

BIOLOGY

Department Chair: Belinda Barbagallo, Ph.D.

Consistent with the mission of the University, the Department of Biology and Biomedical Sciences provides students with the scientific knowledge and the ethical understanding to stand as responsible stewards of God's creation. With evolution as an organizing concept, courses in Biology and Biomedical Sciences, for both majors and non-majors, develop the skills necessary for critical and creative thinking, thoughtful and careful analysis, and sound judgment. Such skills will be fostered through the use of classroom discussions and debates, texts and appropriate readings from the primary scientific literature, interactive computer programs and other technologies.

In addition, courses with a laboratory component aim to provide students with a hands-on approach to the exploration of scientific methods. These important skills are needed to advance one's scientific knowledge and, moreover, are critical in preparing our students for the challenge of exciting careers in the biological sciences.

Medical School and Professional Health Career Preparations

Biology majors interested in professional graduate programs such as medical, dental, veterinary and physical therapy should consult with the Salve Regina University health professions advisor to determine the appropriate degree and courses that should be taken. The B.S. in Biology and Biology- Environmental Sciences meet most of the requirements for these programs. Students are advised to check the admission requirements of the professional and graduate program.

Student Learning Outcomes

The BA and BS programs in Biology equip students with the knowledge (core concepts) and skills (core competencies) to be competitive for employment and/or acceptance into a professional or graduate program in the sciences. The BS in Medical Laboratory Sciences prepares students to pass the National Medical Laboratory Scientist certification exam and pursue employment as a Medical Laboratory Scientist.

BS in Biology and BS in Medical Laboratory Sciences Core Concepts

At the conclusion of the program, students will have an explicit understanding of the following learning outcomes at the molecular, organismal and population levels.

1. Analyze relationships between structure and function in dynamic biological systems.
2. Demonstrate an understanding of the process of evolution and the factors that influence it.
3. Apply knowledge of the central dogma of molecular biology and analyze the mechanisms that regulate the flow of genetic information.
4. Analyze connections between the molecular, organismal and population levels that define biological systems and the influence of abiotic factors on these systems.
5. Analyze how energy and matter are harnessed, transformed and cycled within biological systems from the molecular to the ecosystem level.

Core competencies

At the conclusion of the program, students will be able to

1. Apply the process of science to conduct literary and biological investigations.
2. Use mathematical and bioinformatics techniques to analyze and present biological data.
3. Apply and create models and simulations to evaluate biological phenomena.
4. Connect knowledge from multiple disciplines and apply interdisciplinary problem solving to address real world challenges.
5. Communicate and collaborate effectively with others incorporating constructive feedback and self-reflection of learning.
6. Analyze ethical and societal dimensions of science and apply to daily life.

BA in Biology

Core Concepts

At the conclusion of the program, students will have an explicit understanding of the following learning outcomes at the molecular, organismal and population levels.

1. Describe and predict the relationships between structure and function in dynamic biological systems.
2. Demonstrate an understanding of the process of evolution and the factors that influence it.
3. Apply knowledge of the central dogma of molecular biology and the mechanisms that regulate the flow of genetic information.
4. Display an understanding of the connection between the molecular, organismal and population levels that define biological systems and the influence of abiotic factors on these systems.
5. Determine how energy and matter are harnessed, transformed and cycled within biological systems from the molecular to the ecosystem level.

Core competencies

At the conclusion of the program, students will be able to

1. Apply the process of science to conduct literary and biological investigations.
2. Use mathematical and bioinformatics techniques to analyze and present biological data.
3. Apply and create models and simulations to evaluate biological phenomena.
4. Connect knowledge from multiple disciplines and apply interdisciplinary problem solving to address real world challenges.
5. Communicate and collaborate effectively with others incorporating constructive feedback and self-reflection of learning.
6. Analyze ethical and societal dimensions of science and apply to daily life.

Bachelor's

- Biology (B.A.) (<https://catalog.salve.edu/undergraduate/academic-programs/biology/biology-ba/>)
- Biology (B.S.) (<https://catalog.salve.edu/undergraduate/academic-programs/biology/biology-bs/>)
- Biology (B.S.) Leading to Pharm.D. (<https://catalog.salve.edu/undergraduate/academic-programs/biology/biology-bs-leading-pharmd/>)
- Biology and Secondary Education (B.A.S.) (<https://catalog.salve.edu/undergraduate/academic-programs/biology/biology-secondary-education-bas/>)
- Medical Laboratory Sciences (B.S.) (3+1) (<https://catalog.salve.edu/undergraduate/academic-programs/biology/medical-laboratory-sciences-bs/>)
- Medical Laboratory Sciences (B.S.) (4+1) (<https://catalog.salve.edu/undergraduate/academic-programs/biology/medical-technology-41-bs/>)

Minors

- Biology Minor (<https://catalog.salve.edu/undergraduate/academic-programs/biology/biology-minor/>)
- Neuroscience Minor (<https://catalog.salve.edu/undergraduate/academic-programs/biology/neuroscience-minor/>)

Biochemistry

BCH-403: Biochemistry (4 Credits)

Co-requisite(s): BCH-403L is required.

Pre/Co-requisite(s): CHM-206 is required.

This course provides an introduction to biochemistry. The organizing principles of cellular biochemistry are emphasized. Within this framework the structures, chemistry, and function of proteins, nucleic acids and amino acids, lipids and carbohydrates are presented. Molecular topics such as evolution, protein sequencing, proteomics are also introduced.

Lab Fee: \$175.00

BCH-403L: Biochemistry Lab (0 Credits)

Co-requisite(s): BCH-403 is required.

This course consists of laboratory exercises to give the students experience with fundamental biochemistry and structure and function of biomolecules. Lab exercises to give the students experience with amino acid properties and protein purification along with techniques to examine enzyme kinetics.

BCH-404: Advanced Biochemistry (4 Credits)

Pre-requisite(s): BCH-403 is required.

Co-requisite(s): BCH-404L is required.

The metabolic pathways of carbohydrates, lipids, amino acids and their metabolic controls are presented. The central concepts of genomics, nucleic acid sequencing, the molecular basis of self-assembly, morphogenesis and cellular differentiation are stressed. Emphasis is also given to the important ultra-structural elements of the cell, neurotransmission, hormones, and cell signaling.

Lab Fee: \$175.00

BCH-404L: Advanced Biochemistry Lab (0 Credits)

Co-requisite(s): BCH-404 is required.

The laboratory portion of the course complements and reinforces the lecture through the use of modern techniques in experimental biochemistry. Experiments may include enzymology, protein purification, and gene expression and organization. Methods include spectrophotometry, polymerase chain reaction, DNA cloning, electrophoresis, protein detection by immunoblot, RNA hybridization, and computer analysis of DNA and protein sequence data.

BCH-410: Pharmacology and Toxicology (3 Credits)

The fundamentals of how chemicals produce therapeutic and toxic responses are presented. Emphasis is given to the absorption, distribution, metabolism and elimination of drugs from the body and their receptors and interactions. Through case studies and informed debate, students learn the effects of drugs on the human population and the environment. Junior or senior academic standing; Biology major or Neuroscience minor are required.

Biology

BIO-105: Human Anatomy & Physiology I (4 Credits)

Co-requisite(s): BIO-105L is required.

A systematic study of the gross and microscopic anatomy of the human body and the function of its parts are explored in this course. Laboratory work includes dissections, microscopic examinations of structures and experiments in physiology. This sequence is for those in nursing. It is not appropriate, in and of itself, for those considering professional schools or graduate school in anatomy, physiology or development. Nursing majors only.

Fulfills Core Requirement in Natural Sciences.

Theme: Engaging Creative, Aesthetic and Spiritual Experience.

Lab Fee: \$175.00

BIO-105L: Human Anatomy and Physiology I Lab (0 Credits)

Co-requisite(s): BIO-105 is required.

This course consists of laboratory exercises to give the students experience with anatomical terminology and structure and function of components of the human body. The laboratory portion of the course complements and reinforces the lecture through the use of additional resources, focusing on closer examination of the body's components.

BIO-106: Human Anatomy and Physiology II (4 Credits)

Pre-requisite(s): BIO-105 is required.

Co-requisite(s): BIO-106L is required.

A systematic study of the gross and microscopic anatomy of the human body and the function of its parts are explored in this course. Laboratory work includes dissections, microscopic examinations of structures and experiments in physiology. This sequence is for those in nursing. It is not appropriate, in and of itself, for those considering professional schools or graduate school in anatomy, physiology or development. Nursing majors only.

Fulfills Core Requirement in Natural Sciences.

Theme: Engaging Creative, Aesthetic and Spiritual Experience.

Lab Fee: \$175.00

BIO-106L: Human Anatomy and Physiology II Lab (0 Credits)

Co-requisite(s): BIO-106 is required.

This course consists of laboratory exercises to give the students experience with fundamental biochemistry and structure and function of components of the human body. The laboratory portion of the course complements and reinforces the lecture through the use of additional resources, focusing on closer examination of the body's components.

BIO-110: Human Biology: Physiology and Health (3 Credits)

This course is a concept-oriented study of the interrelationships and variations in the physiological processes in health, disease, heredity and sexuality that can be applied to real-life situations. Students will be given opportunities to read and critically analyze many of the new and challenging developments in human biology, along with the moral and ethical choices, responsibilities and dilemmas that inevitably accompany them.

Fulfills Core Requirement in Natural Sciences.

Theme: Engaging Creative, Aesthetic and Spiritual Experience.

BIO-110L: Human Biology: Physiology and Health Lab (1 Credits)

Co-requisite(s): BIO-110 is required.

The laboratory taken with BIO-110 will fulfill the core requirement in science and will consist of student-performed and sometimes student-designed experiments following the scientific method. The lab coordinates with the concepts covered in the lecture: biochemistry of the body, cellular organization, genetics, anatomy and physiology of the human body, all related to the idea of human health. Students will learn hypothesis testing, statistics, graphing and analysis of individual and group data sets. Also included will be practice in scientific communication.

BIO-113: Biology I (4 Credits)

Co-requisite(s): BIO-113L and BIO-113R are required. - Must be taken at the same time as this course.

Introduction to the unifying principles of biology at the levels of organization from molecules through cells. Emphasis is placed on basic biological chemistry, molecular and cellular biology, metabolism and energy transformation, genetics, and evolution. This course presents an exploration of the contemporary view of the cell with an emphasis on cell theory, mechanisms of cellular activity, and cell cycling. The course also presents an overview of the molecules and mechanisms of genetics with a focus on the central dogma. Describing the process of information transfer from genetic code in DNA through protein synthesis and function. Evolution as an organizing principle in biology is also discussed. The course explores the core concepts of evolution; structure and function; information flow, exchange and storage; pathways and transformations of energy and matter; and systems biology. Emphasizes the process of science and relevance of biology to society.

Fulfills Core Requirement in Natural Sciences.

Theme: Engaging Creative, Aesthetic and Spiritual Experience.

Lab Fee: \$175.00

BIO-113L: Biology I Lab (0 Credits)

Co-requisite(s): BIO-113 and BIO-113R are required. - Must be taken at the same time as this course.

This lab is designed to reinforce the concepts of BIO-113. The course emphasizes scientific methodology and investigative approaches to the natural world inhabiting Aquidneck Island. Topics examined include the operation of basic laboratory equipment, observations of the natural world, cellular processes (e.g., respiration, photosynthesis, mitosis, meiosis) and genetics.

BIO-113R: Biology I Recitation (0 Credits)

Co-requisite(s): BIO-113 and BIO-113L are required. - Must be taken at the same time as this course.

This is an interactive course designed to reinforce concepts introduced in BIO-113 through discussion, case studies, and group work. The course also provides the opportunity for students to critically evaluate their work and engage in metacognition to improve their study habits.

BIO-114: Biology II (4 Credits)

Co-requisite(s): BIO-114L and BIO-114R are required. Must be taken at the same time as this course.

This course presents a comprehensive view of the organization of life at the organismal, population, and ecological levels. Foundational concepts include a survey of the diversity of life and comparative anatomy, physiology, and adaptations of plants and animals. The course addresses ecological aspects of population biology, including patterns and processes that inform the distribution and abundance of species, population growth, organisms' responses to environmental variation, and interactions among species. Each of the topics of the course is explored from a comparative viewpoint to recognize common principles as well as variations among organisms that indicate evolutionary adaptation to different environments and niches. The course explores the core concepts of evolution; structure and function; information flow, exchange and storage; pathways and transformations of energy and matter; and systems biology. Emphasizes the process of science and relevance of biology to society.

Fulfills Core Requirement in Natural Sciences.

Theme: Engaging Creative, Aesthetic and Spiritual Experience.

Lab Fee: \$175.00

BIO-114L: Biology II Lab (0 Credits)

Co-requisite(s): BIO-114 and BIO-114R are required. Must be taken at the same time as this course.

This lab is designed to reinforce the concepts of BIO-114. The course emphasizes understanding the diversity of structural and functional adaptations that contribute to an organism's success through investigative exercises and dissections. Topics examined include physiology, anatomy, and ecology.

BIO-114R: Biology II Recitation (0 Credits)

Co-requisite(s): BIO-114 and BIO-114L are required. Must be taken at the same time as this course.

This is an interactive course designed to reinforce concepts introduced in BIO-114 through discussion, case studies, and group work. The course also provides the opportunity for students to critically evaluate their work and engage in metacognition to improve their study habits.

BIO-140: Humans and their Environment (3 Credits)

This course considers the interdependence and tension between humans and their environment. Discussions of contemporary, social, economic, and ecological concerns such as population growth, world hunger, pollution and resource utilization attempt to provide the student with the general background necessary for consideration of environmental ethics. The student will then critically evaluate and analyze the moral choices involved in such environmental dilemmas as intergenerational equity, the needs of developing countries versus the needs of industrialized nations, individual needs and rights versus the good of both the local and global communities.

Fulfills Core Requirement in Natural Sciences.

Theme: Building Global Awareness.

BIO-140L: Humans and their Environment Lab (1 Credits)

Pre/Co-requisite(s): BIO-140 is required.

This course consists of laboratory exercises to give the students experience with the scientific method, measurement, computation, quantification, statistical analysis, and lab report writing. These include topics such as osmotic gradients, analysis of temperature, pH, conductivity, population demographics, water, air and soil quality, toxicology and behavioral ecology.

Lab Fee: \$175.00

BIO-190: Nutrition (3 Credits)

This course presents a survey of nutrition. Various nutrients and their relationship to human growth and development will be analyzed. Both the benefits and the safety problems associated with the rapid changes in the technology of food science will be assessed along with hunger as serious global, moral, and ethical concerns.

Fulfills Core Requirement in Natural Sciences.

Theme: Building Global Awareness.

Course Fee: \$60.00

BIO-200: Botany (4 Credits)

Pre/Co-requisite(s): BIO-200L is required.

This is an introductory course with laboratory emphasizing the continuous interaction of living plants with the environment by examining the structures and functions of cells, tissues and organs of both terrestrial and marine plants and algae. Special emphasis will be placed on ecology, particularly the role of plants in the biosphere, and on appropriate environmental issues. Additionally, this class examines through laboratories and hands-on work in our greenhouse how environmental factors affect plant growth and survival.

Lab Fee: \$175.00

BIO-200L: Botany Lab (0 Credits)

Co-requisite(s): BIO-200 is required.

This laboratory emphasizes the continuous interaction of living plants with the environment by examining the structures and functions of cells, tissues and organs of both terrestrial and marine plants and algae. This class examines how environmental factors affect plant growth and survival through hands-on work in our greenhouse.

BIO-207: Microbiology of Health and Disease (4 Credits)

Co-requisite(s): BIO-207L is required.

This course is designed for students interested in pursuing a Nursing degree. Emphasis is on microorganisms in health and disease. Structure physiology and genetics of viruses, bacteria and fungi are discussed as well as non-parasitic relationships, immune responses and treatment and prevention of disease. Laboratory component includes the cultivation, biochemical differentiation, control and diagnosis of microorganisms. Nursing majors only.

Lab Fee: \$175.00

BIO-207L: Microbiology of Health and Disease Lab (0 Credits)

Co-requisite(s): BIO-207 is required.

This course is designed for students interested in pursuing a Nursing degree. Laboratory component includes the cultivation, biochemical differentiation, control and diagnosis of microorganisms.

BIO-210: Microbiology (4 Credits)

Pre-requisite(s): BIO-112 or BIO-113 or BIO-105 and BIO-106 or BIO-110 and permission of instructor is required.

Co-requisite(s): BIO-210L is required.

This introductory course is a foundational, yet comprehensive overview of microbiology. The principles of morphological structure, physiology and genetics of viruses, bacteria and fungi are discussed. Upon completion of this course the student will have a good understanding of the nature of host-parasite interactions in infectious diseases, host defense mechanisms, the control of microbial populations, and the diagnosis of human disease. Laboratory work includes the cultivation, biochemical differentiation, control and diagnosis of microorganisms.

Fulfills Core Requirement in Natural Sciences.

Lab Fee: \$175.00

BIO-210L: Microbiology Lab (0 Credits)

Co-requisite(s): BIO-210 is required.

This introductory course is a foundational, yet comprehensive overview of microbiology. Laboratory work includes the cultivation, biochemical differentiation, control and diagnosis of microorganisms.

BIO-220: Cell Biology and Chemistry (4 Credits)

Pre-requisite(s): BIO-112 or BIO-113 or BIO-105 and BIO-106 or permission of department chair are required.

Co-requisite(s): BIO-220L is required.

A comprehensive comparison of the structure and function of prokaryotic and eukaryotic cells and their components are examined in detail at the cellular, subcellular and molecular levels. The molecular mechanisms of cell growth and survival, metabolism and cell-cell interactions are presented in both the normal state (development, species preservation) and in the abnormal state (cancer, genetic diseases). The fundamentals of cellular chemistry and the chemical properties of biologically important macromolecules are emphasized. Laboratory experiments are designed to introduce the current concepts and techniques in molecular biology, biochemistry and cell biology as a means to study cellular structure and function.

Fulfills Core Requirement in Natural Sciences.

Theme: Engaging Creative, Aesthetic and Spiritual Experience.

Lab Fee: \$175.00

BIO-220L: Cell Biology and Chemistry Lab (0 Credits)

Co-requisite(s): BIO-220 is required.

A comprehensive comparison of the structure and function of prokaryotic and eukaryotic cells and their components are examined in detail at the cellular, subcellular and molecular levels. Laboratory experiments are designed to introduce the current concepts and techniques in molecular biology, biochemistry and cell biology as a means to study cellular structure and function.

BIO-230: Biotechnology (3 Credits)

An introduction to recent developments in basic biological research that are improving technologies for producing food, medicines, clinical diagnostic procedures, and a vast array of other biochemicals that extend and improve modern life. The course discusses the basic principles of genetics, applied microbiology, agribusiness and industrial biotechnology. Also considered are governmental policies regarding the development and regulation of biotechnology research. Students will then analyze and evaluate the moral and ethical choices and dilemmas of this rapidly evolving technology and its global effects.

BIO-232: Bioinformatics (4 Credits)

Pre-requisite(s): BIO-110, BIO-112 or BIO-113 is required.

Bioinformatics is an interdisciplinary dimension of biotechnology that merges the development of computer technology application with molecular biology. This introductory level course will combine the fundamental information required to understand the basic DNA-protein and molecular biology concepts with the computer applications that will enable the student to annotate, manipulate and interpret such databases.

Fulfills Core Requirement in Natural Sciences.

BIO-235: Biotechniques (3 Credits)

Pre-requisite(s): BIO-220 or permission of department chair is required. This laboratory course covers the theory and practice of commonly used laboratory techniques in modern biology. Students will acquire skills in recombinant DNA technologies, gene manipulation, cloning, cell culture, and gene transfer, as well as protein expression, protein purification and characterization. Techniques in electrophysiology, anatomical tracing and surgery will be included on an alternating basis. The course emphasizes laboratory skills for entry-level employment in biotechnology, pharmaceutical and biomedical laboratories.

Course Fee: \$175.00

BIO-250: Kinesiology (3 Credits)

Pre-requisite(s): BIO-111 and BIO-112 or BIO-113 and BIO-114 or BIO-105 and BIO-106 are required.

This course presents an introduction to the discipline of kinesiology, the study of human biomechanics. Emphasis will be on examination of muscle movement and physiology from an integrated function, health and disease perspective.

BIO-253: Genetics: Classical, Molecular and Population (4 Credits)

Pre-requisite(s): BIO-112 or BIO-113 is required.

Co-requisite(s): BIO-253L is required.

This course includes topics on the structure and synthesis of DNA, RNA and protein. The gene theory, various methods by which genes are expressed or repressed, structural changes in the chromosomes and their effects, elementary Mendelian mechanism and its modification and the genetics of prokaryotes and eukaryotes are emphasized. Laboratory emphasizes both classical and modern laboratory techniques.

Fulfills Core Requirement in Natural Sciences.

Theme: Engaging Creative, Aesthetic and Spiritual Experience.

Lab Fee: \$175.00

BIO-253L: Genetics Lab (0 Credits)

Co-requisite(s): BIO-253 is required.

This course includes topics on the structure and synthesis of DNA, RNA and protein. Laboratory emphasizes both classical and modern laboratory techniques.

BIO-255: Conservation Biology (3 Credits)

Pre-requisite(s): BIO-140 or BIO-111 or BIO-114 is required.

Conservation Biology is the integrated science of diversity and scarcity developed to face the challenge of stemming the current rate of extinction. Students will be introduced to the discipline in three key areas: understanding patterns of global biodiversity, investigating the human influence on biological species, populations, communities and ecosystems, and to gain a basic understanding of the practical approaches to prevent extinction, maintain genetic variation, and protect and restore biological communities.

Course Fee: \$60.00

BIO-260: Marine Biology (4 Credits)

Pre-requisite(s): BIO-140 and BIO-140L or BIO-111 and BIO-112 or BIO-113 and BIO-114 are required.

Co-requisite(s): BIO-260L is required.

Estuarine, coastal and marine environments and their organisms that inhabit these environments are studied in this course. The technology needed to monitor and maintain marine ecosystems is practiced in the lab and the field.

Lab Fee: \$175.00

BIO-260L: Marine Biology Lab (0 Credits)

Co-requisite(s): BIO-260 is required.

The laboratory examines the estuarine, coastal and marine environments and the organisms that inhabit these environments. The laboratory focuses on the technology and techniques needed to monitor and maintain marine ecosystems and how it is practiced in the field.

BIO-262: Animal Behavior (3 Credits)

Pre-requisite(s): BIO-111 is required or BIO-110 and permission of department chair.

This course investigates the evolutionary basis of human and animal behavior. Students will consider causes and consequences of behavior across biological levels, from molecular, genetic, and cellular, through neurobiological, physiological, organismal, and societal. We will take an evolutionary perspective in order to gain insight beyond simply how a behavior occurs, but also why it may have arisen, and fitness consequences for an individual or group. We will discuss the extent to which studies of behavioral evolution in other animals can inform our understanding of human behavior.

BIO-275: Tropical Biology (3 Credits)

Pre-requisite(s): BIO-111 or BIO-114 or BIO-140 and BIO-140L are required. Must be a biology or environmental studies major or minor.

An introduction to terrestrial and marine biomes of tropical latitudes, biodiversity of Neotropical wildlife and fisheries of the Caribbean, human ecology in Central America, and coral reef, mangrove and tropical forest ecology. Tropical biology offers students the exciting opportunity to study first-hand the evolutionary ecology of important plant and animal taxa in tropical ecosystems. Course design emphasizes intensive field exploration of tropical ecosystems on land and sea in Belize, Central America, where students are introduced to a great diversity of tropical habitats, each possessing distinctive biotas that in turn demonstrate unique evolutionary histories and ecological dynamics. The course and field exploration emphasize the human dimensions of tropical systems and the principles of conservation biology.

Fulfills Core Requirement in Natural Sciences.

Theme: Building Global Awareness.

BIO-278: Tropical Biology Field Experience (1 Credits)

Pre-requisite(s): One of the following courses is required. BIO-140 SCI-104 BIO-111 or BIO-112.

Fulfills core in Natural Science. This course consists of tropical field experience in another country (e.g., Belize, Brazil) to give the students experience with applying concepts in environmental science, ecology, evolution, animal behavior, botany, zoology, and conservation to tropical systems. Field skills are developed in taxonomic field identification, survey methods, study design, field data collection and analysis.

BIO-284: Hormones & Behavior (3 Credits)

Pre-requisite(s): BIO-110 or BIO-112 or BIO-113 and PSY-100, or Biology major/minor or Neuroscience minor, sophomore or higher academic standing are required.

Hormones and Behavior is a one-semester introduction to the field of behavioral endocrinology. As such, it is enormously broad in scope, encompassing psychology, cell biology, biochemistry and neurobiology. The action of hormones in the body and their interactions with internal and external forces influence animal and human behavior. Topics addressed in this course are cellular mechanisms of hormone action, metabolism, stress, sexual differentiation and sexual development, gender identity, hunger, thirst, aggression, affiliation, mating behavior and learning and memory.

BIO-305: Human Anatomy (4 Credits)**Pre-requisite(s):** BIO-220 is required.**Co-requisite(s):** BIO-305L is required.

Human Anatomy is a four-credit lecture/lab course for juniors and seniors. Students will study the anatomy of the human body on the microscopic, tissue and organ level. Clinical cases involving changes in anatomy and the pathologies that lead from them will be included. The lab includes study of cells and tissues, the dissection of organs and tissues from mammalian specimens and includes a field trip to a human dissection laboratory. The course is designed to offer the student the fundamentals of human anatomy for future graduate health professions or medical study.

Lab Fee: \$175.00**BIO-305L: Human Anatomy Lab (0 Credits)****Co-requisite(s):** BIO-305 is required.

This laboratory course includes study of cells and tissues, the dissection of organs and tissues from mammalian specimens and includes a field trip to a human dissection laboratory.

BIO-310: Ecology (4 Credits)**Pre-requisite(s):** BIO-111 or BIO-114 or BIO-140 and BIO-140L and permission of department chair are required.**Co-requisite(s):** BIO-310L is required.

This course examines the concepts of the ecosystem, populations, communities, the flows of energy, material cycles, and the necessity of diversity organismal, physiological and evolutionary responses. Concepts including the unity of organisms and inseparable interactions with the physical environment are analyzed. Class discussions include topics such as the formation, distribution, and organization of ecological communities; plant succession and nutrient cycling; evolutionary trends of plant and animal populations.

Lab Fee: \$175.00**BIO-310L: Ecology Lab (0 Credits)****Co-requisite(s):** BIO-310 is required.

This course examines the concepts of the ecosystem, populations, communities, the flows of energy, material cycles, and the necessity of diversity. Laboratory topics such as the formation, distribution, and organization of ecological communities; plant succession and nutrient cycling; evolutionary trends of plant and animal populations are examined.

BIO-320: Evolution (3 Credits)**Pre/Co-requisite(s):** BIO-111 and BIO-112 or BIO-113 and BIO-114 are required; BIO-253 must be complete or taken concurrently.

The goal of this course is to provide students with an intellectual understanding of the principles of evolution, an appreciation of the historical processes leading to the development of the theory, and a sense of the scientific debate and controversy regarding the operation of evolutionary processes. The course will cover the history of evolutionary thought from Aristotle to the present. Emphasis will be placed on the cultural, religious, and philosophical atmosphere in Europe at the time Darwin was writing and publishing *Origin of Species*. The social and scientific ramifications of Darwinian theory will be presented. The course will include macroevolution, microevolution, and sexual selection.

BIO-324: Fundamentals of Medical Laboratory Sciences (3 Credits)**Pre-requisite(s):** BIO-112 or BIO-113 is required and junior/senior level standing or permission of Department Chair.

This course serves as an introduction to the theory and practice of clinical laboratory medicine. Students will gain an understanding of how blood, urine and other samples are collected and analyzed in a medical laboratory. With the use of clinical case studies, students will engage with analytical methods from each specialty area: hematology, immunology, chemistry, immunohematology and microbiology.

BIO-325: Human Physiology (4 Credits)**Pre-requisite(s):** BIO-220 is required.**Co-requisite(s):** BIO-325L is required.

Human Physiology, a four-credit lecture/lab course for junior and seniors, explores the normal functioning of the human body. It encompasses the molecular and cellular processes that maintain homeostasis under a broad range of conditions. Using the disciplines of neuroscience, anatomy, chemistry, physics and mathematics, each organ system and its role will be detailed. As this course is designed for future healthcare professionals and graduate students in Biology, examples in health and medicine will be used to illustrate all major concepts. The lab will consist of experiments using both animals and humans and will represent physiology in all levels of body organization from the molecular to the whole organism.

BIO-325L: Human Physiology Lab (0 Credits)**Co-requisite(s):** BIO-325 is required.

This laboratory course includes experiments using both animals and humans and will represent physiology in all levels of body organization from the molecular to the whole organism.

BIO-342: Microbiology of Infectious Diseases (4 Credits)**Pre-requisite(s):** BIO-210 or BIO-207 is required.**Co-requisite(s):** BIO-342L is required. Must be taken at the same time as this course.

The epidemiology of diseases of bacteria, parasites and fungi are used to introduce the different concepts of pathogenicity. Mechanisms of bacterial, parasitic and fungal virulence and host defenses are examined to demonstrate the delicate balance in host-pathogen relationships.

BIO-342L: Microbiology of Infectious Diseases Lab (0 Credits)**Co-requisite(s):** BIO-342 is required. Must be taken at the same time as this course.

This laboratory is focused on methods used to isolate, examine and identify human and animal pathogens, and to study virulence mechanisms used by these pathogens.

BIO-370: Molecular Biology (4 Credits)**Pre-requisite(s):** BIO-253 and junior/senior academic standing are required.

This course provides an introduction to the basics of the molecular processes and genetics of the cell. Particular emphasis will be given to DNA synthesis, DNA repair, protein synthesis and structure, development, differentiation and regulation of gene activity.

BIO-370L: Molecular Biology Lab (0 Credits)**Co-requisite(s):** BIO-370 is required. Must be taken at the same time as this course.

This course offers comprehensive training in molecular biology techniques such as cloning, bacterial transformation, PCR, and gene editing. Through a project-based approach, students gain hands-on experience, enhancing skills in experimental design, troubleshooting, and scientific communication, with presentations to showcase their findings.

BIO-390: Environmental Science Internship (3-4 Credits)

A supervised work experience in areas of environmental science such as wildlife management, water resources, sewer treatment systems, salt marsh monitoring and restoration, environmental education or natural resource management are available. Students are expected to review the literature on the chosen internship project and to make formal oral and written presentation of the internship experience. Permission of the department chair is required.

Course Fee: \$60.00

BIO-391: Biology Internship (3 Credits)

A supervised work experience in an area of biomedical science, including, but not exclusive to, clinical laboratory work, close work with a medical, dental or veterinary professional, forms of patient care in hospitals and health clinics, or work with health care NGOs. Students are expected to review the literature on the chosen internship project and to make formal oral and written presentations of the internship experience. Permission of instructor or department chair is required.

BIO-399: Special Topics (3-4 Credits)

This course investigates topics of current interest in the field of Biology and Biomedical Sciences. The topics to be covered and the focus of the course will be specified at the time of registration. This course may be repeated for different topics. 200 level biology course, or as indicated at the time of offering is required.

Course Fee: \$175.00

BIO-399L: Special Topics: Biology Lab (0 Credits)

Co-requisite(s): BIO-399 is required.

This a laboratory course investigates topics of current interest in the field of Biology and Biomedical Sciences. The topics to be covered and the focus of the course will be specified at the time of registration.

BIO-420: Immunology (3 Credits)

Pre-requisite(s): BIO-220 and junior/senior academic standing are required.

A study of the cellular and humoral interaction involved in the response of the host to antigenic stimulation. Special emphasis is given to bursal and thymic influence on lymphoid cells, immune mechanisms in viral diseases, vaccines, autoimmune disorders and immunochemistry.

BIO-425: Neuroscience (3 Credits)

Pre-requisite(s): BIO-220 and junior/senior academic standing are required.

Neuroscience is an interdisciplinary field encompassing cell biology and physiology, biochemistry, physics and psychology. As such, it is considered to be an integrative science of brain, body and emotion. The anatomical features of the nervous system and the principle molecular and physiological events that govern neuronal communication are the foundations of the course. These fundamentals will be used to introduce students to system level concepts, such as neural development, sensory and motor control, learning and conditioning behavior and memory.

BIO-426: Experiments in Neuroscience (1 Credits)

Pre/Co-requisite(s): BIO-425 or concurrent enrollment, junior/senior academic standing are required.

This laboratory course correlates with BIO-425: Neuroscience. It may be taken with BIO-425 or following it. The lab will cover anatomical, physiological, behavioral, and neuro-biological modeling techniques used to study the nervous system and the brain. This course will emphasize learning basic neuroscience laboratory techniques using living, non-vertebrate animals. The students will also practice designing research experiments and taking them through the grant approval process.

Lab Fee: \$175.00

BIO-450: Pathophysiology (3 Credits)

Pre-requisite(s): BIO-220 and junior/senior academic standing are required.

This course presents an in-depth study of the present theories of what constitutes the normal cell, the adapted cell, the injured cell and the dead cell. The exogenous and endogenous environmental stresses that exceed the adaptive capabilities of the cells are examined. Their injury at the cellular level is related to diseases of the individual organs and to the effects these diseases have on the body as a whole.

BIO-460: Virology (3 Credits)

Pre-requisite(s): BIO-210, BIO-220 and junior/senior academic standing are required.

The basic properties of viruses are examined in depth. This information serves as the basis for analyzing the mechanisms by which viruses interact with humans, animals, plants or bacteria to produce disease. The use of viruses as tools for studies in genetics, biochemistry, and molecular biology are also presented. Viruses are considered in two parallel ways, as very interesting organisms and as agents of disease.

BIO-471: Biology Seminar (3 Credits)

Pre-requisite(s): One 300-level biology course is required.

This course provides an opportunity for students to make formal written and oral presentations of in-depth areas of current biological and biomedical research literature. Class discussions include recent developments in the biological sciences including the ethical considerations of those developments. In addition, the student will review the history and philosophy of science.

BIO-471L: Biology Seminar Lab (0 Credits)

Pre/Co-requisite(s): BIO-471 is required.

BIO-497: Undergraduate Research (1-8 Credits)

In-depth laboratory investigation of a specific topic in biology. Topic and credit to be determined by the faculty member who is acting as research advisor. Permission of instructor is required.

Course Fee: \$175.00

BIO-499: Independent Study (2-4 Credits)

Supervised study in an area not available in a regularly scheduled course. Proposal must be approved by the department chair. Biology majors and minors only.

Medical Laboratory Sciences

MED-410: Clinical Microbiology (8 Credits)

This course addresses the relationship of bacteria and bacterial diseases of man with an emphasis on the application to medical diagnosis. Students rotate through all routine areas of clinical microbiology, parasitology and virology.

MED-420: Clinical Chemistry (8 Credits)

The chemistry of body constituents such as minerals, carbohydrates, lipids, proteins, enzymes, vitamins and hormones and the relationship of these constituents to the diagnosis of human disease is studied. The student receives instruction in manual procedures and automated analysis. Toxicology and therapeutic drug monitoring are also covered.

MED-430: Immunohematology I (4 Credits)

Instruction is given in drawing and processing blood and in ascertaining blood compatibility. Major topics include the development and chemical structure of blood group antigens, the correlation of physical properties of antigens and antibodies with testing procedures, the role of complements in blood banking, autoimmune status, and the inheritance patterns of blood groups. Hemolytic Disease of the Newborn, transfusion reactions, and the preparation and use of blood components. Laboratory practice also emphasizes serological procedures in the diagnosis of disease. Donor recipient blood tissue reactions are covered in detail. Students gain experience in blood bank operations.

MED-440: Hematology & Coagulation (6 Credits)

This course addresses the morphology of the blood and blood-forming organs and the study of abnormalities associated with diseases. Diagnostic procedures are emphasized. Experience is also gained in the dynamics of coagulation. During the clinical laboratory rotation, the student is expected to master the routine procedures performed in hematology and to become familiar with specialized hematology procedures and automated hematology instrumentation.

MED-460: Molecular Pathology (2 Credits)

This course is an introduction to pathology. The correlation between pathological processes and clinical symptoms and the courses of disease will be studied. (Note: This course is not offered by all affiliated hospitals).

MED-470: Professional Topics in Clinical Laboratory Sciences (2 Credits)

This course investigates current topics in the field of Biomedical Technology. The topics to be covered and the focus of the course will be specified at the time of registration. This course may be repeated for different topics.

MED-480: Clinical Immunology (2 Credits)

This course will cover the reaction of antigens with antibodies and the role of the laboratory in detecting and identifying the antibodies and antigens. Topics of discussion will include defining disease states associated with autoimmune diseases, hypersensitivity, immunization and other antigen/antibody interactions.