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. Courses furnish a broad scientific background for advanced study in various biological and medical areas. Students may be admitted to advanced standing by obtaining satisfactory grades in the Advanced Placement Tests or the College Level Examination Program of the College Entrance Examination Board. Majors in the Department of Biological Sciences must achieve a science GPA of 2.25 (a minimum grade of “C-” is required in all courses with a “BIO” designation used to satisfy Biological Science Core or Biology Elective Requirements), and an overall GPA of 2.0 to qualify for graduation.

A score of 4 in the AP biology exam is required to receive credit for BIO 101—BIO 102, although taking BIO 150 and BIO 151 is highly recommended by the department, regardless of the AP biology score. A score of 3 on the AP biology exam will result in credit being granted for BIO 105—BIO 106. BIO 105—BIO 106 meets the needs of students in non-science areas, but not students in the biology majors.

The mission of the Department of Biological Sciences is to provide students with the breadth and depth of knowledge in biology that will allow them to:

1. Incorporate the biological sciences and its scholarly methodologies into the broad perspectives of an arts and sciences education and their own individual lives.
2. Continually reconstruct a worldview that is consistent with the current state of scientific knowledge.
3. Appreciate the unity of knowledge across disciplinary boundaries, and the ways in which the various fields of knowledge enlighten and illuminate one another.
4. Become useful and productive contributors within their chosen professions.
5. Continue learning independently throughout their lives.
6. Assess, from a critical and analytic perspective, the state of knowledge within a variety of biological subdisciplines.
7. Have at their fingertips the intellectual tools to formulate readily testable hypotheses, design sound experiments, analyze and evaluate data, and draw legitimate conclusions.

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, the chemistry of life, and molecular and cellular evolution. Selected topics include cellular biochemistry, the central dogma of biology, regulation of gene expression, cell structure and function, respiration and photosynthesis, and cell cycles. 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, animal reproduction and development, 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 II Lab. 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-.
Corequisites: Take BIO 102.
Offered: Every year, Spring and Summer
UC: Natural Sciences
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Description</th>
<th>Prerequisites</th>
<th>Corequisites</th>
<th>Offered</th>
<th>UC</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 105</td>
<td>Introduction to the Biological Sciences I.</td>
<td>3</td>
<td>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.</td>
<td>Take BIO 105L.</td>
<td>Take BIO 105.</td>
<td>Every year, Fall</td>
<td>Natural Sciences</td>
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<tr>
<td>BIO 105L</td>
<td>Introduction to Biological Science Lab.</td>
<td>1</td>
<td>Lab to accompany BIO 105. (2 lab hrs.) Must be taken in conjunction with BIO 105.</td>
<td>Take BIO 105.</td>
<td>Take BIO 105.</td>
<td>Every year, Fall</td>
<td>Natural Sciences</td>
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<tr>
<td>BIO 106</td>
<td>Science and Society: Concepts and Current Issues.</td>
<td>3</td>
<td>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.</td>
<td>Take BIO 106L.</td>
<td>Take BIO 106.</td>
<td>Every year, Spring</td>
<td>Natural Sciences</td>
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<tr>
<td>BIO 106L</td>
<td>Science and Society: Concepts and Current Issues Lab.</td>
<td>1</td>
<td>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.</td>
<td>Take BIO 106.</td>
<td>Take BIO 106.</td>
<td>Every year, Spring</td>
<td>Natural Sciences</td>
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<tr>
<td>BIO 120</td>
<td>The Biology of Beer.</td>
<td>3</td>
<td>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.</td>
<td>Take BIO 106L.</td>
<td>Take BIO 106.</td>
<td>Every year, Fall</td>
<td>Natural Sciences</td>
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<tr>
<td>BIO 121</td>
<td>Human Genetics from ACTG to XY.</td>
<td>3</td>
<td>Sequencing of the human genome has allowed, for the first time in history, the ability to read the complete set of instructions for making a human being. This course, which is designed for nonscience majors, introduces students to human genetics, from the micro to the macro level. The structure of DNA and the organization of the human genome is explained as students learn how genes influence development and health. The genetic basis of human disease is utilized as a tool to explore inheritance patterns within families, personalized genetics, genetic testing and new therapeutic approaches from both a biological and an ethical perspective.</td>
<td>Take BIO 150 BIO 150L; Minimum grade C-.</td>
<td>Take BIO 150L.</td>
<td>As needed</td>
<td>Natural Sciences</td>
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<tr>
<td>BIO 125</td>
<td>Cross My Heart: An Introduction to the Human Cardiovascular System.</td>
<td>3</td>
<td></td>
<td>Take BIO 151.</td>
<td>Take BIO 151.</td>
<td>Every year, Spring</td>
<td>Natural Sciences</td>
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<tr>
<td>BIO 128</td>
<td>Global Health Challenges: A Human Perspective.</td>
<td>3</td>
<td>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.</td>
<td>Take BIO 128L.</td>
<td>Take BIO 128.</td>
<td>Every year, Fall</td>
<td>Natural Sciences</td>
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<tr>
<td>BIO 128L</td>
<td>Global Health Challenges Lab.</td>
<td>1</td>
<td>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.</td>
<td>Take BIO 128.</td>
<td>Take BIO 128.</td>
<td>Every year, Fall</td>
<td>Natural Sciences</td>
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<tr>
<td>BIO 150</td>
<td>General Biology for Majors.</td>
<td>4</td>
<td>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.</td>
<td>Take BIO 150L.</td>
<td>Take BIO 150L.</td>
<td>Every year, Fall</td>
<td>Natural Sciences</td>
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<tr>
<td>BIO 150L</td>
<td>General Biology for Majors Laboratory.</td>
<td>0</td>
<td>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.</td>
<td>Take BIO 150.</td>
<td>Take BIO 150.</td>
<td>Every year, Fall</td>
<td>Natural Sciences</td>
</tr>
<tr>
<td>BIO 151</td>
<td>Molecular and Cell Biology and Genetics.</td>
<td>4</td>
<td>Students investigate key concepts in molecular and cell biology and genetics. Topics include evolution, the central dogma, regulation of gene expression, cell structure and physiology, cell communication, immunology, cancer and cell division. Must be taken in conjunction with BIO 151L.</td>
<td>Take BIO 150L.</td>
<td>Take BIO 150L.</td>
<td>Every year, Spring</td>
<td>Natural Sciences</td>
</tr>
<tr>
<td>BIO 151L</td>
<td>Molecular and Cell Biology and Genetics Lab.</td>
<td>0</td>
<td>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.</td>
<td>Take BIO 150 BIO 150L; Minimum grade C-.</td>
<td>Take BIO 151.</td>
<td>Every year, Spring</td>
<td>Natural Sciences</td>
</tr>
</tbody>
</table>
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 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-.
Corequisites: Take BIO 152L.
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 Summer

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 practicum 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 utilizing 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 218. Vertebrate Natural History. 4 Credits.
This course involves the observation, collection and identification of terrestrial and aquatic vertebrate animals. Emphasis is on life histories of local species. There are frequent field trips. (2 class hrs., 4 lab hrs.)
Prerequisites: Take BIO 102 BIO 102L or BIO 151 BIO 151L.
Offered: Every other year, Fall

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 259. Biology Elective. 1-15 Credits.

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 291. Biological Research Methods. 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 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. Must be taken in conjunction with 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 other 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 organismal 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 metabolism, 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 physiology of the mammalian heart is studied in detail. The course examines electrophysiology of the heart, structure and function, cardiac cycle, hemodynamics, capillary dynamics, cardiac output and venous return. Cardiovascular pathologies also are discussed.  
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.  
The focus of this course is on the unique position of humans in nature—our ability to understand the historical background of current ecological dilemmas and develop realistic possibilities for solving them. Specific course topics include environmental issues of 1) overpopulation; 2) sustainability associated with food, water and energy sources; 3) climate change; 4) protection of biodiversity and other natural resources; 5) reduction and mitigation of pollution; and 6) the economics and politics associated with conservation. 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, Fall

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. Because evolution is often a focus of social debate about ways of knowing and about the nature of humanity, students also explore the history of this debate and its influence on society.
Prerequisites: Take BIO 102 BIO 102L or BIO 151 BIO 151L.
Offered: Every other year, Spring

BIO 385. Experiential Inquiry 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. (4 lab hrs.)
Corequisites: Take BIO 471
Offered: Every 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 502. Special Topics. 2 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 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 548. Vertebrate Natural History. 4 Credits. This course involves the observation, collection and identification of terrestrial and aquatic vertebrate animals. Emphasis is placed on life histories of local species. There are frequent field trips. This course primarily serves the graduate science requirements of MAT students. Students enrolling in this course are expected to complete course goals beyond those students enrolled in BIO 218. (2 class hrs., 4 lab hrs.) Offered: As needed

BIO 552. Bioinformatics. 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 558. Molecular and Cell Biology. 4 Credits. This course examines the molecular biology of the cell, including the structure and composition of the cell's macromolecules, cell organelle structure, biosynthesis and regulation, and the mechanisms by which the cell communicates with its external environment and other cells. Offered: Every year, Fall

BIO 571. Molecular Genetics. 4 Credits. This study of the prokaryotic and eukaryotic genetic material includes 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 605. DNA Methods Laboratory. 4 Credits. These laboratories enable students to develop hands-on experience with the basic techniques in cell biology and molecular biology pertaining to DNA purification, modification and analysis. Prerequisites: Take BIO 571. Offered: Every year, Spring

BIO 606. Protein Methods Laboratory. 4 Credits. These laboratories enable students to develop hands-on experience with the basic techniques in cell biology and molecular biology pertaining to protein purification and analysis. Prerequisites: Take BIO 515. Offered: Every year, Fall

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, All

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, 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