Biology (BIO) - Graduate Courses

Courses

BIO 404/504 Cr.3
**Plant Taxonomy**
Collection, identification, classification, and evolution of the vascular plants with emphasis on local flora. Lect. 1, Lab. 4. Prerequisite: BIO 203 or BIO 304. Offered Spring - Odd Numbered Years.

BIO 405/505 Cr.2
**Aquatic and Wetland Vascular Plants**
Identification and collection of vascular plants of aquatic and marsh habitats with emphasis on adaptive morphology and ecology of local species. Field trips required. Lect. 1, Lab. 2. Prerequisite: BIO 203 or BIO 304. Offered Fall - Even Numbered Years.

BIO 406/506 Cr.4
**Parasitology**
A survey of the major groups of animal parasites with regard to their taxonomy, morphology, life histories, host-parasite relationships, and economic importance. Lect. 2, Lab 4. Prerequisite: BIO 203 or BIO 210 or BIO 303. Offered Fall.

BIO 408/508 Cr.4
**Developmental Biology**
An exploration of the cellular and molecular mechanisms that underlie embryonic development in several model organisms. Topics include fertilization, regulation of gene expression, cell fate determination, stem cells, early pattern formation, morphogenesis of tissues/organs, and limb formation. The course primarily focuses on animal models with an emphasis on evolutionarily conserved processes, structures, and molecular pathways. Technological advances and relevance to human development and disease are highlighted throughout. Lect. 2, Lab. 4. Prerequisite: BIO 203 or BIO 210 or BIO 303. Offered Spring.

BIO/PAS/PTS 509 Cr.3
**Human Gross Anatomy**
A comprehensive consideration of human gross anatomy. Systems included are musculoskeletal, neurological, urogenital, gastrointestinal, and cardiopulmonary. Function, development, and topographic correlations are emphasized as a means toward evaluating clinical applications. Biomechanical function, topographic and clinical applications are emphasized. Prerequisite: admission to the Biology CRNA Program, PAS Program, or DPT Professional Program; concurrent enrollment in BIO/PAS/PTS 510 under same department. (Cross-listed with BIO/PAS/PTS; may only earn credit in one department.) Offered Summer.

BIO/PAS/PTS 510 Cr.3
**Applied Human Gross Anatomy**
A comprehensive consideration of human anatomy including both neuro-musculoskeletal components and internal organ systems. Systems included are musculoskeletal, neurological, urogenital, gastrointestinal, and cardiopulmonary. The course provides an in-depth understanding of the gross anatomy of the human body through regional dissection. This understanding will then be demonstrated through the application of anatomy within clinical presentations. Prerequisite: admission to the Biology CRNA Program, PAS Program, or DPT Professional Program; concurrent enrollment in BIO/PAS/PTS 509 under same department. (Cross-listed with BIO/PAS/PTS; may only earn credit in one department.) Offered Summer.

BIO 412/512 Cr.4
**Mycology**
A survey of all the major groups of fungi of the fungal kingdom (and relatives) in terms of systematics, anatomy, morphology, ecology, physiology, genetics, evolutionary relationships, and human and plant pathology. Laboratory includes microscopic and macroscopic study of the fungi, as well as making a collection of cultures and of fungal reproductive structures (including mushrooms) from selected groups. Lect. 2, Lab. 4. Prerequisite: BIO 203 or BIO 304 or MIC 230. Both the microbiology course and one of the biology courses are strongly recommended. Offered Fall.

BIO 413/513 Cr.3
**Medical Mycology**
A study of the increasing number of medically important fungi, including the yeasts, molds, other fungi, and actinomycetes that are pathogenic to humans and other animals. Emphasis is on laboratory techniques for isolation and identification of these pathogenic fungi. Lect. 2, Lab. 2. Prerequisite: BIO 412/512 or MIC 230. Offered Spring.

BIO 414/514 Cr.3
**Freshwater Invertebrate Zoology**
Introduces the ecology and taxonomy of the metazoan, non-parasitic freshwater invertebrates. An extensive course designed to provide a foundation for taxonomic knowledge, and basic understanding of the biology and ecology of freshwater invertebrates for advanced students in aquatic and environmental sciences. Lectures will focus on ecology; labs on taxonomy and quantitative skills. A student reference collection and weekend field trips will be required. Lect. 2, Lab. 2. Prerequisite: BIO 203 or BIO 210 or BIO 341. Offered Fall - Even Numbered Years.

BIO 419/519 Cr.3
**Quantitative Methods in Ecology**
An introduction to field and laboratory procedures used by ecologists to describe and analyze the interactions between organisms and their environments. The course will emphasize quantitative techniques, including the use of computer technology, for collecting, recording and interpreting ecological data. Lect. 2, Lab. 2. Prerequisite: BIO 307 or BIO 341. Offered Fall.

BIO 421/521 Cr.3
**Comparative Vertebrate Endocrinology**
A comprehensive study of the production, regulation, structure, molecular to whole-body actions, metabolism, and excretion of biochemical signaling molecules across vertebrates with a focus on amphibians, fish, birds, and mammals. Hormone and neurotransmitter pathways will be examined with relationship to evolutionary and environmental influences using lecture, review of primary literature, and case studies. Prerequisite: BIO 313 or BIO 458/558. Offered Spring.

BIO 422/522 Cr.3
**Ichthyology**
A study of the taxonomy, anatomy, physiology, and ecology of fish, with emphasis on the fresh water fishes. Lect. 2, Lab. 2. Prerequisite: BIO 203 or BIO 210 or BIO 303. Offered Fall - Odd Numbered Years.

BIO 424/524 Cr.3
**Human Endocrinology**
A comprehensive study of the production, regulation, structure, molecular to whole body actions, metabolism, and excretion of biochemical signaling molecules in humans. The classical and more recently recognized neurotransmitter and hormone pathways and clinical and pharmacology considerations of each will be explored with lectures, primary literature and case studies. Prerequisite: BIO 313 or BIO 458/558. Offered Fall.
**BIO 428/528 Cr.3**

**Advanced Nutrition for the Health Professions**
A comprehensive study of nutrition-related diseases and nutrition assessment, evaluation, and management in clinical settings that people working in healthcare may encounter. Prerequisite: BIO 313 or NUT 200. Offered Spring.

**BIO 429/529 Cr.3**

**Evolution**
Consideration of the principles and the record of organic evolution of plants and animals. Lect. 3. Prerequisite: BIO 306. Offered Spring.

**BIO 432/532 Cr.2**

**Biotechnology**
A survey of the current knowledge of cancer biology. The course will include lectures, readings and discussions on a wide range of cancer topics, including: characteristics of cancer cells, carcinogenesis, cancer genes, tumor classification, invasion, metastasis, impact of cancer on body functions, epidemiology, inheritance, immunology, diagnosis, treatment, and prevention. Prerequisite: BIO 303 or BIO 313; BIO 306 or MIC 416. Offered Fall.

**BIO 435/535 Cr.3**

**Molecular Biology**
A study of molecular biology with an emphasis on eukaryotic systems. The course will focus on the molecular aspects controlling biological processes. The impact of recombinant DNA technology on biotechnology and medicine will also be examined. Lect. 3. Prerequisite: BIO 306 and BIO 315, or MIC 416/516; three semesters of college chemistry including organic chemistry. Biochemistry strongly recommended. BIO 436/536 is an optional laboratory which can be taken concurrently. Offered Fall.

**BIO 436/536 Cr.1**

**Molecular Biology Laboratory**
A study of molecular biology with an emphasis on eukaryotic systems. Laboratory emphasis is on recombinant DNA technology, current techniques used to express recombinant proteins in eukaryotic cells, computer based DNA analysis, macromolecular modeling using computers, and quantitative assay techniques. Lab. 3. Prerequisite: taken concurrently with BIO 435/535. This lab is optional for those enrolled in BIO 435/535. Offered Fall.

**BIO 437/537 Cr.3**

**Plant Growth and Development**
Discussion of experiments and analysis of research data obtained from the living plant. Prerequisite: BIO 203 or BIO 304 or equivalent. Offered Occasionally.

**BIO 439/539 Cr.3**

**Plant Anatomy**
A detailed examination of plant structure and development as revealed with the light and electron microscopes. Primarily seed plants will be examined. Structure and development will be studied as a means by which plants cope with their ecology, evolution and function. Lect. 2. Lab. 2. Prerequisite: BIO 203 or BIO 304 or an equivalent general botany course. Offered Occasionally.

**BIO/MIC 440/540 Cr.2**

**Bioinformatics**
In this course, students will use computers to study and compare the sequence of nucleotides in DNA or RNA, or the amino acids in a protein. Computers are also used to examine the three dimensional structure of protein. Being able to manipulate and study this information is the basis for the current revolution in biotechnology. Topics include evolution, taxonomy, genomics and understanding disease. This course provides students an opportunity to explore the relationships between biology, microbiology, chemistry, and computer science. Lect. 2. Lab 1. Prerequisite: BIO 306 or MIC 416/516. (Cross-listed with BIO/MIC; may only earn credit in one department.) Offered Spring, Winter.
BIO 456/556 Cr.4

**Plant Ecology**
Conservation biology, ecological restoration, and predicting the effects of climate change all require an understanding of plant ecology. This course is focused on the interactions among plants, other organisms, and the environment. We will work across the individual, population, and community levels, and emphasize an exploratory approach to plant ecology. Class activities will include lectures, the discussion of ecological journal articles, and carrying out student-designed experiments. Offered Fall - Even Numbered Years.

BIO 458/558 Cr.3

**Comparative Animal Physiology**
This course provides a thorough understanding of Animal Physiology from a comparative perspective. Emphasis will be placed on the basic physiological principles by which animals perform their life sustaining functions. Discussion will focus on vertebrates, but will span both invertebrate and vertebrate models to illustrate how largely divergent groups have evolved different (or similar) mechanisms to cope with their specific environmental challenges. Class activities will include lectures and discussion of physiological journal articles. Offered Fall.

BIO 460/560 Cr.1-4

**Symposium in Biology**
Studies in biology of interest to specific groups. Varying topics will be offered at intervals with a specific title assigned to each. May be staffed by resident faculty or visiting lecturers. Other departments may be invited to participate. Repeatable for credit - maximum 16. Variable offerings - check registration schedules. Prerequisite: four semesters of biology. Offered Occasionally.

BIO 563 Cr.3

**Aquatic Animal Health**
The study of pathogens of aquatic animals, including fish, shellfish, crustaceans, amphibians, waterfowl and mammals. Sections on nutrition and toxicology are included. Emphasis is on laboratory techniques for isolation and identification of pathogenic bacteria, viruses and parasites. Field trips required. Lect. 2, Lab. 3. Prerequisite: BIO 105; BIO 203 or BIO 210 or BIO 303; and CHM 103. MIC 230 strongly recommended. Offered Occasionally.

BIO 464/564 Cr.3

**Stream and Watershed Ecology**
Introduces key concepts and theory pertinent to understanding and managing fluvial ecosystems (rivers and streams) and their watersheds. The course will emphasize rivers as large-scale physical and biological systems. Course work includes a comparative case study of distinctive types of temperate, tropical, and polar rivers. Prerequisite: BIO 341 or BIO 307. Offered Spring.

BIO 465/565 Cr.3

**Neurophysiology**
An examination of the nervous system beginning at the cellular level and working up to neuronal systems. Topics covered include the ionic basis of membrane potentials, synaptic communication, organization of functional circuits of neurons, and systems within the brain and/or spinal cord which control learning and memory, and vision and motor function. Exploration of these fundamental neurophysiology topics form the basis for understanding a variety of student-selected topics which will be covered later in the semester. Late-semester topics often include higher-order aspects of brain function or challenges to the nervous system - such as the repair of brain or spinal cord injury, degenerative disease states, dyslexia, or gender differences. BIO 467/567 is an optional laboratory course which can be taken concurrently. Prerequisite: BIO 312. Offered Spring.

BIO 466/566 Cr.3

**Human Molecular Genetics**
A study of the basic principles of heredity in humans. Focus will be on modern molecular techniques used in isolating human disease genes and modes of inheritance of human traits and disorders. Ethical issues in human genetics will also be discussed. BIO 468/568 is an optional laboratory course which can be taken concurrently. Prerequisite: BIO 306. Offered Fall.

BIO 467/567 Cr.2

**Neurobiology Laboratory Techniques**
An introduction to common laboratory techniques in neurobiology, including electrophysiology with invertebrate preparations, mammalian neuronal cell culture, and computational modeling. Students will receive training in techniques while performing classical experiments, then design their own novel experiments and carry them out. Lab. 4. Prerequisite: BIO 312; BIO 465/565 or concurrent enrollment. Offered Spring - Odd Numbered Years.

BIO 468/568 Cr.1

**Human Molecular Genetics Lab**
A study of the techniques used in doing research in human molecular genetics with a focus on commonly used model organisms in the study of human genetic disorders. Laboratory emphasis is on phenotype analysis, library screening, DNA microarray analysis, gene mapping, and bioinformatics. This lab is optional for those enrolled in BIO 466/566. Lab. 3. Prerequisite: BIO 306. BIO 466/566 must be taken concurrently. Offered Fall.

BIO 473/573 Cr.3

**Marine Biology**
Marine biology is an interdisciplinary field that includes elements of geology, physics, chemistry and biology. Students will gain an introduction to how biological organisms deal with varying physical, geological and chemical conditions found in marine ecosystems. Emphasis will be placed on current conservation concerns and marine invertebrate diversity. Prerequisite: BIO 203 and CHM 103. Offered Spring - Odd Numbered Years.

BIO 476/576 Cr.3

**Ecosystem Ecology**
Ecosystems include the living and non-living components of an environmental system and have emergent properties that can only be understood by examining the system as a whole. This course will examine advanced ecological topics centered around the structure and function of aquatic and terrestrial ecosystems. Topics covered will include the development of the ecosystem concept, ecosystem succession, production/decomposition, energy transfer in food webs, and nutrient cycling. The course will consist of classroom lectures, problem sets, and reading/discussion of relevant literature. Prerequisite: BIO 307 and one semester of chemistry. Offered Spring - Even Numbered Years.

BIO 490/590 Cr.1-3

**Current Topics in Biology Education**
Biological researchers produce new discoveries almost daily. The purpose of this course is to train K-12 pre-service and in-service teachers in the current technologies and theories used in biology and to demonstrate the current approaches to teaching these materials. Repeatable for credit under different topics. Departmental option for pass/fail grading. Pass/Fail grading. Offered Fall.
BIO 701 Cr.4  
**Communication in the Biological Sciences**  
This course covers in detail the preparation and submission of scientific manuscripts for publication and the presentation of papers at scientific conferences. Topics covered include preparation of manuscript sections, figures, and tables; writing with clarity, precision, and word economy; dealing with journal editors and reviewers; reviewing and editing of manuscripts; preparation of proposals for funding; presentation of oral (platform) and poster papers at scientific conferences; preparation of visual aids; risk communication; serving on expert panels; serving as an expert witness; and communicating with the public, the press, lawyers, and politicians. Offered Spring - Even Numbered Years.

BIO 713 Cr.2  
**Physiology of Drug Action**  
A study of the general principles of pharmaco-dynamics and pharmacokinetics of drugs in human systems with emphasis on the physiological responses at the cellular and organ levels. Prerequisite: BIO 718 or concurrent enrollment. Offered Occasionally.

BIO/MIC 714 Cr.3  
**Advanced Genetics**  
The application of molecular-genetic analysis to problems in modern biology. The course will cover the fundamentals of genetic analysis in both procaryotic and eucaryotic systems. Assigned readings from current literature will be discussed and evaluated. A variety of topic areas will be considered including ecology, biotechnology, bioremediation, food science, medicine and basic research. Prerequisite: a previous course in genetics, microbial genetics, or molecular biology. (Cross-listed with BIO/MIC; may only earn credit in one department.) Offered Spring - Odd Numbered Years.

BIO 715 Cr.3  
**Pathophysiology I**  
A study of diseases of the human central nervous system, pulmonary, cardiovascular, and renal systems with an emphasis on pathophysiology, treatment, and interaction with other organ systems. Prerequisite: BIO 718; BIO 719; admission to the Biology Certified Registered Nurse Anesthetist (CRNA) program. Offered Fall.

BIO 716 Cr.3  
**Current Topics in Physiology**  
Consideration of selected topics in physiology such as advanced cellular physiology, membrane and endocrinological physiology, and systemic physiology. Assigned readings will be largely from current literature. Offered Occasionally.

BIO 717 Cr.3  
**Pathophysiology II**  
A study of diseases of the human hepatic, gastrointestinal, immune, neuromuscular, and endocrine systems with an emphasis on pathophysiology, treatment, and interaction with other organ systems. Prerequisite: BIO 718; BIO 719; admission to the M.S. Biology Certified Registered Nurse Anesthetist (CRNA) Program. Offered Spring.

BIO 718 Cr.4  
**Advanced Human Physiology I**  
An in-depth study of the physiology (including associated anatomic structures) of human organ systems. Covers the cell, and the nervous, muscular and respiratory systems. Prerequisite: B.S. in biology or allied health related field. Offered Fall.

BIO 719 Cr.4  
**Advanced Human Physiology II**  
An in-depth study of the physiology (including associated anatomic structures) of human organ systems. Covers the circulation, endocrine, digestive and excretory systems, and temperature regulation. Prerequisite: BIO 718. Offered Spring.

BIO 720 Cr.2  
**Research in Anesthesia**  
The student will conduct a critical review and analysis of the primary literature and/or patient records (after IRB approval) in the area of clinical anesthesia or applied physiology. The results and analysis will be summarized and presented in a poster format. Students will be required to present their poster at a professional meeting. Prerequisite: BIO 718; BIO 719; admission to the M.S. Biology Certified Registered Nurse Anesthetist (CRNA) Program. Offered Summer.

BIO/MIC 721 Cr.1-2  
**Directed Studies**  
Directed readings or presentation of material not available in formal departmental courses. Repeatable for credit - maximum four between BIO and MIC. (Cross-listed with BIO/MIC.) Offered Fall, Spring.

BIO 723 Cr.3  
**21st Century Mycology**  
An in-depth examination of contemporary research on fungi, including systematics and evolution, genetics, molecular ecology, biotechnology, bioremediation, physiology, plant or animal pathology, and/or developmental biology, through critical analysis and discussion of primary literature sources. Readings will exemplify major questions, experimental approaches, and methods, and will be analyzed to identify important contemporary research themes, paradigm shifts, and unanswered questions. Prerequisite: BIO 412/512; BIO 306. Offered Occasionally.

BIO 725 Cr.1-3  
**Forum in Biology**  
An in-depth examination of selected topics in biology through critical analysis of the primary literature. Participants will be required to read and discuss the experimental design, methods, results and major conclusions of scientific research. Repeatable for credit - maximum six. Variable offerings - check registration schedules. Offered Occasionally.

BIO 726 Cr.1-3  
**Advanced Laboratory Techniques in Biology**  
Development of accessory research skills in specialized areas of biology. Repeatable for credit - maximum six. Variable offerings - check registration schedules. Offered Occasionally.

BIO 732 Cr.2  
**Effective Teaching Strategies for Grad Teaching Assts in the Science Lab**  
This course aims to improve proficiency of graduate teaching assistants in the science laboratory. Topics covered may include, but are not limited to, students learning styles, lecture and question techniques, design of assessment tools, portfolio development, and grading techniques. Offered Fall.

BIO/MIC 751 Cr.1  
**Graduate Seminar**  
Reading, oral reports, and discussion on selected topics in biology. Repeatable for credit - maximum two. (Cross-listed with BIO/MIC.) Offered Fall, Spring.

BIO 761 Cr.2  
**Research and Seminar in Biology**  
Principles of research in biology. As part of the requirements for this course and for the degree, each student must complete an acceptable seminar paper unless pursuing Plan A and writing a master’s thesis. Offered Fall, Spring, Summer.
BIO 779 Cr.1-2

**Biology Laboratory Assistant**

Allows graduate students to gain experience in assisting with preparation and teaching 300 and 400 level laboratory-based courses in conjunction with the regular instructor. Students will be expected to assist in preparation of course materials, demonstrate proper techniques, and evaluate students' performance. Repeatable for credit - maximum three. Lab. 2-6. Prerequisite: graduate standing. Not applicable to students assisting in 100 or 200 level courses. Consent of instructor. Offered Fall, Spring.

BIO 799 Cr.1-9

**Research: Master's Thesis**

Independent research on a problem selected for a thesis under the direction of an assigned staff member. For students following Plan A. Repeatable for credit - maximum 15. Maximum of six credits applicable to the M.S. in biology degree. Offered Fall, Spring, Summer.