DEPARTMENT OF BIOLOGICAL SCIENCES

Programs in the Department of Biological Sciences provide scientific training as part of an arts and sciences education and develop an understanding of the nature of biological systems. The courses we offer furnish a broad scientific background for advanced study in various biological and medical areas.

A note about advanced placement equivalencies: Students who receive a score of 3 on the AP biology exam can receive credit for BIO 105 and BIO 106, which meet the needs of students in non-science areas. Students who receive a score of 4 on the AP biology exam can receive credit for BIO 101 and BIO 102. For students majoring in the natural sciences, we strongly encourage students to begin with BIO 150 and BIO 151, regardless of whether they receive credit for BIO 101 and BIO 102.

The mission of the Department of Biological Sciences is to provide students with the breadth and depth of knowledge in biology as follows:

1. Knowledge and Comprehension: Successful completion of the following objectives establishes that students have achieved an appropriate understanding of foundational biological concepts.
   1. Apply critical thinking and the scientific method to community/world issues and decision-making.
   2. Evaluate the quality and validity of scientific evidence.
   3. Create an understanding of biology as a whole by integrating and synthesizing information from multiple biological subdisciplines.

2. Applications and Analysis: Successful completion of the following objectives demonstrates that students have the ability to apply foundational knowledge and analyze information/data to make meaning from it.
   1. Demonstrate basic skills and an understanding of safety procedures in the field and/or laboratory.
   2. Organize and interpret experimental data (from their own experiments and/or those in primary literature sources).
   3. Design and perform well controlled experiments.

3. Self and Society: Successful completion of the following objectives indicates that students successfully utilize biological knowledge to present and defend opinions in a variety of arenas.
   1. Develop an in-depth understanding of the complexity of the natural world by understanding how a biologist thinks about complex systems.
   2. Apply scientific methodology and knowledge of biological facts to real-world problems.

Bachelor’s Degree
• Bachelor of Science in Biology (http://catalog.qu.edu/arts-sciences/biological-sciences/biology-bs/)

Minor
• Minor in Biology (http://catalog.qu.edu/arts-sciences/biological-sciences/biology-minor/)

Dual-Degree Programs
• Accelerated Dual-Degree BS/MS in Molecular and Cell Biology (3+1) (http://catalog.qu.edu/graduate-studies/arts-sciences/molecular-cell-biology-accelerated/)
• Dual-Degree BS/MS in Molecular and Cell Biology (4+1) (http://catalog.qu.edu/graduate-studies/arts-sciences/molecular-cell-biology-combined/)

Master of Science
• Master of Science in Molecular and Cell Biology (http://catalog.qu.edu/graduate-studies/arts-sciences/molecular-cell-biology-ms/)

Biology (BIO)

BIO 101. General Biology I. 3 Credits.
This course considers the basic concepts of life science with emphasis on the methods of science and the role of science in society, an introduction to evolution, the chemistry of life, and molecular and cellular evolution. Selected topics include cell structure and function, respiration and photosynthesis, cellular biochemistry, the central dogma of biology, regulation of gene expression, cell cycles, and animal reproduction and development. This course is primarily for students in health science programs or in the School of Engineering. First semester of a full-year course; must be taken in sequence. Must be taken in conjunction with BIO 101L.
Corequisites: Take BIO 101L.
Offered: Every year, All
UC: Natural Sciences

BIO 101L. General Biology I Lab. 1 Credit.
Lab to accompany BIO 101. Selected projects develop skills in experimental design, data analysis and scientific writing. (2 lab hrs.) Must be taken in conjunction with BIO 101.
Corequisites: Take BIO 101.
Offered: Every year, All
UC: Natural Sciences

BIO 102. General Biology II. 3 Credits.
This course covers the basic concepts of life science with an emphasis on animal anatomy and physiology, the nervous system, evolutionary mechanisms and ecological principles. Selected topics include microevolution, speciation, macroevolution, animal behavior and application of comparative anatomy and physiology to illuminate evolutionary relationships and their ecological context. This course is primarily for students in health science programs or in the School of Engineering. Second semester of a full-year course; must be taken in sequence. Must be taken in conjunction with BIO 102L.
Prerequisites: Take BIO 101, BIO 101L; Minimum grade C-.
Corequisites: Take BIO 102L.
Offered: Every year, Spring and Summer
UC: Natural Sciences
BIO 102L. General Biology Lab II. 1 Credit.
Lab to accompany BIO 102. Selected projects develop skills in experimental design, data analysis and scientific writing. (2 lab hrs.) Must be taken in conjunction with BIO 102.
Prerequisites: Take BIO 101, BIO 101L; Minimum grade C-.
Offered: Every year, Spring and Summer
UC: Natural Sciences

BIO 105. Introduction to the Biological Sciences I. 3 Credits.
This course introduces natural science to the nonscientist with an emphasis on problems confronting society. Relationships between humans and the environment are included. This course is designed for nonscience majors. Must be taken in conjunction with BIO 105L.
Corequisites: Take BIO 105L.
Offered: Every year, Fall
UC: Natural Sciences

BIO 105L. Introduction to Biological Science Lab. 1 Credit.
Lab to accompany BIO 105. (2 lab hrs.) Must be taken in conjunction with BIO 105.
Corequisites: Take BIO 105.
Offered: Every year, Fall
UC: Natural Sciences

BIO 106. Science and Society: Concepts and Current Issues. 3 Credits.
This course introduces natural science to the nonscientist with an emphasis on problems confronting society. Current health and scientific issues in the news are emphasized to help students recognize the importance of science in their daily lives. This course is designed for nonscience majors. May not be taken for credit concurrently with or after completion of BIO 161. Must be taken in conjunction with BIO 106L.
Corequisites: Take BIO 106L.
Offered: Every year, Spring
UC: Natural Sciences

BIO 106L. Science and Society: Concepts and Current Issues Lab. 1 Credit.
Lab to accompany BIO 106. (2 lab hrs.) May not be taken for credit concurrently or after completion of BIO 161. Must be taken in conjunction with BIO 106.
Corequisites: Take BIO 106.
Offered: Every year, Spring
UC: Natural Sciences

BIO 120. The Biology of Beer. 3 Credits.
This lecture course uses the biological processes of beer production and consumption as a framework for examining basic principles of molecular, cellular and organismal biology. Students begin by studying the life cycle of the brewer's yeast and the process of fermentation. They then consider how the human body responds to beer, and finally, they examine the biological basis of alcoholism and fetal alcohol syndrome. This course is designed for nonscience majors.
Offered: Every year, Fall
UC: Natural Sciences

BIO 125. Cross My Heart: An Introduction to the Human Cardiovascular System. 3 Credits.
Heart and blood vessel disease is the leading cause of death in both men and women. This lecture course is designed for non-science majors interested in examining basic principles of the anatomy and physiology of the heart, and in understanding common disease conditions. Discussion focuses on risk factors and steps to preventing disease. An overview of common diagnostic tests and treatments introduces students to the identification and management of common disorders. May not be taken for credit concurrently with or after completion of BIO 350.
Offered: Every year, Spring
UC: Natural Sciences

BIO 128. Global Health Challenges: a Human Perspective. 3 Credits.
This course addresses a series of topics that elucidate and address challenges in global public health, with an emphasis on neglected tropical diseases and the profound impact that they have on humanity. Biological information concerning the etiology, pathology and epidemiology of the diseases is presented at the level of the nonscientist. Emphasis is placed on human aspects of the diseases, such as impacts of diseases on education, socioeconomics and stigmatization.
Corequisites: Take BIO 128L.
Offered: Every year, Fall
UC: Natural Sciences

BIO 128L. Global Health Challenges Lab. 1 Credit.
Lab to accompany BIO 128L (2 lab hrs). Selected projects introduce students to the basics of the scientific method, experimental design, data analysis and scientific writing.
Corequisites: Take BIO 128.
Offered: Every year, Fall
UC: Natural Sciences

BIO 150. General Biology for Majors. 4 Credits.
Students develop sound learning strategies and introductory knowledge within five core concepts in biology: science as a way of knowing, chemistry of life, structure and function relationships; major pathways and transformations of energy and matter, as well as living systems as interactive and interconnected. This is the first course of a three-course sequence for biology and related majors. Must be taken in conjunction with BIO 150L.
Corequisites: Take BIO 150L.
Offered: Every year, Fall
UC: Natural Sciences

BIO 150L. General Biology for Majors Laboratory. 0 Credits.
Lab to accompany BIO 150. Students take an investigative/inquiry-based approach and become competent within the process of science including experimental design and analysis, as well as scientific communication and collaboration. Must be taken in conjunction with BIO 150.
Corequisites: Take BIO 150.
Offered: Every year, Fall
UC: Natural Sciences

BIO 151. Molecular and Cell Biology and Genetics. 4 Credits.
Students investigate key concepts in molecular and cell biology and genetics. Topics include evolution, the central dogma, regulation of gene expression, cell communication, classical genetics, immunology, cancer and cell division. Must be taken in conjunction with BIO 151L.
Prerequisites: Take BIO 150, BIO 150L; Minimum grade C-.
Corequisites: Take BIO 151L.
Offered: Every year, Spring
UC: Natural Sciences
BIO 151L. Molecular and Cell Biology and Genetics Lab.  0 Credits.
Lab to accompany BIO 151. Selected projects enable students to develop
skills in experimental design through an investigative/inquiry-based
approach, data analysis and scientific writing.
Prerequisites: Take BIO 150, BIO 150L; Minimum grade C-.
Offered: Every year, Spring
UC: Natural Sciences

BIO 152. Ecological and Biological Diversity.  4 Credits.
Students develop a deeper understanding of central concepts and issues
in ecology and biodiversity by building on information and skills acquired
in BIO 150 and BIO 151. Specific areas of interest include populations and
forces that regulate them, species concepts, and the ecological roles and
and evolutionary significance of key organisms. Must be taken in conjunction
with BIO 152L.
Prerequisites: Take BIO 102, BIO 102L or BIO 151, BIO 151L; Minimum
grade C-.
Offered: Every year, Fall and Spring

BIO 152L. Ecological and Biological Diversity Laboratory.  0 Credits.
Lab to accompany BIO 152. Selected activities, field experiences and
exercises develop skills in observation, documentation, experimental
design, data analysis and scientific written and oral communication.
Must be taken in conjunction with BIO 152.
Corequisites: Take BIO 152.
Offered: Every year, Fall and Spring

BIO 161. Introduction to the Biological Aspects of Science and
Society.  3 Credits.
This course introduces natural science to the nonscientist with an
emphasis on current problems confronting society. Current health and
scientific issues in the news are emphasized to help students recognize
the importance of science in their daily lives. This course is designed
for nonscience majors. May not be taken for credit concurrently or after
completion of BIO 106.
Offered: Every year, Spring
UC: Natural Sciences

BIO 205. Bioethics.  3 Credits.
This course explores major ethical issues arising from advances in
biomedical technology, such as when human life begins, the ethics
of assisted reproduction, cloning, stem cell research and genetic
engineering, among others. Emphasis is on understanding the science
behind the various biotechnologies and applying sound moral reasoning
to the ethical issues discussed.
Prerequisites: Take BIO 102, BIO 102L or BIO 151, BIO 151L or PL 101 or
PS 101.
Offered: Every year, Spring
UC: Natural Sciences

BIO 207. Coral Reef Organismal Diversity - An Immersive
Approach.  3 Credits.
In this hands-on course, participants focus on a series of topics related
to coral reef and marine ecology, with an emphasis on adaptations to
underwater life, conspecific and interspecific relationships, and the role
conservation and education play in developing responsible tourism
practices. Students study the underwater world in a way that relatively
few people do: directly via SCUBA diving in Bonaire, Netherlands Antilles.
Students are expected to complete multiple dives per day and use their
observations to discuss reef structure, animal behavior, conservation and
eco-tourism. By the start of the course, students must either possess
(at a minimum) Open Water SCUBA certification or have completed the
online portion of PADI Open Water Certification with the understanding
that they will complete the practical portion in the first two days on
Bonaire.
Offered: Every year, Summer

BIO 208. Introduction to Forensic Science.  3 Credits.
This course begins with a historical overview of the discipline as a
method of understanding the contemporary field of forensics. Scientific
principles and practices are applied to specific examples within crime
scene and evidence analysis including, but not limited to physical
evidence, glass and soil, organic and inorganic substances, hair and
fibers, toxicology, serology and fingerprinting. Additionally, students
utilize FBI cases, popular press and television to evaluate the use of
science and distinguish among science, law and entertainment. Must be
taken in conjunction with BIO 208L.
Corequisites: Take BIO 208L.
Offered: Every year, Spring
UC: Natural Sciences

BIO 208L. Introduction to Forensic Science Laboratory.  1 Credit.
Students develop skills in observation, measurement, microscopy,
glass fracture patterns, soil and footprint analysis, chromatography,
spectrophotometry, hair and fiber analysis, fingerprinting and DNA
analysis. The culmination of the laboratory experience involves synthesis
of lecture and laboratory activities into a single class project that begins
with control of a simulated crime scene and evidence search patterns,
and continues through processing evidence, evidence analysis and
presentation of results. Must be taken in conjunction with BIO 208. (3 lab
hrs.)
Corequisites: Take BIO 208.
Offered: Every year, Spring
UC: Natural Sciences

BIO 211. Human Anatomy and Physiology I.  3 Credits.
This advanced course provides a comprehensive analysis of human
anatomy and physiology, including a detailed examination of molecular
and cellular aspects of cell and organ function and metabolism
incorporated with system physiology in the human body. Systems
studied in the course include integumentary, skeletal, muscle, nervous,
special senses and endocrine. Emphasis is on function and homeostasis.
Relevant diseases also are presented. Primarily for students in bachelor's
degree health science programs. First semester of a full-year course;
must be taken in sequence. Must be taken in conjunction with BIO 211L.
Prerequisites: Take BIO 102, BIO 102L or BIO 151, BIO 151L; Minimum
grade C-.
Corequisites: Take BIO 211L.
Offered: Every year, Fall and Spring
BIO 211L. Human Anatomy and Physiology Lab I. 1 Credit.
Lab to accompany BIO 211. A detailed study of the major body systems using anatomical models, cadavers, animal specimens, histological slides, physiological experiments and simulations. (3 lab hrs.) Must be taken in conjunction with BIO 211.
Prerequisites: Take BIO 102, BIO 102L or BIO 151, BIO 151L; Minimum grade C-.
Corequisites: Take BIO 211.
Offered: Every year, Fall and Summer

BIO 212. Human Anatomy and Physiology II. 3 Credits.
This course is a continuation of BIO 211 with an emphasis on the anatomy and physiology of the major body systems. Systems studied in this course include cardiovascular, lymphatic, immune, respiratory, urinary, digestive and reproductive. Emphasis is on structure, function, interdependence and the maintenance of homeostasis. Relevant diseases also are presented. Primarily for students in bachelor's degree health science programs. Second semester of a full-year course; must be taken in sequence. Must be taken in conjunction with BIO 212L.
Prerequisites: Take BIO 211, BIO 211L; Minimum grade C-.
Corequisites: Take BIO 212L.
Offered: Every year, Spring and Summer

BIO 212L. Human Anatomy and Physiology II Lab. 1 Credit.
Lab to accompany BIO 212. A detailed study of the major body systems utilizing anatomical models, cadavers, animal specimens, histological slides, physiological experiments and simulations. Must be taken in conjunction with BIO 212. (3 lab hrs.)
Prerequisites: Take BIO 211, BIO 211L; Minimum grade C-.
Corequisites: Take BIO 212.
Offered: Every year, Spring and Summer

BIO 225. Physiological Diversity. 3 Credits.
This course provides an analysis of the physical and chemical processes that maintain animal life, including humans. Lectures cover the interdependent function of molecules, cells, organs and tissues as they relate to organismal function and fitness. Physiological principles are examined in a comparative framework and investigated through inquiry-based activities such as case study analyses and the reading of primary literature. Emphasis is on the roles of physiology in the maintenance of homeostasis throughout the life cycle of an animal. Must be taken in conjunction with BIO 225L.
Prerequisites: Take BIO 102, BIO 102L or BIO 151, BIO 151L.
Corequisites: Take BIO 225L.
Offered: Every other year, Fall

BIO 225L. Physiological Diversity Lab. 1 Credit.
This course complements the BIO 225 lecture section by allowing students to investigate physiological principles via experimentation and case study analyses. Must be taken in conjunction with BIO 225.
Corequisites: Take BIO 225.
Offered: Every other year, Fall

BIO 240. Cellular Communication. 3 Credits.
This class focuses on the molecular mechanisms by which cells communicate with each other. Using examples from both prokaryotes and eukaryotes, students examine how cells release signaling molecules and then consider how target cells recognize and respond to the signals. Participants discuss how the basic processes are altered in diseases of signal processing such as cancer, diabetes and depression.
Prerequisites: Take BIO 102, BIO 102L or BIO 151, BIO 151L.
Offered: Every year, Fall

BIO 250. Biology Journal Club. 1 Credit.
BIO 250 is a scientific journal club in which students present published research papers to their peers, providing the background necessary for their peers to understand the experiments and discussing the implications of the science.
Prerequisites: Take BIO 101 or BIO 150; Minimum grade C-.
Offered: Every year, Spring

BIO 282. Genetics. 3 Credits.
This course considers the basic principles of inheritance, including data analysis and problem-solving skills. Students gain laboratory experience with a variety of techniques and organisms of current research importance, as well as with solving problems and analyzing data. Emphasis is on sound logic, creative thought and experimental design. Must be taken in conjunction with BIO 282L.
Prerequisites: Take BIO 102, BIO 102L or BIO 151, BIO 151L.
Corequisites: Take BIO 282L.
Offered: Every year, Fall

UC: Natural Sciences

BIO 282L. Genetics Lab. 1 Credit.
Lab to accompany BIO 282. Must be taken in conjunction with BIO 282.
Corequisites: Take BIO 282.
Offered: Every year, Fall

BIO 298. Research Methods in Biology. 3 Credits.
This introduction to biological research includes discussion and demonstrated skills in library use, literature citation, academic integrity, experimental design and statistical and graphical treatment of data. It culminates in the collaborative design, preparation and presentation of a scientific research project. This course also includes exploration of the skills and values important to careers in science. Primary emphasis is given to the development of scientific literacy, critical thinking and reasoning, and written and oral communication.
Prerequisites: Take BIO 102, BIO 102L or BIO 151, BIO 151L.
Offered: Every year, Fall and Spring

BIO 300. Special Topics. 3-4 Credits.
Special topics in biology.
Prerequisites: Take BIO 101, BIO 102 or BIO 150, BIO 151.
Corequisites: Take BIO 300L.
Offered: As needed

BIO 300L. Special Topics Lab. 1 Credit.
Lab to accompany BIO 300.
Corequisites: Take BIO 300.
Offered: As needed

BIO 317. Developmental Biology. 2 Credits.
This course is an introduction to the basic developmental processes that enable a single cell to differentiate and create entire organ systems. Various animal models are explored, compared and integrated to illustrate key molecular and cellular events that lead to the formation of an entire organism. Must be taken in conjunction with BIO 317L.
Prerequisites: Take BIO 102, BIO 102L or BIO 151, BIO 151L.
Corequisites: Take BIO 317L.
Offered: Every year, Spring

BIO 317L. Developmental Biology Lab. 2 Credits.
Lab to accompany BIO 317. This project-based laboratory uses a variety of different model systems to examine development. Must be taken in conjunction with BIO 317.
Corequisites: Take BIO 317.
Offered: Every other year, Spring
BIO 323. Invertebrate Zoology. 3 Credits.
This course introduces the basic adaptive features of the major invertebrate groups with emphasis on structure, classification, ecology and evolution, utilizing both lab and field studies. Must be taken in conjunction with BIO 323L.
Prerequisites: Take BIO 102, BIO 102L or BIO 151, BIO 151L.
Corequisites: Take BIO 323L.
Offered: Every other year, Spring

BIO 323L. Invertebrate Zoology Lab. 1 Credit.
Lab to accompany BIO 323. (3 lab hrs.) Must be taken in conjunction with BIO 323.
Corequisites: Take BIO 323.
Offered: Every other year, Spring

BIO 328. Human Clinical Parasitology. 3 Credits.
This course considers the biology of protozoan and helminth parasites of humans and includes an introduction to tropical medicine. Lectures focus on the life cycles of selected parasites and epidemiology and pathology of selected parasitic diseases. Laboratory work focuses on clinical diagnosis, diagnostic techniques (including immunodiagnostic techniques), recognition of vectors, and experimental life cycle studies using both living and preserved materials. Must be taken in conjunction with BIO 328L.
Prerequisites: Take BIO 102, BIO 102L or BIO 151, BIO 151L.
Corequisites: Take BIO 328L.
Offered: Every other year, Spring

BIO 328L. Human Clinical Parasitology Lab. 1 Credit.
Lab to accompany BIO 328. (3 lab hrs.) Must be taken in conjunction with BIO 328.
Corequisites: Take BIO 328.
Offered: Every other year, Spring

BIO 329. Neurobiology. 3 Credits.
This course provides an introduction to molecular, cellular and systems neuroscience. After exploring basic topics including electrical excitability, neurotransmitters and receptors, the course considers higher-level integrated systems such as the sensory systems. Human disorders are discussed to highlight the importance of proper functioning of the various components of the nervous system.
Prerequisites: Take BIO 102, BIO 102L or BIO 151, BIO 151L and CHE 111, CHE 111L; Minimum grade C-.
Offered: Every year, Spring

BIO 346. Cell Physiology. 3 Credits.
This course examines the physiology of the cell with emphasis on the structure and function of the eukaryotic cell. Topics include intracellular transport, cytoskeleton, movement, communication and control of cellular reproduction. The lab involves current techniques for studying proteins, cellular components and living organisms. Must be taken in conjunction with BIO 346L.
Prerequisites: Take BIO 102, BIO 102L or BIO 151, BIO 151L; and CHE 210, CHE 210L.
Corequisites: Take BIO 346L.
Offered: Every year, Fall

BIO 346L. Cell Physiology Lab. 1 Credit.
Lab to accompany BIO 346. This project-based laboratory uses current techniques for separating and studying cellular proteins and components and observing living organisms. The lab culminates with a major project investigating eukaryotic motility and cell structure. (3 lab hrs.) Must be taken in conjunction with BIO 346.
Corequisites: Take BIO 346.
Offered: Every year, Fall

BIO 350. Cardiovascular Physiology. 3 Credits.
The focus of this course is to advance the study of the mammalian heart. This clinically-oriented course examines the structure and function of the heart, electrophysiology, cardiac cycle, cardiac output, blood vessels, hemodynamics and blood pressure. Students participate in "Grand Rounds" presentations while learning about cardiovascular pathologies. May not be taken for credit concurrently with or after completion of BIO 125.
Prerequisites: Take BIO 212.
Offered: Every other year, Fall

BIO 352. Botany. 2 Credits.
The biology of plants, focusing on morphology, physiology, growth, genetics, evolution, ecology, ethnobotany and their importance to humans.
Prerequisites: Take BIO 102, BIO 102L or BIO 151, BIO 151L.
Corequisites: Take BIO 352L.
Offered: Every other year, Fall

BIO 352L. Botany Lab. 2 Credits.
Lab to accompany BIO 352. (4 lab hrs.)
Corequisites: Take BIO 352.
Offered: Every other year, Fall

BIO 356. Aquatic Ecology. 2 Credits.
This introduction to the study of the biology, chemistry, geology and the physics of ponds, lakes and streams includes studies of life histories of representative freshwater organisms. Students receive field training in limnological techniques.
Prerequisites: Take BIO 102, BIO 102L or BIO 151, BIO 151L.
Corequisites: Take BIO 356L.
Offered: Every other year, Fall

BIO 356L. Aquatic Ecology Lab. 2 Credits.
Lab to accompany BIO 356. (4 lab hrs.)
Corequisites: Take BIO 356.
Offered: Every other year, Fall

BIO 358. Life on a Changing Planet. 2 Credits.
This course examines the effects humans have on the ecosystem and explores how plants and animals have adapted to the changing planet. Students learn how to quantify changes in the ecological communities and begin to explore possible solutions to environmental issues. Must be taken in conjunction with BIO 358L.
Prerequisites: Take BIO 102, BIO 102L or BIO 151, BIO 151L.
Corequisites: Take BIO 358L.
Offered: Every other year, Spring

BIO 358L. Life on a Changing Planet Lab. 2 Credits.
Lab to accompany BIO 358. Must be taken in conjunction with BIO 358.
Corequisites: Take BIO 358.
Offered: Every other year, Spring

BIO 365. Cancer Biology. 3 Credits.
This course provides an overview of cancer biology. With a focus on the molecular genetics of cancer, the course explores the identification of the genes and biochemical pathways which when disrupted lead to a deregulation of cell growth and differentiation. A discussion of disease pathology includes tumor classification, prognosis and current treatment options.
Prerequisites: Take BIO 102, BIO 102L or BIO 151, BIO 151L.
Offered: Every other year, Spring
BIO 375. Physiological Models for Human Disease. 3 Credits.
This course investigates cellular and molecular mechanisms of animal physiology using a variety of animal model systems including Drosophila melanogaster (fruit fly), Caenorhabditis elegans (roundworm), Dugesia tigrina (planaria), Danio rerio (zebrafish) and Gallus gallus domesticus (chicken). Students are introduced to current applications of several experimental models for biomedical research on human health and diseases. Must be taken in conjunction with BIO 375L.
**Prerequisites:** Take BIO 102, BIO 102L or BIO 151, BIO 151L.
**Corequisites:** Take BIO 375L.
**Offered:** Every other year, Fall

BIO 375L. Physiological Models for Human Disease Lab. 1 Credit.
Lab to accompany BIO 375. Students work in groups to design and carry out experiments using one of four model systems listed Drosophila melanogaster (Fruit Fly), Caenorhabditis elegans (Roundworm), Dugesia tigrina (Planaria) and Danio rerio (Zebrafish). Students analyze experimental data and present findings via oral presentations. Must be taken in conjunction with BIO 375.
**Corequisites:** Take BIO 375.
**Offered:** Every other year, Fall

BIO 382. Human Genetics. 3 Credits.
This course examines the genetic mechanism in humans, including data analysis and problem solving skills. The course includes an exposure to techniques for analysis of genetic variation in humans, the structure of the human genome, the implication of human genetic variation, somatic cell genetics, an introduction to medical genetics, DNA analysis, and the implications of genetic knowledge in the context of modern society and culture. Must be taken in conjunction with BIO 382L.
**Prerequisites:** Take BIO 102, BIO 102L or BIO 151, BIO 151L.
**Corequisites:** Take BIO 382L.
**Offered:** Every other year, Spring

BIO 382L. Human Genetics Lab. 1 Credit.
Lab to accompany BIO 382. (2 lab hrs.) Must be taken in conjunction with BIO 382.
**Prerequisites:** Take BIO 101, BIO 101L and BIO 102, BIO 102 or; Take BIO 150, BIO 150L and BIO 151, BIO 151L.
**Corequisites:** Take BIO 382.
**Offered:** Every other year, Spring

BIO 383. Evolution. 3 Credits.
This course examines the mechanisms of evolutionary change and surveys the evolutionary and phylogenetic history of life on earth. Using primary research, students focus on how form, function and life histories of organisms have evolved.
**Prerequisites:** Take BIO 102, BIO 102L or BIO 151, BIO 151L.
**Offered:** Every other year, Spring

BIO 385. Explorations in Biology. 1-4 Credits.
In this course, guided individual and group assignments in Blackboard focus on synthesis of foundational knowledge in biology, development of scientific literacy, critical and creative thinking and communication skills and preparation for careers in science as responsible citizens. This course must be completed during the ongoing experiential learning project/experience, which must relate to the biological sciences and occur outside the classroom. The experiential learning project and course credit must be approved by the academic coordinator prior to enrollment.
**Prerequisites:** Take BIO 102, BIO 102L or BIO 151, BIO 151L and BIO 298; Minimum grade C-.
**Offered:** Every year, All

BIO 399H. Honors Research in Biological Sciences. 3 Credits.
This course targets students who are majoring in the biological sciences and are seeking university honors and/or departmental honors. In this capstone seminar, students participate in in-depth examination of primary research papers. The material relates to a central theme chosen by the professor.
**Prerequisites:** Take BIO 102, BIO 102L or BIO 151, BIO 151L and BIO 298.
**Offered:** Every year, Fall

BIO 471. Molecular Genetics. 3 Credits.
This course introduces students to the theory and practice of DNA manipulation that is involved in modern molecular biology, including cancer research, cellular development, regulation of differentiation and construction of designer genes in plants, animals, humans, microorganisms and virus. These methods are common in health research, industrial discovery and environmental remediation. The lecture and the laboratory, which involves DNA manipulation and gene cloning, are designed for students interested in careers in medicine, biotechnology, microbiology and graduate programs. Must be taken in conjunction with BIO 471L.
**Prerequisites:** Take BIO 102, BIO 102L or BIO 151, BIO 151L and CHE 110, CHE 111.
**Corequisites:** Take BIO 471L.
**Offered:** Every other year, Spring

BIO 471L. Molecular Genetics Lab. 1 Credit.
Lab to accompany BIO 471. (3 lab hrs.) Must be taken in conjunction with BIO 471.
**Corequisites:** Take BIO 471.
**Offered:** Every other year, Spring

BIO 498. Independent Study in Biology. 1-4 Credits.
Students may take a total of 8 credits of Independent Study/research through enrollment in BIO 498, BIO 499.
**Offered:** As needed

BIO 499. Independent Study in Biology. 1-4 Credits.
Students may take a total of 8 credits of Independent Study/research through enrollment in BIO 498, BIO 499.
**Offered:** As needed

BIO 500. Special Topics in Molecular and Cell Biology. 3 Credits.
**Offered:** As needed

BIO 501. Special Topics: Advanced Protein Methods. 4 Credits.
**Offered:** As needed

BIO 505. Writing and Science. 3 Credits.
This course reviews how scientific results and ideas are communicated and reviewed. Course content includes the storage and retrieval of scientific information, data presentation (table, figures, graphics), the writing of reports and papers as well as the preparation of publications for peer review. Copyright, patent law and the ethical issues involved in scientific communication also are considered. Assignments include oral and written presentations and attendance at assigned seminars and meetings.
**Offered:** Every year, Fall

BIO 510. Special Topics. 3-4 Credits.
**Offered:** As needed

BIO 515. Advanced Biochemistry. 4 Credits.
This course offers advanced insights into major areas of biochemistry, including the structure and function of biological molecules, cell and membrane structure and function, bioenergetics and enzyme function, and cellular metabolism. This is a suitable prerequisite for many graduate courses.
**Offered:** Every year, Spring
BIO 521. Stem Cell Biology. 3 Credits.
This course provides a comprehensive overview of stem cell biology. Participants explore the topics of embryonic and adult stem cells, stem cell characteristics, reprogramming, stem cell therapies and tissue regeneration. Primary research literature associated with each topic is discussed and students gain an understanding of the role of stem cells in health and disease.
Offered: Every year, Spring

BIO 523. Classical Genetics. 1 Credit.
This 1-credit course is aimed at graduate students who are preparing to teach in the biological sciences and are preparing for the PRAXIS exam specifically the Biology Content Test. In this interactive course, students review foundational information pertaining to classical genetics and further develop a knowledge base by participating in in-depth examination of primary research papers.
Offered: As needed

BIO 524. Evolution. 1 Credit.
This 1-credit course is aimed at graduate students who are preparing to teach in the biological sciences and are preparing for the PRAXIS exam specifically the Biology Content Test. In this interactive course, students review foundational information pertaining to evolution and further develop a knowledge base by participating in in-depth examination of primary research papers.
Offered: As needed

BIO 525. Diversity of Life and Organismal Biology. 2 Credits.
This 2-credit course is aimed at graduate students who are preparing to teach in the biological sciences and are preparing for the PRAXIS exam specifically the Biology Content Test. In this interactive course, students review foundational information pertaining to organismal biology and further develop a knowledge base by participating in in-depth examination of primary research papers.
Offered: As needed

BIO 526. Ecology. 2 Credits.
This 2-credit course targets graduate students who are preparing to teach in the biological sciences and are preparing for the PRAXIS exam specifically the Biology Content Test. In this interactive course, students review foundational information pertaining to ecology and further develop a knowledge base by participating in in-depth examination of primary research papers.
Offered: As needed

BIO 527. Biostatistics. 3 Credits.
This hands-on course is for students seeking to understand methods of sequence and structural analysis using nucleic acid and protein databases. An understanding of the database format provides the basis for sequence analysis and alignment to determine common evolutionary origins, RNA secondary structure, gene prediction and regulation, protein structure prediction and classification, genome analysis and analysis of microarrays.
Offered: As needed

BIO 568. Molecular and Cell Biology. 4 Credits.
This course examines the cell from a molecular perspective. Cell composition, structure and organization are investigated in order to understand how cells grow, divide and respond to different intracellular and extracellular signals.
Offered: Every year, Fall

BIO 571. Molecular Genetics. 4 Credits.
This study of the prokaryotic and eukaryotic genetic material including transcription, translation, DNA replication and repair, gene cloning techniques, the regulation of the synthesis of gene products and genomics. Emphasis is placed on new genetic techniques that are used in industry and medicine.
Offered: Every year, Fall

BIO 589. Molecular and Cell Neurobiology. 3 Credits.
This course provides students with a detailed foundation of the basic principles of cellular and molecular neurobiology. Through lectures and interactive simulations, students become fluent in modern experimental approaches to explore and understand the properties of electrical signaling and cell-cell communication. Students apply their knowledge in independent projects investigating the physical basis of a disease of neurophysiological origin.
Offered: As needed

BIO 590. Stem Cell Biology. 3 Credits.
This course provides a comprehensive overview of stem cell biology. Participants explore the topics of embryonic and adult stem cells, stem cell characteristics, reprogramming, stem cell therapies and tissue regeneration. Primary research literature associated with each topic is discussed and students gain an understanding of the role of stem cells in health and disease.
Offered: Every year, Spring

BIO 649. Independent Research. 2 Credits.
Students work independently to define and conduct original research. This course is required for students anticipating thesis work in Molecular and Cell Biology, and is conducted under the guidance and with the approval of a thesis adviser and thesis committee.
Offered: As needed

BIO 650. Thesis I in Molecular and Cell Biology. 4 Credits.
This course is a requirement for the thesis option within the MS in Molecular and Cell Biology. Students must demonstrate both breadth and depth of knowledge in their field of specialization. They also must demonstrate scientific research skills and present their findings to a thesis committee and the greater molecular and cell biology community.
Prerequisites: Take BIO 649.
Offered: Every year, Fall

BIO 651. Thesis II in Molecular and Cell Biology. 4 Credits.
Thesis II is a requirement for the thesis option MS in Molecular and Cell Biology. Students complete their independent research project, write an original thesis describing their research results, defend their thesis in front of a thesis committee, and give a presentation to the greater molecular and cell biology community.
Prerequisites: Take BIO 650 BIO 688.
Offered: Every year, Fall

BIO 652. Bioinformatics. 3 Credits.
This project-based lab course enables students to develop hands-on experience with basic techniques in cell and molecular biology including DNA purification, cloning, and gene expression analysis.
Offered: As needed

BIO 653. Molecular and Cell Neurobiology. 3 Credits.
This course provides students with a detailed foundation of the basic principles of cellular and molecular neurobiology. Through lectures and interactive simulations, students become fluent in modern experimental approaches to explore and understand the properties of electrical signaling and cell-cell communication. Students apply their knowledge in independent projects investigating the physical basis of a disease of neurophysiological origin.
Offered: As needed

BIO 654. Independent Research. 2 Credits.
Students work independently to define and conduct original research. This course is required for students anticipating thesis work in Molecular and Cell Biology, and is conducted under the guidance and with the approval of a thesis adviser and thesis committee.
Offered: As needed

BIO 655. Thesis I in Molecular and Cell Biology. 4 Credits.
This course is a requirement for the thesis option within the MS in Molecular and Cell Biology. Students must demonstrate both breadth and depth of knowledge in their field of specialization. They also must demonstrate scientific research skills and present their findings to a thesis committee and the greater molecular and cell biology community.
Prerequisites: Take BIO 649.
Offered: Every year, All

BIO 656. Protein Methods Laboratory. 4 Credits.
This project-based lab course enables students to develop hands-on experience with basic techniques in cell biology and protein biochemistry including protein purification, chromatographic and electrophoretic techniques, and immunoanalysis.
Prerequisites: Take BIO 515.
Offered: Every year, Fall

BIO 657. Molecular and Cell Neurobiology. 3 Credits.
This course provides students with a detailed foundation of the basic principles of cellular and molecular neurobiology. Through lectures and interactive simulations, students become fluent in modern experimental approaches to explore and understand the properties of electrical signaling and cell-cell communication. Students apply their knowledge in independent projects investigating the physical basis of a disease of neurophysiological origin.
Offered: As needed

BIO 658. Molecular and Cell Biology. 4 Credits.
This course provides a comprehensive overview of stem cell biology. Participants explore the topics of embryonic and adult stem cells, stem cell characteristics, reprogramming, stem cell therapies and tissue regeneration. Primary research literature associated with each topic is discussed and students gain an understanding of the role of stem cells in health and disease.
Offered: Every year, Spring

BIO 659. Molecular and Cell Neurobiology. 3 Credits.
This course provides students with a detailed foundation of the basic principles of cellular and molecular neurobiology. Through lectures and interactive simulations, students become fluent in modern experimental approaches to explore and understand the properties of electrical signaling and cell-cell communication. Students apply their knowledge in independent projects investigating the physical basis of a disease of neurophysiological origin.
Offered: As needed

BIO 660. Protein Methods Laboratory. 4 Credits.
This project-based lab course enables students to develop hands-on experience with basic techniques in cell biology and protein biochemistry including protein purification, chromatographic and electrophoretic techniques, and immunoanalysis.
Prerequisites: Take BIO 515.
Offered: Every year, Fall

BIO 661. Independent Research. 2 Credits.
Students work independently to define and conduct original research. This course is required for students anticipating thesis work in Molecular and Cell Biology, and is conducted under the guidance and with the approval of a thesis adviser and thesis committee.
Offered: As needed

BIO 662. Bioinformatics. 3 Credits.
This project-based lab course enables students to develop hands-on experience with basic techniques in cell biology and protein biochemistry including protein purification, chromatographic and electrophoretic techniques, and immunoanalysis.
Prerequisites: Take BIO 515.
Offered: Every year, Fall

BIO 663. Molecular and Cell Neurobiology. 3 Credits.
This course provides students with a detailed foundation of the basic principles of cellular and molecular neurobiology. Through lectures and interactive simulations, students become fluent in modern experimental approaches to explore and understand the properties of electrical signaling and cell-cell communication. Students apply their knowledge in independent projects investigating the physical basis of a disease of neurophysiological origin.
Offered: As needed

BIO 664. Independent Research. 2 Credits.
Students work independently to define and conduct original research. This course is required for students anticipating thesis work in Molecular and Cell Biology, and is conducted under the guidance and with the approval of a thesis adviser and thesis committee.
Offered: As needed

BIO 665. Thesis I in Molecular and Cell Biology. 4 Credits.
This course is a requirement for the thesis option within the MS in Molecular and Cell Biology. Students must demonstrate both breadth and depth of knowledge in their field of specialization. They also must demonstrate scientific research skills and present their findings to a thesis committee and the greater molecular and cell biology community.
Prerequisites: Take BIO 649.
Offered: Every year, All

BIO 666. Thesis II in Molecular and Cell Biology. 4 Credits.
Thesis II is a requirement for the thesis option MS in Molecular and Cell Biology. Students complete their independent research project, write an original thesis describing their research results, defend their thesis in front of a thesis committee, and give a presentation to the greater molecular and cell biology community.
Prerequisites: Take BIO 650 BIO 688.
Offered: Every year, All
BIO 675. Comp Exam in Molecular and Cell Biology.  2 Credits.
The written comprehensive exam is a requirement of the non-thesis option for the MS in Molecular and Cell Biology. Students must demonstrate both breadth and depth of knowledge by illustrating a command of the subject matter obtained from individual courses into unified concepts which link the student's own specialization to other fields of study. Students are encouraged to meet with the program director before registering for the comprehensive exam. Minimum grade of a B- is required to pass the comprehensive examination.

Prerequisites: Take a minimum of four of the five following courses: BIO 515 BIO 568 BIO 571 BIO 605 BIO 606.

Offered: Every year, Fall and Spring

BIO 688. Independent Study.  1-4 Credits.
Offered: As needed

BIO 689. Independent Study.  1-4 Credits.
Offered: As needed