

# BIOLOGY (BIOL)

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## Courses

### BIOL 502 GENERAL ECOLOGY (4)

Effects of the abiotic and biotic environment on distribution and abundance of organisms: organization of biological communities, ecosystems, evolution of different reproductive strategies and application of ecological principles to natural resource conservation. Several day-long trips required. Not open to those who have successfully completed BIOL 402.

### BIOL 506 LIMNOLOGY (4)

Physical, chemical and biological factors that affect fresh-water organisms, and some of the standard methods used to analyze these factors. Average of 3 laboratory hours per week. Not open to those who have successfully completed BIOL 406. Prerequisite: BIOL 402/BIOL 502 or equivalent recommended.

### BIOL 508 CELL BIOLOGY (4)

The molecular and morphological organization of the cell in relationship to cellular activities with emphasis on eukaryotic cells. Includes average of two recitation hours per week. Prerequisites: BIOL 207 or BIOL 222/BIOL 222L (BIOL 214); CHEM 330 or CHEM 331 or equivalents.

### BIOL 510 CONSERVATION BIOLOGY (4)

Application of ecological theory to conservation of biological diversity. Exploration of past and present processes leading to and maintaining diversity and how such processes are impacted by human disturbance. Average of three laboratory hours per week. Prerequisites: 10 hours of biology or combination of 10 hours from biology, geography, or physical science.

### BIOL 513 EVOLUTION (3)

Concepts of biological evolution, the history of the development of these concepts and current topics in evolutionary biology. Not open to those who have successfully completed BIOL 413.

### BIOL 515 MEDICAL MICROBIOLOGY (4)

Pathogenesis of bacterial, viral, rickettsial and fungal diseases with emphasis on medically important bacteria and microbiological techniques. Recommended for students pursuing a career in medical sciences. Either this course or BIOL 518, but not both, may count toward an M.S. degree in Biology.

### BIOL 518 MICROBIOLOGY (4)

Biology of micro-organisms with emphasis on bacteria. Microbial morphology, physiology and genetics, and the role of micro-organisms in natural processes and disease. Laboratory will include methods of observing, isolating and identifying bacteria. Not open to those who have successfully completed BIOL 318 or BIOL 515.

### BIOL 519 ENVIRONMENTAL MICROBIOLOGY (3)

Biology and ecology of microorganisms in natural and anthropogenic environments. Culture-based and molecular methods for detection, evaluation, and manipulation of microorganisms and their metabolism.

### BIOL 521 IMMUNOLOGY (4)

Fundamental principles of immunology with emphasis on the nature of antibodies and antigens, blood groups, antibody-antigen reactions, hypersensitivity, autoimmunization, tumor immunology, artificial grafting and the preparation of vaccines. Includes average of two recitation hours per week. Prerequisite: BIOL 315 / BIOL 515 or BIOL 318 / BIOL 518 or equivalent.

### BIOL 525 DISSECTION OF THE UPPER EXTREMITY (2)

Gross anatomical dissection of the human upper extremity including the muscles, nerves and blood vessels which supply the appendage. Special emphasis will be placed on development of techniques which assure careful and accurate dissection. Will be offered only in the Minimester. Prerequisite: BIOL 221 / BIOL 221L (BIOL 213) or equivalent, and consent of instructor.

### BIOL 527 NEUROMUSCULAR MECHANISMS OF THE UPPER BODY (2)

Gross anatomy of the human upper extremity and cranial nerves. Upper extremity emphasis includes muscle action, innervation, and major spinal cord pathways. Olfactory, optic, auditory and vestibular functions of cranial nerves are stressed. One lecture and two laboratory periods per week. Prerequisites: Undergraduate course in human or vertebrate anatomy and permission of instructor. Lab/class fee will be assessed.

### BIOL 528 VIROLOGY (3)

Cell and molecular biology of viruses. General virology, including pathogenesis and mortality, interaction with the immune system, and some medically relevant viruses. Prerequisites: BIOL 315 / BIOL 515 or BIOL 318 / BIOL 518 or BIOL 408 / BIOL 409/ BIOL 602.

### BIOL 532 VASCULAR PLANT TAXONOMY (4)

A study of the history and principles of vascular plant systematics with laboratory time devoted to collection and identification of plants in the local flora. An average of 3 laboratory hours per week. Prerequisites: BIOL 205, BIOL 331/531, the equivalents or consent of instructor. Lab/Class fee will be assessed.

### BIOL 535 PLANT ECOLOGY (4)

Environmental factors and processes which control plant distribution, plant communities and vegetational biomes of North America. An average of 3 laboratory hours per week with two required three-day weekend field trips and a Saturday field trip emphasizing examples from Maryland and the mid-Atlantic states. Prerequisites: BIOL 205 or equivalent.

### BIOL 536 PLANT PHYSIOLOGY (3-4)

Life functions of plants as related to structure at all levels: cells, organs and the complete organism. Consideration of the interaction of environmental and genetic factors on plant metabolism. Prerequisite: BIOL 205 or BIOL 208 and CHEM 132 / BIOL 132L (CHEM 111), CHEM 330 recommended.

### BIOL 546 TROPICAL ECOLOGY AND CONSERVATION (3)

Evolution and ecology of tropical ecosystems. Mechanisms that maintain tropical diversity, species interactions, anthropogenic impacts, and conservation strategies.

### BIOL 547 TROPICAL FIELD ECOLOGY (4)

Field course set in the tropical rainforest. Includes exploration of different tropical ecosystems and training in techniques to carry out field research. Students will develop a research proposal and conduct their independent research projects including data collection, statistical analyses, write up, and an oral presentation of results. Permit required. Prerequisites: Permission of instructor.

**BIOL 552 WETLAND ECOLOGY (4)**

Wetland ecology and wetland management, with special focus on wetland of the Mid-Atlantic region. Emphasis is on biological, physical, chemical, and ecological aspects of wetlands. Course also deals with valuation, classification, delineation and management of wetlands for biotic resources and water management. Average of three laboratory hours per week. Two mandatory Saturday field trips. Lab/Class fee will be assessed.

**BIOL 553 INVERTEBRATE ZOOLOGY (4)**

Aquatic and terrestrial species of phyla from the Protozoa through the Echinodermata with special emphasis on local forms. Economic, ecological and taxonomic considerations. Average of 3 laboratory hours per week. Prerequisite: BIOL 207 or equivalent.

**BIOL 554 ANIMAL PARASITOLOGY (3)**

Major groups of animal parasites and their vectors. Emphasis will be placed on pathogenesis of medically relevant organisms. Lecture discussions will incorporate an examination of relevant primary literature. Prerequisite: BIOL 309 or permission of instructor.

**BIOL 555 FISH BIOLOGY (4)**

Introduction to the evolutionary history, functional biology, ecology and conservation of fishes. Laboratory experiences emphasize both identification of fishes and experiments designed to understand their functional biology. Independent research project and weekend field trips are required. Average of 3 hours of lecture and 3 hours of lab per week. Prerequisite: BIOL 207 and CHEM 132/132L (CHEM 111) or equivalents; BIOL 325 or equivalent recommended.

**BIOL 556 ORNITHOLOGY (4)**

Evolutionary history, morphology, physiology, behavior and ecology of birds. One daylong weekend field trip and several early-morning weekday field trips required. Prerequisite: BIOL 207 or equivalent.

**BIOL 558 MAMMALOLOGY (4)**

Evolution, comparative morphology, systematics, and distribution of mammals. Representative life histories are considered. Average of three laboratory hours per week.

**BIOL 560 HISTOLOGY (4)**

Tissues of the vertebrate body. Average of 2 laboratory hours per week. Prerequisite: BIOL 343 or equivalent. Lab/Class fee will be assessed.

**BIOL 561 ENTOMOLOGY (4)**

Laboratory and field course in insects. Identification and recognition of the more common families and orders and a study of their structure, behavior, ecology, economic importance and control. Average of 3 laboratory hours per week. Prerequisite: BIOL 207 or equivalent.

**BIOL 563 DEVELOPMENTAL BIOLOGY (4)**

Embryonic development of animals, including differentiation, morphogenesis, pattern formation, and organogenesis. Emphasis on cellular and molecular mechanisms governing these processes. Average of 2 recitation hours per week.

**BIOL 567 HERPETOLOGY (4)**

Systematic survey of the modern reptiles and amphibians. Emphasis is placed on the evolution of morphological and behavioral traits which have enabled the reptiles and amphibians to successfully exploit their individual habitats. Laboratory includes systematic classification, student seminars and field work. Average of 3 laboratory hours per week. Prerequisite: BIOL 207 or equivalent.

**BIOL 568 ENDOCRINOLOGY (3)**

Endocrine mechanisms regulating homeostasis and functional integrity of animals with emphasis on vertebrates. Prerequisite: BIOL 222 / BIOL 222L (BIOL 214) or equivalent.

**BIOL 570 ADVANCED PHYSIOLOGY (4)**

Physiological topics discussed at the molecular, cellular, organ, organ system and whole organism levels. Emphasis on integrating knowledge gained in prerequisite physiology courses and recent discoveries. Laboratory component will emphasize the scientific method, data interpretation and quantitative skills. Topics may include: osmoregulation, gas exchange, nutrient delivery and use, thermoregulation, locomotion and regulation via the neural and endocrine systems. Includes average of two recitation hours per week.

**BIOL 571 ANIMAL BEHAVIOR (4)**

Introduction to modern study of behavior including the development and control of behavior as well as the evolution and adaptive value of behavior. Two recitation hours per week.

**BIOL 581 DIRECTED READINGS IN BIOLOGY (1-3)**

Independent reading in an area selected by the student in consultation with the instructor.

**BIOL 582 ENVIRONMENTAL EDUCATION & SERVICE LEARNING IN THE TROPICS (3)**

Designed for those majoring in the sciences or education fields with an interest in environmental education. Coursework will take place largely in the tropics of Costa Rica. Emphasis will be placed on the application of forest ecology concepts to PreK-12 environmental education and human use and management of natural resources in the tropics. Prerequisite: Permission of instructor required.

**BIOL 584 SEMINAR IN ECOLOGY, EVOLUTION AND BEHAVIOR (1)**

Discussion and analysis of current research in ecology, conservation biology, environmental science, evolution and animal behavior. Prerequisites: 12 credit hours in Biology.

**BIOL 589 SPECIAL TOPICS IN BIOLOGY (3)**

Current topics in varying areas of biology. May be repeated provided a different topic is covered. Prerequisite: a suitable background in the area emphasized.

**BIOL 601 CURRENT TOPICS IN BIOLOGY (3)**

Current topics in a specific area of biology. The area will vary each time the course is offered. May be repeated provided a different topic is covered. Prerequisite: a suitable background in the area emphasized.

**BIOL 602 MOLECULAR BIOLOGY (3)**

Overview of the base principles of molecular biology including: macromolecules, nucleic acid/protein interactions, replication, transcription, translation, mutations, DNA repair mechanisms, gene regulation and tools and applications of recombinant DNA technology.

**BIOL 603 DATA ANALYSIS AND INTERPRETATION FOR BIOLOGISTS (3)**

Information, techniques, and skills useful in gathering, analyzing, and interpreting data in the Biological Sciences. Topics include introduction to the role of statistical analysis in the biological sciences, hypothesis testing, experimental design, and current controversies in use of statistics in the biological sciences. Graduate students only.

**BIOL 604 MECHANISMS IN ANIMAL PHYSIOLOGY (3)**

Functional design of animal organ systems and discussion of selected adaptations permitting survival in challenging environments. Prerequisite: Students must meet the requirements for admission to the master's degree program in Biology.

**BIOL 606 BIOCHEMICAL ADAPTATIONS (3)**

Characterization of adaptational challenges facing biochemical systems and how these systems have been modified through evolution to permit comparable structures and processes to be persistent in all organisms and in all environments. The underlying unity of biochemical design existing in the face of remarkable adaptive diversification is a theme. Prerequisites: BIOL 604 or upper-level advanced undergraduate course in physiology.

**BIOL 607 EVOLUTIONARY AND ECOLOGICAL PHYSIOLOGY (3)**

The study of how physiological characters evolve and contribute to organismal success and the nature of research in this field. Prerequisites: Previous evolution and/or physiology course highly recommended.

**BIOL 608 SYSTEMATIC BIOLOGY (3)**

Theory and procedures of modern systematics with emphasis on data gathering, use of morphological and/or molecular characters, analysis, and interpretation of results. A variety of approaches for analysis of systematic/phylogenetic data and methods for determining support of phylogenetic hypotheses will be explored. Prerequisites: open to graduate students and advanced undergraduates.

**BIOL 609 COMMUNITY ANALYSIS AND BIOASSESSMENT (3)**

Principles of design of environmental sampling studies, statistical analysis of data composed of multiple species, and environmental variables. Use of statistical software for data analysis projects. Emphasis on application of these methods in bioassessment of aquatic ecosystems, as well as community ecology and evolution. Prerequisite: BIOL 610 or ENV 604 or equivalent at the upper-undergraduate level.

**BIOL 610 POPULATION AND COMMUNITY BIOLOGY (3)**

Processes in biological populations, including population growth, competition and predation, analyzed by the use of conceptual-systems models and simple mathematical models. Prerequisite: BIOL 402 / BIOL 502, BIOL 413 / BIOL 513 or equivalents.

**BIOL 611 GLOBAL CHANGE BIOLOGY (3)**

An investigation of global change with an emphasis on biological responses. Interdisciplinary exploration includes climate change, other human activities contributing to global change, climate policy, and mitigation. Prerequisite: BIOL or ENV Master's program admission.

**BIOL 612 MOLECULAR ECOLOGY AND EVOLUTION (3)**

Use of molecular techniques in ecology and evolution. Application of DNA sequencing, PCR analysis and DNA fingerprinting to understanding genome evolution, the species concept, evolutionary basis of behavior, population structure and gene flow and efforts in species conservation. Reading and discussion of recent scientific literature. Prerequisites: BIOL 602 or permission of instructor.

**BIOL 614 APPLIED BIOTECHNOLOGY (3)**

Overview of basic recombinant DNA technology, gene expression and regulation; medical, agricultural and ecological examples of applied biotechnology; regulations, risks, benefits and bioethics of biotechnology. Prerequisites: BIOL 602 or permission of instructor.

**BIOL 615 PATHOGENIC MICROBIOLOGY (3)**

Pathogenic bacteria and viruses, including virulence of causative agents, epidemiology, pathogenesis, diagnosis, prevention and treatment of representative bacterial and viral diseases. Prerequisite: BIOL 421 / BIOL 521, BIOL 315 / BIOL 515 or BIOL 318 / BIOL 518 or equivalents.

**BIOL 616 MEMBRANE BIOLOGY (3)**

Structure, function and biogenesis of biological membranes. Emphasis on role of membrane in cellular homeostasis, energy transduction and interaction with the extracellular environment. Multidisciplinary perspective taken, drawing on information from molecular biology, cell biology and biophysics. Extensive use of current literature. Prerequisites: BIOL 602 or permission of instructor.

**BIOL 618 MOLECULAR MEDICINE (3)**

Molecular biology as it applies to medicine, including molecular genetic approaches to clone/detect disease genes, analysis of gene function based on human/microbial homologies, prenatal and neonatal diagnosis/screening, tracking infectious disease outbreaks, molecular therapies for disease and impact of human genome project. Ethical issues raised by application of molecular methodology also discussed. Prerequisites: BIOL 602 or permission of instructor.

**BIOL 619 ENVIRONMENTAL MICROBIOLOGY (3)**

Topics to be covered include: the historical importance of environmental microbiology, the different methods of molecular genetic analysis, microbially mediated biogeochemical cycles and their global importance, the adaptability of microorganisms to different environments, microbial functional metabolic plasticity facilitating xenobiotic compound degradation, and the use and importance of metagenomics in environmental microbiology.

**BIOL 620 THE EVOLUTION OF COOPERATIVE BEHAVIOR (3)**

The study of the evolution of cooperative behavior with a focus on cooperative behavior in complex animal societies. Prerequisite: previous evolution course is highly recommended.

**BIOL 621 CELL SIGNALING (3)**

Analysis of the signal transduction pathways used by cells to communicate with each other and with their outside environments. Special emphasis on cell signaling pathways involved in the regulation of immune responses. Prerequisites: BIOL 408/508 and BIOL 421/521 or equivalent are recommended.

**BIOL 622 GENE EXPRESSION AND REGULATION (3)**

Examining how changes from the DNA level to the protein level alter the resulting gene's final expression. Special emphasis on eukaryotic mRNA stability and translatability and on eukaryotic post-translational modifications. Prerequisites: BIOL 602 or permission of instructor.

**BIOL 650 MODERN MICROSCOPY AND MICROTÉCHNIQUES (3)**

Histology of the majority of tissues in the human body through theory and microscopic examinations. Preparation of specimens for microscopic examination. Use and relevance of various types of microscopy: dark-field, phase contrast, fluorescence, confocal, transmission electron, and scanning electron.

### **BIOL 651 ENVIRONMENTAL AND BIOLOGICAL SCIENCE IN INTEGRATED STEM EDUCATION (3)**

Students investigate place-based education, environmental literacy, and outdoor applications of biology education, and consider how teachers teach and students learn about life science and environmental concepts in the context of integrated STEM (Science, Technology, Engineering and Mathematics) education in grades PreK-12. Not for credit towards M.S. in Biology.

### **BIOL 654 LANDSCAPE ECOLOGY (3)**

Spatial and temporal landscape heterogeneity; how it arises, its quantification and its influence on population, community and ecosystem dynamics over multiple scales. Prerequisites: Upper level undergraduate course in ecology or permission of instructor.

### **BIOL 655 THE BIOLOGY OF CANCER (3)**

Overview of human cancer including risk factors, causes, types, epidemiology, the genetic basis of the disease, molecular and cellular alterations, diagnosis, treatment and current research. Extensive use of seminal and current literature. An upper level cellular or molecular biology course is recommended.

### **BIOL 701 NON-THESIS RESEARCH (1-3)**

Field or laboratory research in addition to and/or unrelated to any thesis research. May be repeated for a maximum of 6 units. Graded S/U. Prerequisites: student must submit research proposal prior to enrollment and obtain approval of program director.

### **BIOL 703 INDEPENDENT STUDY (1-3)**

Independent exploration of the concepts, research techniques and recent discoveries in a sub-discipline of the biological sciences in collaboration with a faculty mentor. Prerequisite: Student must submit study proposal prior to enrollment. Requires special permit from graduate program director. May be repeated for a maximum of 6 credits.

### **BIOL 796 PROFESSIONAL ASPECTS OF BIOLOGY (2)**

Information, techniques, and skills useful in completing a MS degree, gaining employment and functioning as a professional biologist, or gaining access to Ph.D programs. Topics include literature retrieval, the publication process, obtaining funds for research, presentations at national meetings, job hunting, and professional ethics.

### **BIOL 797 GRADUATE SEMINAR (1)**

Student reports and discussion dealing with biological research. An outline of the seminar and bibliography are required. A maximum of 1 credit is allowable for an M.S. degree in Biology.

### **BIOL 896 BIOLOGY THESIS (1-6)**

Thesis research. See program director for permission. May be repeated for a maximum of 6 units.

### **BIOL 899 THESIS CONTINUUM (1)**

Continuation of thesis research. Graded S/U based on making satisfactory progress on thesis.