical significance where applicable. This one semester course will focus on the major body systems, including but not limited to, integumentary, skeletal, muscular, nervous systems, cardiovascular, respiratory, digestive, urinary, and reproductive systems. Students who register for BIO 406 must also register for a BIO 406 laboratory. For example, if you register for BIO 406 you must, at the same time, register for a section of BIO 406L.
Prerequisites: BIO 201 and CHM 125
Attributes: Undergraduate

BIO 409 Ecology (4 credits)
A study of the complex interrelationship between organisms and their environment. The course will include discussions on fundamental themes in ecology such as food webs and population growth, as well as topics of current interest such as oil spills and the destruction of the rain forest. Two 50-minute lecture periods, one four- hour laboratory period (BIO 409L). Students may count only one of the following courses towards their graduation requirements: BIO 377, or BS 377, or BIO 409.
Prerequisites: (BIO 201 or BIO 119 or BS 119 or BIO 133 or BS 133) and (CHM 125 or CHM 126 or CH 102 or CH 112)
Attributes: Undergraduate

BIO 409L Ecology Lab (0 credits)
Students who register for BIO 409 must also register for a BIO 409 laboratory. For example, if you register for BIO 409 you must, at the same time, register for a section of BIO 409L.
Attributes: Undergraduate

BIO 411 Molecular Genetics (4 credits)
Study of the molecular biology of the genetic material, its structure, expression, regulation, and its dynamic nature. Two 50-minute lecture periods, one four-hour laboratory period (BIO 411L). Students may count only one of the following courses towards their graduation requirements: BIO 343, or BS 343, or BIO 411, or CHM 342, or CHM 356.
Prerequisites: (BIO 201 or BIO 119 or BS 119 or BIO 133 or BS 133) and (CHM 125 or CH 102 or CH 112 or CHM 126) and ENG 101
Attributes: CCC: Writing Intensive, Undergraduate, GEP. Writing Intensive

BIO 411L Molecular Genetics Lab (0 credits)
Students who register for BIO 411 must also register for a BIO 411 laboratory. For example, if you register for BIO 411 you must, at the same time, register for a section of BIO 411L.
Attributes: Undergraduate

BIO 412 Neurobiology (4 credits)
Introduction to the structure and function of the vertebrate nervous system. Major topics will include neuronal function, sensory and motor systems, behavior, and higher mental processes. Laboratory work will include hands-on experience of several neurobiological techniques to measure molecular and biochemical changes in a mouse brain. Two 50-minute lecture periods, and two 2-hour laboratory periods (BIO 412L). Students may count only one of the following courses towards their graduation requirements: BIO 412 or BIO 460 or BS 460. Students may count BIO 412 or BIO 460 towards their graduation requirements, but not both.
Prerequisites: (BIO 201 or BIO 119 or BS 119 or BIO 133 or BS 133) and (CHM 125 or CHM 126 or CH 102 or CH 112)
Attributes: Undergraduate

BIO 412L Neurobiology Lab (0 credits)
Students who register for BIO 412 must also register for a BIO 412 laboratory. For example, if you register for BIO 412 you must, at the same time, register for a section of BIO 412L.
Attributes: Undergraduate

BIO 413 Plant Physiological Ecology (4 credits)
This course will focus on the physiological mechanisms plants use to respond to their environment. Major topic areas include the basic environmental physiology of carbon, water, and mineral nutrient exchange, and the adaptive mechanisms plants use to survive the variety of global environments. Labs will cover common physiological research methods ranging from cellular to whole organism level measurements and will involve both laboratory and field work. Two 75-minute lecture periods, two 90-min laboratory periods (BIO 413L).
Prerequisites: (BIO 201 or BIO 119 or BS 119 or BIO 133 or BS 133) and (CHM 125 or CH 102 or CH 112 or CHM 126)
Attributes: Undergraduate

BIO 413L Plant Physiological Eco Lab (0 credits)
Students who register for BIO 413 must also register for a BIO 413 laboratory. For example, if you register for BIO 413 you must, at the same time, register for a section of BIO 413L.
Attributes: Undergraduate

BIO 414 Plant Systematics (4 credits)
Students will learn to recognize vascular plant families and understand how taxonomists study evolutionary relationships among plant groups. Economic, medical, and ecological importance of various seed plants will be emphasized. Two 75-minute lecture periods, two 90-minute laboratory periods (BIO 414L).
Prerequisites: (BIO 201 or BIO 119 or BS 119 or BIO 133 or BS 133) and (CHM 125 or CH 102 or CH 112 or CHM 126)
Attributes: Undergraduate

BIO 414L Plant Systematics Lab (0 credits)
Students who register for BIO 414 must also register for a BIO 414 laboratory. For example, if you register for BIO 414 you must, at the same time, register for a section of BIO 414L.
Attributes: Undergraduate

BIO 415 Immunology (4 credits)
An introductory course providing students with an overview of how the immune system works, including molecules, cells and organs of the immune system and their functions and interactions. Discussion of the experimental techniques used to understand the cell-cell interactions that occur in immunity as well as the differentiation and activation of the immune response will be included. Two 50-minute lecture periods, one four-hour laboratory period (BIO 415L). Students may count BIO 350 or BIO 415 towards their graduation requirements, but not both.
Prerequisites: (BIO 201 or BIO 119 or BS 119 or BIO 133 or BS 133) and (CHM 125 or CHM 126 or CH 102 or CH 112)
Attributes: Undergraduate

BIO 415L Immunology Lab (0 credits)
Students who register for BIO 415 must also register for a BIO 415 laboratory. For example, if you register for BIO 415 you must, at the same time, register for a section of BIO 415L.
Attributes: Undergraduate

BIO 416 Microbiology (4 credits)
The structural, cultural, and physiological characteristics of microorganisms and their role in the economy of nature. The principles of immunity, serology, and virology are also considered. Three 50-minute lecture periods, one three-hour laboratory period (BIO 416L). Students may count only one of the following courses towards their graduation requirements: BIO 185 or BIO 243 or BIO 270 or BIO 416 or BIO 453 or BS 453.
Prerequisites: (BIO 201 or BIO 119 or BS 119 or BIO 133 or BS 133) and (CHM 125 or CHM 126 or CH 102 or CH 112)
Attributes: Undergraduate

BIO 416L Microbiology Lab (0 credits)
Students who register for BIO 416 must also register for a BIO 416 laboratory. For example, if you register for BIO 416 you must, at the same time, register for a section of BIO 416L.
Attributes: Undergraduate

BIO 417 Systemic Physiology (4 credits)
A study of the fundamental mechanisms of vertebrate physiology. The basis for the function of the various organ systems and the biological controls that result in the integration of these systems will be discussed. Two 50-minute lecture periods, one four-hour laboratory period (BIO 417L). Students may count only one of the following courses towards their graduation requirements: BS 412, or BIO 440, or BIO 417.
Prerequisites: (BIO 201 or BIO 119 or BS 119 or BIO 133 or BS 133) and (CHM 125 or CH 102 or CH 112 or CHM 126)
Attributes: Undergraduate

BIO 417L Systemic Physiology Lab (0 credits)
Students who register for BIO 417 must also register for a BIO 417 laboratory. For example, if you register for BIO 417 you must, at the same time, register for a section of BIO 417L.
Attributes: Undergraduate

BIO 419 Invertebrate Zoology (4 credits)
A study of the morphology, physiology, behavior, and phylogenetic relationships of the major groups of invertebrates. Participants will compare and contrast the physical and biological challenges facing the invertebrates that live on land, in water, and inside other organisms. The laboratory will include observations and experiments on live and preserved animals. Two 50-minute lecture periods, and two 2-hour lab periods (BIO 419L).
Prerequisites: (BIO 201 or BIO 119 or BS 119 or BIO 133 or BS 133) and (CHM 125 or CHM 126 or CH 102 or CH 112)
Attributes: Undergraduate

BIO 419L Invertebrate Zoology Lab (0 credits)
Students who register for BIO 419 must also register for a BIO 419 laboratory. For example, if you register for BIO 419 you must, at the same time, register for a section of BIO 419L.
Attributes: Undergraduate

BIO 420 Bioinformatics (4 credits)
Introduction to the use of computers in biology. Students learn about important scientific questions and the contemporary tools used to answer them. Topics include genome sequence assembly and annotation, database mining, genome organization, phylogenetics and genetics of human disease. Students who register for BIO 420 must also register for a BIO 420 laboratory. For example, if you register for BIO 420 you must, at the same time, register for a section of BIO 420L.
Prerequisites: (BIO 201 or BIO 119 or BS 119 or BIO 133 or BS 133) and (CHM 125 or CH 102 or CH 112 or CHM 126)
Attributes: Undergraduate

BIO 420L Bioinformatics Lab (0 credits)
Students who register for BIO 420 must also register for a BIO 420 laboratory. For example, if you register for BIO 420 you must, at the same time, register for a section of BIO 420L.
Attributes: Undergraduate

BIO 421 Molecular&Cellular Biophysics (4 credits)
The course is designed to show students how the integration of physics, chemistry and molecular biology are used to explain and predict molecular and cellular processes such as protein-protein interactions, protein folding, diffusion, and signaling. The course will also provide students with a basic understanding and hands- on experience of several biophysical and biochemical laboratory techniques. Two 50-minute lecture periods, one four-hour lab period (BIO 421L).
Prerequisites: (BIO 201 or BIO 119 or BS 119 or BIO 133 or BS 133) and (CHM 125 or CH 102 or CH 112 or CHM 126) and (PHY 101 or PY 202 or PY 212 or PHY 105)
Attributes: Undergraduate

BIO 421L Mol & Cell Biophysics Lab (0 credits)
Students who register for BIO 421 must also register for a BIO 421 laboratory. For example, if you register for BIO 421 you must, at the same time, register for a section of BIO 421L.
Attributes: Undergraduate

BIO 422 Applied & Environ Microbiology (4 credits)
The course will introduce us to the complex relationships between microbes and their environment, including other organisms. In the frame of these relationships, we will explore how microbial activities are key to geochemical cycles and to human-engineered processes that are essential part of our lives. Two 50-minute lecture periods, one four-hour lab period (BIO 422L).
Prerequisites: (BIO 201 or BIO 119 or BS 119 or BIO 133 or BS 133) and (CHM 125 or CH 102 or CH 112 or CHM 126)
Attributes: Undergraduate

BIO 422L Applied & Environ Micro Lab (0 credits)
Students who register for BIO 422 must also register for a BIO 422 laboratory. For example, if you register for BIO 422 you must, at the same time, register for a section of BIO 422L.
Attributes: Undergraduate

BIO 423 Evolution (4 credits)
This course covers the major concepts of evolutionary biology, including natural selection, adaptation, genetic drift, and phylogenetic trees. The course trains students to know how to generate and test evolutionary hypotheses using data and inference. The lab portion of the course (BIO 423L) encourages hands-on learning through computer simulation and problem-solving.
Prerequisites: (BIO 201 or BIO 119 or BS 119 or BIO 133 or BS 133) and (CHM 125 or CH 102 or CH 112 or CHM 126)
Attributes: Undergraduate

BIO 423L Evolution Lab (0 credits)
Students who register for BIO 423 must also register for a BIO 423 laboratory. For example, if you register for BIO 423 you must, at the same time, register for a section of BIO 423L.
Attributes: Undergraduate

BIO 424 Biotechnology (4 credits)
A course in which students will learn how basic cell and molecular biology are used to develop products for biomedical, agricultural and industrial applications. The course will also cover fundamental and emerging techniques in the biotechnology field. The lab section (BIO 424L) will focus on the steps involved in the production and purification of recombinant proteins expressed in bacterial cells. Two 50-minute lecture periods, one four- hour laboratory period (BIO 424L).
Prerequisites: (BIO 201 or BIO 119 or BS 119 or BIO 133 or BS 133) and (CHM 125 or CH 102 or CH 112 or CHM 126)
Attributes: Undergraduate

BIO 424L Biotechnology Lab (0 credits)
Students who register for BIO 424 must also register for a BIO 424 laboratory. For example, if you register for BIO 424 you must, at the same time, register for a section of BIO 424L.
Attributes: Undergraduate

BIO 425 Bacterial Pathogenesis (4 credits)
A study of the physiological, genetic, and biochemical basis underlying some of the commonly encountered bacterial diseases. The course also addresses the roles of antimicrobial compounds and the host immune system in counteracting disease. Finally, in the lab module for the course, students perform discovery-oriented research as they identify novel genes in enteropathogenic Escherichia coli (EPEC) that affect bacterial virulence in a C. elegans (roundworm) model of disease. Two 75-minute lecture periods, one three-hour laboratory period (BIO 425L).
Prerequisites: (BIO 201 or BIO 119 or BS 119 or BIO 133 or BS 133) and (CHM 125 or CHM 126 or CH 102 or CH 112)
Attributes: Undergraduate

BIO 425L Bacterial Pathogenesis Lab (0 credits)
Students who register for BIO 425 must also register for a BIO 425 laboratory. For example, if you register for BIO 425 you must, at the same time, register for a section of BIO 425L.
Attributes: Undergraduate

BIO 426 Fermentation Science (3 credits)
This course will provide students with an overview of various fermentation processes and their use in producing fermented foods and beverages. Fermentation will be considered from biochemical, microbiological, food science, historical and cultural points of view.
Prerequisites: (BIO 201 or BIO 119 or BS 119 or BIO 133 or BS 133) and (CHM 125 or CHM 126 or CH 102 or CH 112)
Attributes: Undergraduate

BIO 426L Fermentation Science Lab (0 credits)
Students who register for BIO 426 must also register for a BIO 426 laboratory. For example, if you register for BIO 426 you must, at the same time, register for a section of BIO 426L.
Attributes: Undergraduate

BIO 427 Human Genetics (4 credits)
This course explores human genetics, covering various topics, including Mendelian and complex diseases, chromosomal abnormalities, heritability, genetic variations, and methods for investigating disease associations. Additional focus areas include population, quantitative, developmental genetics, genetics in cancer and neurodegenerative disease, and epigenetics. Students who register for BIO 427 must also register for a BIO 427 laboratory. For example, if you register for BIO 427 you must, at the same time, register for a section of BIO 427L.
Prerequisites: (BIO 201 or BIO 119 or BIO 133 or BS 119 or BS 133) and (CHM 125 or CHM 126 or CH 102 or CH 112)
Restrictions: Enrollment is limited to students with a major in Biological Studies, Biology, Biomedical Sciences, Chemical Biology, Environmental Science or Medical Laboratory Science.
Attributes: Undergraduate

BIO 427L Human Genetics Lab (0 credits)
The human genetics laboratory will consist of exercises that train students in the mechanisms of inheritance and gene action from the molecular to the organismic and population levels. Additionally, the exercises would train all students in commonly used genetic diagnostic tools and apply the principles of human genetics learned in the lecture. Students who register for BIO 427 must also register for a BIO 427 laboratory. For example, if you register for BIO 427 you must, at the same time, register for a section of BIO 427L.
Attributes: Undergraduate

BIO 428 Histopathology (4 credits)
A study of the microscopic structure and function of normal and diseased cells, tissues and organs, focusing on vertebrates, with a special emphasis on humans. Using prepared slides and computer images, students will learn to identify and differentiate healthy and pathological samples and relate this to abnormal or disrupted organ function. Two 50-minute lecture periods, two, two-hour lab periods (BIO 428L).
Prerequisites: (BIO 201 or BIO 119 or BS 119 or BIO 133 or BS 133) and (CHM 125 or CHM 126 or CH 102 or CH 112)
Attributes: Undergraduate

BIO 428L Histopathology Lab (0 credits)
Students who register for BIO 428 must also register for a BIO 428 laboratory. For example, if you register for BIO 428 you must, at the same time, register for a section of BIO 428L.
Attributes: Undergraduate

BIO 429 Environmental Science (4 credits)
An overview of the relationship between humans, their activities, and the environment around them. Though focused on the biological impacts from pollution, overpopulation, climate change, and resource exploitation, this course will also address the chemical and physical mechanisms that drive those changes and possible solutions to the challenges they present. Three, 50-minute lecture periods, one three-hour laboratory period (BIO 429L).
Prerequisites: (BIO 201 or BIO 119 or BS 119 or BIO 133 or BS 133) and (CHM 125 or CHM 126 or CH 102 or CH 112)
Attributes: Undergraduate

BIO 429L Environmental Science Lab (0 credits)
Students who register for BIO 429 must also register for a BIO 429 laboratory. For example, if you register for BIO 429 you must, at the same time, register for a section of BIO 429L.
Attributes: Undergraduate

BIO 430 Neurological Disorders (4 credits)
Students will learn about the molecular and cellular mechanisms underlying various human nervous system disorders, such as autism, addiction, trauma, and neurodegenerative disorders. There will be a focus on the reading of primary literature and writing. Laboratory work will include a semester-long investigative research project. Two 50-minute lecture periods, and two 2-hour laboratory periods (BIO 430L). Students may count BIO 430 or BIO 455 towards their graduation requirements, but not both.
Prerequisites: (BIO 201 or BIO 119 or BS 119 or BIO 133 or BS 133) and (CHM 125 or CHM 126 or CH 102 or CH 112) and ENG 101
Attributes: CCC: Writing Intensive, Undergraduate

BIO 430L Neurological Disorders Lab (0 credits)
Students who register for BIO 430 must also register for a BIO 430 laboratory. For example, if you register for BIO 430 you must, at the same time, register for a section of BIO 430L.
Attributes: Undergraduate

BIO 433 Parasitology (3 credits)
Survey of the geographic distribution, incidence, symptoms, diagnosis, treatment, prevention, control, and immunology of important parasitic diseases in humans. Emphasis is placed on relationship of culture and social customs to the life cycles of the parasites. Class discussions and presentations will focus on ethical implications of diagnoses, as well as related Western interventions in developing countries. Students who register for BIO 433 must also register for a BIO 433 laboratory. For example, if you register for BIO 433 you must, at the same time, register for a section of BIO 433L.
Prerequisites: BIO 201
Attributes: Undergraduate

BIO 433L Parasitology Lab (1 credit)
Students who register for BIO 433 must also register for a BIO 433 laboratory. For example, if you register for BIO 433 you must, at the same time, register for a section of BIO 433L.

BIO 470 Special Topics (1-4 credits)
Advanced study on a topic or problem to be arranged with any of the Departmental faculty members.
Prerequisites: BIO 201 and CHM 125
Attributes: Undergraduate

BIO 472 Aquatic Biology (4 credits)
A lecture and field course concerning the biological, physical, and chemical aspects of freshwater ecosystems. Includes collection, preservation, and recognition of aquatic organisms other than vertebrates and the study of those aspects of their biology that are important adaptations to aquatic life. Students who register for BIO 472 must also register for BIO 472L lab section. For example, if you register for BIO 472 you must, at the same time, register for a section of BIO 472L.
Prerequisites: (BIO 201 or BIO 243 or BS 243) and (CHM 125 or CHM 126 or CH 102 or CH 112)
Attributes: Undergraduate

BIO 472L Aquatic Biology Lab (0 credits)
Students who register for BIO 472 must also register for BIO 472L lab section. For example, if you register for BIO 472 you must, at the same time, register for a section of BIO 472L.
Attributes: Undergraduate

BIO 473 Biological Sciences Seminar I (1 credit)
Reports and seminars on topics of current biological interest presented by students or outside speakers. Depending on the instructor, topic may be one of students' or instructor's choice. Required of all senior biological sciences majors; open to all qualified students. This course is only open to legacy University of the Sciences students.
Prerequisites: (BIO 119 or BS 119) or (BIO 133 or BS 133)
Restrictions: Enrollment is limited to Undergraduate Division level students. Enrollment limited to students with the University Sciences Legacy attribute.
Attributes: Undergraduate

BIO 474 Emrg Bio Threat & Glbl Sustain (3 credits)
Biological threats such as emerging human/animal diseases, food insecurity, and population growth are examined in connection with causes and effects on global changes in climate, land use, decline in biodiversity, etc. Topics are covered through journal readings, reports, presentations, and student blogs.
Prerequisites: (BIO 201 or BIO 119 or BS 119 or BIO 133 or BS 133) and (CHM 125 or CHM 126 or CH 102 or CH 112)
Attributes: Undergraduate

BIO 475 Biological Sciences Seminar II (1 credit)
Continuation of BIO 473 - Biological Sciences Seminar I. Students will integrate knowledge and ideas within biology and across other fields.
Prerequisites: (BIO 473 or BS 493)
Attributes: Undergraduate

BIO 491 Biology Internship (1-3 credits)
Internships enable the student to gain first-hand experience working in some field of biology. Interns should work a minimum of 10 hours weekly for 14 weeks to earn credit for a single course. Permission to take an internship for course credit must be obtained prior to beginning the internship. Permission of the Chair of Biology required.
Prerequisites: BIO 201 and (CHM 125 or CHM 126)
Attributes: Undergraduate

BIO 492 Biology Internship II (1-3 credits)
Internships enable the student to gain first-hand experience working in some field of biology. Interns should work a minimum of 10 hours weekly for 14 weeks to earn credit for a single course. Permission to take an internship for course credit must be obtained prior to beginning the internship. Permission of the Chair of Biology required.
Prerequisites: BIO 201 and (CHM 125 or CHM 126)
Attributes: Undergraduate

BIO 493 Undergraduate Research in Bio (1-6 credits)
Laboratory or field work on a specific biological problem in cooperation with a faculty member of the department. Normally requires three hours of work per week for each unit of credit. This course may be taken for credit multiple semesters but only one semester counts as a biology elective. In subsequent semesters this course will count as a general elective.
Prerequisites: BIO 201 and (CHM 125 or CHM 126)
Attributes: Undergraduate

BIO 494 Undergraduate Research in Bio (1-6 credits)
Laboratory or field work on a specific biological problem in cooperation with a faculty member of the department. Normally requires three hours of work per week for each unit of credit. This course may be taken for credit multiple semesters but only one semester counts as a biology elective. In subsequent semesters this course will count as a general elective.
Prerequisites: BIO 201 and (CHM 125 or CHM 126)
Attributes: Undergraduate

BIO 499 Independent Study in Biology (1-3 credits)
By permission only, must be arranged with the Biology department chair.
Attributes: Undergraduate

BIO 550 Research Techniques (3 credits)
An introduction to techniques commonly used in life science research laboratories. Weekly meetings by different faculty members on their area of specialty. One lecture period.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 550L Research Techniques Lab (1 credit)
Students who register for BIO 550 must also register for a BIO 550 laboratory. For example, if you register for BIO 550 you must, at the same time, register for a section of BIO 550L.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 552 Graduate Seminar (1 credit)
Presentations and discussions of primary literature articles. Topic varies by semester. One period.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 600 Developmental Genetics (3 credits)
Students will learn about the principles governing plant and animal development and the underlying cellular and genetic mechanisms. This includes: gametogenesis and fertilization, sex determination, embryogenesis and early development, ectoderm development (nervous systems, skin and appendages), mesoderm development (muscle, bone, blood and cardiovascular), endoderm development (organogenesis, tube formation and reproduction) and an introduction to common developmental disorders. Students will read primary literature and learn about the techniques employed in developmental genetics research using model systems.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 601 Animal Behavior (4 credits)
Study of animals and their behaviors with strong emphasis on evolutionary relationships and ecology. Two lecture periods, one four hour laboratory period (BIO 601L).
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 601L Animal Behavior Lab (0 credits)
Students who register for BIO 601 must also register for a BIO 601L lab section.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 602 Advanced Cell Biology (4 credits)
In depth analysis of eukaryotic cell structure and function. Emphasis is on experimental approaches to understanding concepts in cell biology. Two lecture periods, one four-hour laboratory period (BIO 602L).
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 602L Advanced Cell Biology Lab (0 credits)
Students who register for BIO 602 must also register for a BIO 602L lab section.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 604 Biochemistry (3 credits)
An introduction to the study of the chemistry of living systems. The study of important macromolecules, metabolic pathways, and control systems will be emphasized. Two lecture periods.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 605 Biomechanics (4 credits)
Students are introduced to the ways in which the behavior, morphology and material composition of plants and animals are affected by and take advantage of physical forces. This course will include lectures given by the members of the Biology and Physics Department, as well as an integrated laboratory section where students will observe and measure the effect of physical forces on organisms in both aquatic and terrestrial systems. Two 75-minute lecture periods, one three-hour laboratory period (BIO 605L).
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 605L Biomechanics Lab (0 credits)
Students who register for BIO 605 must also register for a BIO 605L lab section.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 606 Comparative Anatomy (4 credits)
An integrated comparative study of vertebrate structure and development. A synthesis of the embryological development, the gross anatomy, and the histology of selected forms. Two lecture periods, one four-hour laboratory period (BIO 606L).
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 606L Comparative Anatomy Lab (0 credits)
Students who register for BIO 606 must also register for a BIO 606L lab section.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 609 Ecology (4 credits)
Study of complex interrelationship between organisms and their environment. Two lecture periods, one four- hour laboratory period (BIO 609L).
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 609L Ecology Lab (0 credits)
Students who register for BIO 609 must also register for a BIO 609L lab section.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 611 Molecular Genetics (4 credits)
Study of the molecular biology of the genetic material, its structure, expression, regulation, and its dynamic nature. Two lecture periods, one four-hour laboratory period (BIO 611L).
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 611L Molecular Genetics Lab (0 credits)
Students who register for BIO 611 must also register for a BIO 611L lab section.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 612 Neurobiology (4 credits)
Introduction to the structure and function of the vertebrate nervous system. Major topics will include neuronal function, sensory and motor systems, behavior, and higher mental processes. Laboratory work will include hands-on experience of several neurobiological techniques to measure molecular and biochemical changes in a mouse brain. Two 50-minute lecture periods, and two 2-hour laboratory periods (BIO 612L).
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 612L Neurobiology Lab (0 credits)
Students who register for BIO 612 must also register for a BIO 612L lab section.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 613 Plant Physiological Ecology (4 credits)
This course will focus on the physiological mechanisms plants use to respond to their environment. Major topic areas include the basic environmental physiology of carbon, water, and mineral nutrient exchange, and the adaptive mechanisms plants use to survive the variety of global environments. Labs will cover common physiological research methods ranging from cellular to whole organism level measurements and will involve both laboratory and field work. Two 75-minute lecture periods, two 90 minute lab periods (BIO 613L).
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 613L Plant Physiological Eco Lab (0 credits)
Students who register for BIO 613 must also register for a BIO 613L lab section.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 614 Plant Systematics (4 credits)
Students will learn to recognize vascular plant families and understand how taxonomists study evolutionary relationships among plant groups. Economic, medical, and ecological importance of various seed plants will be emphasized. Two 75-minute lecture periods, two 90-minute laboratory periods (BIO 614L).
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 614L Plant Systematics Lab (0 credits)
Students who register for BIO 614 must also register for a BIO 614L lab section.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 615 Immunology (4 credits)
An introductory course providing students with an overview of how the immune system works, including molecules, cells and organs of the immune system and their functions and interactions. Discussion of the experimental techniques used to understand the cell-cell interactions that occur in immunity as well as the differentiation and activation of the immune response will be included. Two 50-minute lecture periods, one four-hour laboratory period (BIO 615L).
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 615L Immunology Lab (0 credits)
Students who register for BIO 615 must also register for a BIO 615L lab section.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 616 Microbiology (4 credits)
The structural, cultural, and physiological characteristics of microorganisms and their role in the economy of nature. Three 50-minute lecture periods, one three-hour laboratory period (BIO 616L).
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 616L Microbiology Lab (0 credits)
Students who register for BIO 616 must also register for a BIO 616L lab section.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 617 Systemic Physiology (4 credits)
A study of the fundamental mechanisms of vertebrate physiology. The basis for the function of the various organ systems and the biological controls that result in the integration of these systems will be discussed. Two lecture periods, one four-hour laboratory period (BIO 617L).
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 617L Systemic Physiology Lab (0 credits)
Students who register for BIO 617 must also register for a BIO 617L lab section.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 619 Invertebrate Zoology (4 credits)
A study of the morphology, physiology, behavior, and phylogenetic relationships of the major groups of invertebrates. Participants will compare and contrast the physical and biological challenges facing the invertebrates that live on land, in water, and inside other organisms. The laboratory will include observations and experiments on live and preserved animals. Two 50-minute lecture periods; two two-hour lab periods (BIO 619L).
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 619L Invertebrate Zoology Lab (0 credits)
Students who register for BIO 619 must also register for a BIO 619L lab section.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 620 Bioinformatics (4 credits)
Introduction to the use of computers in biology. Students learn about important scientific questions and the contemporary tools used to answer them. Topics include genome sequence assembly and annotation, database mining, genome organization, phylogenetics and genetics of human disease. Two 50-minute lecture periods, one four-hour lab period (BIO 620L).
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 620L Bioinformatics Lab (0 credits)
Students who register for BIO 620 must also register for a BIO 620L lab section.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 621 Molecular&Cellular Biophysics (4 credits)
The course is designed to show students how the integration of physics, chemistry and molecular biology are used to explain and predict molecular and cellular processes such as protein-protein interactions, protein folding, diffusion, and signaling. The course will also provide students with a basic understanding and hands- on experience of several biophysical and biochemical laboratory techniques. Two 50-minute lecture periods, one four-hour lab period (BIO 621L).
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 621L Mol & Cel Biophysics Lab (0 credits)
Students who register for BIO 621 must also register for a BIO 621L lab section.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 622 Applied & Environ Microbiology (4 credits)
The course will introduce us to the complex relationships between microbes and their environment, including other organisms. In the frame of these relationships, we will explore how microbial activities are key to geochemical cycles and to human-engineered processes that are essential part of our lives. Two 50-minute lecture periods, one four-hour lab period (BIO 622L).
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 622L Applied & Environ Micro Lab (0 credits)
Students who register for BIO 622 must also register for a BIO 622L lab section.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 623 Evolution (4 credits)
This course covers the major concepts of evolutionary biology, including natural selection, adaptation, genetic drift, and phylogenetic trees. The course trains students to know how to generate and test evolutionary hypotheses using data and inference. The lab portion of the course encourages hands-on learning through computer simulation and problem-solving. Two 50-minute lecture periods, one four-hour lab period (BIO 623L).
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 623L Evolution Lab (0 credits)
Students who register for BIO 623 must also register for a BIO 623L lab section.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 624 Biotechnology (4 credits)
A course in which students will learn how basic cell and molecular biology are used to develop products for biomedical, agricultural and industrial applications. The course will also cover fundamental and emerging techniques in the biotechnology field. The lab section will focus on the steps involved in the production and purification of recombinant proteins expressed in bacterial cells. Two 50-minute lecture periods, one four- hour lab period (BIO 624L).
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 624L Biotechnology Lab (0 credits)
Students who register for BIO 624 must also register for a BIO 624L lab section.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 625 Bacterial Pathogenesis (4 credits)
A study of the physiological, genetic, and biochemical basis underlying some of the commonly encountered bacterial diseases. The course also addresses the roles of antimicrobial compounds and the host immune system in counteracting disease. In the lab module for the course, students perform discovery-oriented research as they identify novel genes in enteropathogenic Escherichia coli (EPEC) that affect bacterial virulence in a C. elegans (roundworm) model of disease. Two 75-minute lecture periods, one three-hour laboratory period (BIO 625L).
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 625L Bacterial Pathogenesis Lab (0 credits)
Students who register for BIO 625 must also register for a BIO 625L lab section.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 626 Fermentation Science (4 credits)
This course will provide students with an overview of various fermentation processes and their use in producing fermented foods and beverages. Fermentation will be considered from biochemical, microbiological, food science, historical and cultural points of view.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 626L Fermentation Science Lab (0 credits)
Students who register for BIO 626 must also register for a BIO 626L lab section.
Attributes: Graduate

BIO 627 Human Genetics (4 credits)
This course explores human genetics, covering various topics, including Mendelian and complex diseases, chromosomal abnormalities, heritability, genetic variations, and methods for investigating disease associations. Additional focus areas include population, quantitative, developmental genetics, genetics in cancer and neurodegenerative disease, and epigenetics.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 627L Human Genetics Lab (0 credits)
The human genetics laboratory will consist of exercises that train students in the mechanisms of inheritance and gene action from the molecular to the organismic and population levels. Additionally, the exercises would train all students in commonly used genetic diagnostic tools and apply the principles of human genetics learned in the lecture. Students who register for BIO 627 must also register for a BIO 627 laboratory. For example, if you register for BIO 627 you must, at the same time, register for a section of BIO 627L.
Attributes: Graduate

BIO 628 Histopathology (4 credits)
A study of the microscopic structure and function of normal and diseased cells, tissues and organs, focusing on vertebrates, with a special emphasis on humans. Using prepared slides and computer images, students will learn to identify and differentiate healthy and pathological samples and relate this to abnormal or disrupted organ function. Two 50-minute lecture periods, two, two-hour lab periods (BIO 628L).
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 628L Histopathology Lab (0 credits)
Students who register for BIO 628 must also register for a BIO 628 laboratory. For example, if you register for BIO 628 you must, at the same time, register for a section of BIO 628L.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 629 Environmental Science (4 credits)
An overview of the relationship between humans, their activities, and the environment around them. Though focused on the biological impacts from pollution, overpopulation, climate change, and resource exploitation, this course will also address the chemical and physical mechanisms that drive those changes and possible solutions to the challenges they present. Three, 50-minute lecture periods, one three-hour laboratory period (BIO 629L).
Attributes: Graduate

BIO 629L Environmental Science Lab (0 credits)
Students who register for BIO 629 must also register for a BIO 629L lab section.
Attributes: Graduate

BIO 630 Neurological Disorders (4 credits)
Students will learn about the molecular and cellular mechanisms underlying various human nervous system disorders, such as autism, addiction, trauma, and neurodegenerative disorders. There will be a focus on the reading of primary literature and writing. Laboratory work will include a semester-long investigative research project. Two 50-minute lecture periods, and two 2-hour laboratory periods (BIO 630L).
Attributes: Graduate

BIO 630L Neurological Disorders Lab (0 credits)
Students who register for BIO 630 must also register for a BIO 630L lab section.
Attributes: Graduate

BIO 672 Aqua Ecology (4 credits)
A lecture and field course concerning the biological, physical, and chemical aspects of freshwater ecosystems. Includes collection, preservation, and recognition of aquatic organisms other than vertebrates and the study of those aspects of their biology that are important adaptations to aquatic life. Students who register for BIO 672 must also register for a BIO 672 laboratory. For example, if you register for BIO 672 you must, at the same time, register for a section of BIO 672L.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 672L Aqua Ecology Lab (0 credits)
This course will combine both laboratory exercises on the Hawk Hill campus as well as field trips to local aquatic ecosystems for hands-on collections and analysis of the systems and their associated organisms. Students who register for BIO 672 must also register for a BIO 672 laboratory. For example, if you register for BIO 672 you must, at the same time, register for a section of BIO 672L.
Attributes: Graduate

BIO 710 Fundamentals of Brewing Scienc (3 credits)
Comprehensive course in the brewing process and its underlying scientific principles. Students will learn methods of brewing beer from grain to glass as instructed by industry experts. There will be a focus on raw ingredient quality, assessment, application, and processing in the brewery.

BIO 711 Brewery Engineering (3 credits)
Designed to inform students of key engineering principles with application to best brewery practices. A combination of theory and application will enable the student to better understand the function, theory, and design of brewery process, equipment, and layout.
Prerequisites: BIO 710 or BS 770

BIO 712 Microbiology of Beer (2 credits)
Through laboratory exercises, students will learn general concepts in cell and molecular biology as it pertains to yeast, bacteria, and fermentation including microscopy, culturing techniques, identification, and yeast management. Through the Yeast Hunters program, students will learn essential techniques while isolating wild yeast strains.
Restrictions: Enrollment is limited to students with a major in Brewing Science.

BIO 713 Quality Control Lab (2 credits)
In this laboratory, students will practice and demonstrate the theory behind common analytical techniques as described by the American Society of Brewing Chemists. Many of these techniques can be incorporated into the brewery, while alternative / more advanced methods will inform the student of possible analytical lab expansion or outsourcing.

BIO 714 Project in Brewing Science (3 credits)
This course is an opportunity to study a topic or establish a skill set as determined by the student with program director oversight. It is meant to prepare students for the industry internship. This will likely be a team-based project that asks a research-based question, utilizing the pilot brewing system.
Restrictions: Enrollment is limited to students with a major in Brewing Science.

BIO 715 Brewing Science Internship (1-3 credits)
Internships enable the student to gain first-hand experience working in brewing science. Interns should work a minimum of 10 hours weekly for 14 weeks to earn credit for a single course. Permission to take an internship for course credit must be obtained prior to beginning the internship. Permission of the Chair of Biology required.
Restrictions: Enrollment is limited to students with a major in Brewing Science.
Attributes: Graduate

BIO 720 Science Communication&Outreach (1 credit)
Optional Service Learning course can be taken in conjunction with any Biology course. Guided experience in preparing and presenting hands-on science lessons to K-12 children. Time commitment is 3 hrs per week.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 770 Advanced Topics in Biology (3-4 credits)
Topics, course format, and instructors may vary each semester.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 770L Adv Topics in Biology Lab (0 credits)
Depending on the nature of the course, BIO 770 may also have a lab component. When it does, students who register for BIO 770 must also register for a BIO 770L lab section.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 772 Current Topics in Zymology (3 credits)
This course focuses on current research and techniques in fermentation science through primary literature review, discussion, and analysis. Additional material will cover current issues such as supply chain management, regulatory compliance, and safety.
Prerequisites: BIO 710

BIO 785 Introduction to Research (1-2 credits)
This course is designed for students who are beginning the research phase of their thesis project or who are deciding between the thesis and non-thesis options. The course consists of at least two rotations in the laboratories of department faculty.

BIO 786 Research Ethics (1 credit)
This course will provide an examination of ethical behavior and practice in research in the scientific research. The course will follow a case study format in which students will be expected to present and participate in group discussions.
Restrictions: Enrollment is limited to Doctoral or Graduate level students.

BIO 790 Independent Study (3 credits)
By permission only, must be arranged with the Biology Graduate Director.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 791 Graduate Internship (1-4 credits)
Internships enable the student to gain first-hand experience working in some field of biology. Interns should work a minimum of 10 hours weekly for 14 weeks to earn credit for a single course. Permission to take an internship for course credit must be obtained prior to beginning the internship. Permission of the Biology Graduate Director required.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 793 Research (1-6 credits)
Research project undertaken in the laboratory of a member of the graduate faculty. Meeting times arranged.
Restrictions: Enrollment is limited to Graduate level students.
Attributes: Graduate

BIO 799 Master's Research (1-9 credits)
Candidates for the master of science in cell biology and biotechnology (thesis option) are required to complete a research project under the direction of an advisor chosen from within the department.
Restrictions: Enrollment is limited to Doctoral or Graduate level students.

BIO 801 Scientific Discourse (1 credit)
Graduate students will learn and improve upon their skills in presentation and debate of primary scientific data. The course will take the format of student presentations about their own ongoing research to their peers. Students will be expected to actively participate in the presentation of others through discussion and critical evaluation of the work presented. General presentation skills and strategies will be covered and feedback will be provided to students on an individual basis. All levels of graduate students are welcome and those without a significantly advanced research project may, at the discretion of the instructor, present current literature related to their research topic.
Restrictions: Enrollment is limited to Doctoral or Graduate level students.

BIO 887 Graduate Colloquium (1 credit)
This course is focused on those skills required by the graduate scientist and consideration of career options.
Restrictions: Enrollment is limited to Doctoral or Graduate level students.

BIO 897 Scientific Proposals (2 credits)
The course is focused on writing and peer assessment of grant proposals. Thesis students will use their approved research prospectus to compose the Specific Aims page and Research Plan sections of a federally-supported funding opportunity. Non-thesis graduate students will develop a grant application focused on a research project of interest.

BIO 899 Doctoral Research (1-9 credits)
Candidates for the doctor of philosophy degree are required to fulfill their research requirements under the direction of a graduate faculty member of the department.