

**BIO**

**Biology**

- BIO 101 WAYS OF DOING BIOLOGY. (1)**  
Through a series of lectures and discussions students will gain a better understanding of the various academic programs in the life sciences across campus. Information will also be provided about research opportunities and career possibilities. Pass/fail only. Enrollment limited to freshmen and sophomore science majors.
- BIO 102 HUMAN ECOLOGY. (3)**  
A study of the interrelationships of man, populations, space, energy, food, mineral resources and other life on earth. Not for life science majors.
- BIO 103 BASIC IDEAS OF BIOLOGY. (3)**  
Introductory biology. Discussion topics are those relevant to both plants and animals - cell structure and function, molecules important to living things, metabolism, heredity, environment. Not for life science majors.
- BIO 104 ANIMAL BIOLOGY. (3)**  
An introduction to the major areas of interest in animal biology, e.g., life processes, the cell, development, heredity, body systems, evolution, taxonomy, phylogeny, ecology. Prereq: High school chemistry recommended.
- BIO 106 PRINCIPLES OF PLANT BIOLOGY. (3)**  
The principles underlying the structure, physiology and reproduction of flowering plants. Prereq: High school chemistry recommended.
- BIO 110 INTRODUCTION TO HUMAN BIOLOGY AND HEALTH. (3)**  
This course provides the student with a general overview of the basic dimensions of health (such as physical, social and emotional) and the applications of these dimensions to personal wellness.
- BIO 111 GENERAL BIOLOGY LABORATORY. (1)**  
Laboratory studies in the structure and function of cells, plants, and animals; ecology; heredity; and evolution. Prereq or coreq: BIO 103 or consent of instructor.
- #BIO 148 INTRODUCTORY BIOLOGY I. (3)**  
BIO 148 introduces the student to the biological mechanisms operating at the molecular, cellular, and population level that contribute to the origin, maintenance, and evolution of biodiversity including the origins and history of the evolutionary process. Course material is presented within a phylogenetic context, emphasizing the shared history of all living organisms on earth through common ancestry. The first semester of an integrated one-year sequence (BIO 148 and BIO 152). Prereq: Math ACT of 23 or above or MA 109, past or concurrent enrollment in CHE 105.
- BIO 150 PRINCIPLES OF BIOLOGY I. (3)**  
The first semester of an integrated one-year sequence (BIO 150 and BIO 152) that is designed to develop an appreciation of biological principles necessary to explore life at the cellular and molecular levels. Similarities and differences in structure and function of simple and complex cells will be covered along with theories on the origin and evolution of biological systems. Prereq: CHE 105, or Math ACT score of 26 or above plus concurrent enrollment in CHE 105, or chemistry placement test passed plus concurrent enrollment in CHE 105.
- BIO 151 PRINCIPLES OF BIOLOGY LABORATORY I. (2)**  
An introductory laboratory in which biological systems are investigated at the cellular and molecular levels. Laboratory, four hours per week. Prereq: This course is a companion to the BIO 150 lecture course, but it need not be taken concurrently.
- BIO 152 PRINCIPLES OF BIOLOGY II. (3)**  
The second semester of an integrated one-year sequence (BIO 150 and 152) that is designed to develop understanding and appreciation for the diverse forms of plant and animal life, and their relationships to each other and to their environment. Structure and function relationships will be explored at many levels of organization: cell, tissue, organ, organism, population and community. Prereq: CHE 105, or Math ACT of 26 or above plus concurrent enrollment in CHE 105, or chemistry placement test passed plus concurrent enrollment in CHE 105.

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**BIO 153 PRINCIPLES OF BIOLOGY LABORATORY II. (2)**

An introductory laboratory course in which biological systems are investigated at the organismal, population and community levels. Laboratory, four hours per week. Prereq: CHE 105, or Math ACT of 26 or above plus concurrent enrollment in CHE 105, or chemistry placement test passed plus concurrent enrollment in CHE 105.

**#BIO 155 LABORATORY FOR INTRODUCTORY BIOLOGY I. (1)**

This course is designed to provide a broad introduction into the data, results, and information associated with biological research, and into some of the analytical approaches used to test biological hypotheses. Communication of these aspects of biological research is crucial, and much of this lab course will be focused on the development of effective writing skills for the delivery of this information. Prereq: Math ACT of 23 or above or MA 109, past or concurrent enrollment in CHE 105.

**BIO 190 SUPPLEMENTAL BIOLOGY WORKSHOP I. (1)**

Cooperative workshop offered only as an optional supplement to certain biology lecture courses. Offered only on a pass/fail basis. Coreq: BIO 150.

**BIO 192 SUPPLEMENTAL BIOLOGY WORKSHOP II. (1)**

Cooperative workshop offered only as an optional supplement to certain biology lecture courses. Offered only on a pass/fail basis. Coreq: BIO 152.

**BIO 199 RESEARCH EXPERIENCE IN BIOLOGY. (0-1)**

Participation in biological research under the direction of a faculty mentor in Biology or a related field. A research contract signed by the student and faculty mentor must be approved by the Director of Undergraduate Studies in Biology. Offered pass/fail only.

**BIO 208 PRINCIPLES OF MICROBIOLOGY. (3)**

The course introduces fundamental microbiological principles and techniques. Emphasis is placed on structural, functional, ecological and evolutionary relationships among microorganisms, principally viruses, rickettsiae bacteria, fungi and algae. Prereq: High school chemistry recommended.

**BIO 209 INTRODUCTORY MICROBIOLOGY LABORATORY. (2)**

Laboratory exercises in general microbiology. Laboratory, four hours per week. Prereq: One unit of chemistry or consent of instructor; BIO 208 or BIO 308 should be taken concurrently.

**BIO 210 THE LIFE PROCESSES OF PLANTS. (3)**

This course is intended to provide a basic understanding of the natural products and processes that shape the nature of modern plants, and govern their interactions with the environment and characteristics unique to plants, and develop a basic understanding of how these plant attributes relate to organismic function. Emphasis will be placed on exploring the nature of the major plant biomes of the Earth, their community dynamics, and how member plants compete for space and other resources. Development of optimal plant strategies for reproductive success, plant interaction with other living systems as well as abiotic factors and their defense from predation and attack will also be considered. (Same as PLS 210.)

**BIO 300 GENERAL ENTOMOLOGY. (3)**

Fundamentals of insect biology and relationships among insects, plants, and other organisms; identification of commonly encountered insects. Beneficial and detrimental effects of insects are discussed. Lecture, two hours; laboratory, two hours per week. Prereq: One course in introductory biology. (Same as ENT 300.)

**#BIO 303 INTRODUCTION TO EVOLUTION. (4)**

This course covers topics in evolution, concentrating on the Darwinian theories of evolution including descent with modification, natural selection, and sexual selection. Topics will include: patterns of evolution, the genetic source of variation, measuring evolution, adaptation, speciation, human evolution, "evodevo", and evolutionary medicine. Lecture: three hours; recitation, three hours. Prereq: BIO 148, BIO 152 and BIO 155 or equivalent.

**\*BIO 304 PRINCIPLES OF GENETICS. (4)**

A study of the physical and chemical aspects of the genetic material and their relationship to the expression and inheritance of the phenotype. Lecture, three hours; laboratory, three hours per week. Prereq: BIO 148, BIO 152, BIO 155, CHE 107, CHE 113.

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**BIO 308 GENERAL MICROBIOLOGY. (3)**

Fundamental concepts of microbiology. The nutrition, physiology, genetics, molecular biology of microorganisms, and their roles in nature and in infection and immunity will be studied. Prereq: BIO 150, 151, 152, and 153 (or equivalent courses); CHE 230; and BIO 315 or BIO 304.

**\*BIO 315 INTRODUCTION TO CELL BIOLOGY. (4)**

The structure and function of cells will be considered. Emphasis will be placed on the ultrastructure of cell organelles in plants and animals as a framework for understanding the compartmentalized nature of cell activity. Lecture, three hours; laboratory three hours/weekly. Prereq: BIO 303 and BIO 304. Coreq: CHE 230 or equivalent. Or consent of instructor.

**\*BIO 325 ECOLOGY. (4)**

This course introduces the scientific study of relationship between organisms and their environment. The course is structured around levels of organization – from physiological ecology to individuals, populations, communities, ecosystems, landscapes, regions, and the biosphere. Students will be expected to develop a solid knowledge base and understanding of key concepts and issues in contemporary ecology; to become familiar with how ecological understanding is attained by researchers; and to see how ecological knowledge and methods can be used to address important societal problems. Lecture, three hours per week; laboratory, an average of three hours per week. Prereq: BIO 150-153 or equivalent introductory biology sequence; and BIO 304 or equivalent genetics course; or consent of instructor.

**BIO 340 COMPARATIVE ANATOMY. (5)**

Comparative study of the anatomy of vertebrates with emphasis on evolutionary change, adaptive and functional significance of structural organization and basic concepts of the comparative approach. Laboratory studies on representative vertebrates involving dissections, models, and demonstrations. Lecture, three hours; laboratory, four hours per week. Prereq: BIO 150, 151, 152, 153 or BIO 104, 105 or equivalent course in animal biology.

**BIO 350 ANIMAL PHYSIOLOGY. (4)**

An introduction to the basic principles of animal physiology. An elementary discussion of the major vertebrate organ systems including nutrition, metabolism, respiration, circulation, excretion, muscle contraction, peripheral and central nervous system, and endocrine function emphasizing homeostasis. Lecture, three hours; laboratory, three hours. Prereq: BIO 150-153 or equivalent introductory biology sequence, BIO 315, CHE 105, CHE 107.

**BIO 351 PLANT KINGDOM. (3)**

An evolutionary survey of the morphology, taxonomy, life histories and biological relationships of all plant groups comprising the plant kingdom. Lecture, two hours; laboratory, two hours. Prereq: An introductory course in biology.

**BIO 355 BIOLOGY STUDY ABROAD (Subtitle required). (3)**

This course offers students an opportunity to study unique biological communities and to experience living in a foreign culture. Specific content and location varies. May be repeated a maximum of two times under different subtitles. Prereq: Will be set by instructor.

**BIO 361 ECOLOGY OF THE KENTUCKY FLORA AND VEGETATION. (3)**

An overview of the physiography, geology, soils, hydrology, climate (paleo and recent), vegetation (paleo and recent), floras (including floristic relationships), archaeobotany, and agriculture of Kentucky. Lecture, two hours; laboratory, two hours per week. Prereq: One year of introductory Biology or consent of instructor.

**BIO 375 BEHAVIORAL ECOLOGY AND SOCIOBIOLOGY. (3)**

This course will explore the selective forces influencing animal behavior, such as foraging, predator avoidance, mate choice, parental care, and social interaction. Specific phenomena to be explored include the evolution of optimal foraging and search images, extravagant male characteristics, female preferences, conflicts between the sexes, infanticide, parent-offspring conflict, dominance hierarchies, optimal group size, altruism, and eusociality. The study of these behaviors integrates ideas and approaches from ecology, genetics, physiology, and psychology. Students will be encouraged to read outside material, to think carefully, logically, and critically about ideas, and to ask questions and defend their views in class. Prereq: A year of introductory biology (BIO 150/152).

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**BIO 395 RESEARCH IN BIOLOGY. (1-3)**

An independent research project in an area of biology under the direction of a faculty mentor. The research may be conducted in the School of Biological Sciences or in other biological units on campus. A research contract signed by the student and the faculty research mentor must be approved by the Director of Undergraduate Studies in Biology. May be repeated to a maximum of 12 credits, but a maximum of only 6 credits may be used to satisfy the requirements of a BS or BA in Biology. Prereq: BIO 150, 151, 152, and 153. Completion of at least one of the Biology core courses (Cell Biology, Genetics, Physiology, Ecology) is strongly recommended.

**BIO 401G SPECIAL TOPICS IN BIOLOGY FOR ELEMENTARY, MIDDLE AND HIGH SCHOOL TEACHERS (Subtitle required). (1-4)**

Selected topics in biology of special interest to teachers such as biological research experiences related to pharmacological assays, collecting behavioral data, compilation and statistically analysis of data. When the course is offered, a specific title with specific credits, the number of hours in lecture-discussion and laboratory, will be given. Lecture/discussion, two-four hours; laboratory, zero-four hours. May be repeated to a maximum of 12 credits. Prereq: By consent of instructor only.

**BIO 410 LABORATORY IN GENETICS AND CELL BIOLOGY. (3)**

A laboratory course for students of genetics and cell biology to provide practical experience in contemporary experimental analysis. Prereq: BIO 315 and BIO 304, or equivalent (may be taken concurrently).

**BIO 420G TAXONOMY OF VASCULAR PLANTS. (4)**

A survey of the evolutionary relationships among the major of vascular plant groups, concentrating heavily on important families flowering plants. Issues in contemporary systematics, including cladistic methods, will be covered. Students will gain practical experience learning the language of descriptive botany and using botanical keys in technical manuals for species identification. Field trips highlight the local spring flora. Lecture, three hours; laboratory, three hours; plus two Saturday field trips. Prereq: Junior standing; BIO 150, 152 or one course in introductory botany, or consent of instructor. (Same as NRE 420G.)

**BIO 425 BIOLOGY SEMINAR: (Subtitle required). (1)**

This seminar develops effective analysis, presentation, and discussion skills required of Biology majors by exploring various life science topics of interest to faculty and students. Satisfies seminar requirements for Biology majors and can be repeated for a maximum of 2 credits under a different subtitle. Prereq: Senior standing in Biology recommended. BIO 150-153 or equivalent. Additional prereq(s) may be identified by instructor when topic is selected.

**\*BIO 430G PLANT PHYSIOLOGY. (4)**

Basic principles of plant physiology; the physiological processes of green plants and the effect of the environment on these processes. Lecture (three hours) and laboratory (three hours). Prereq: BIO 148, 152, 155 (or equivalent); CHE 230/231 (or equivalent); BIO 315 (or equivalent) or consent of instructor.

**BIO 452G LABORATORY IN ECOLOGY. (2)**

An introduction to laboratory and field experimentation and computer simulation in ecology. Exercises and demonstrations will be performed to familiarize students with (1) particular populations and ecosystems, (2) some important research problems in ecology, and (3) current research techniques for dealing with them. One or two Saturday field trips will be required. Laboratory, four hours. Prereq or coreq: BIO 325 or equivalent and consent of instructor.

**BIO 461 INTRODUCTION TO POPULATION GENETICS. (3)**

This survey course examines the population dynamics and equilibria of genes in nuclei, chloroplasts and mitochondria. Emphasis will be on biological relevance (in plants, animals, and micro-organisms), but some theoretical derivations will also be introduced. Prereq: ABT 360 (or equivalent) and one course in probability/statistics. (Same as ABT/ENT/FOR 461.)

**BIO 494G IMMUNOBIOLOGY. (3)**

A survey of theories and mechanisms of immunity including: nature of antigens and antibodies, antigen-antibody reactions, immunocompetent cells, immunogenetics, allergic reactions, tumor immunology and transplantation immunology. Prereq: BCH 401G (may be taken concurrently) and BIO 208 or BIO 308 or consent of instructor. (Same as MI 494G.)

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### **BIO 499 BIOLOGY RESEARCH SEMINAR.**

(1)

A seminar for students engaged in independent research. Students with BIO 395 experience will interact with student colleagues and an experienced research mentor. Prereq: Past or current enrollment in BIO 395.

### **BIO 502 PRINCIPLES OF SYSTEMS, CELLULAR AND MOLECULAR PHYSIOLOGY.**

(5)

Advanced survey of major mammalian physiological systems at the systems, cellular and molecular level; lectures, assigned reading, advanced texts or monographs, demonstrations and problem oriented study questions. Prereq: One year each, physics, general chemistry; PGY 206 or its equivalent. (Same as PGY 502.)

### **BIO 507 BIOLOGY OF SLEEP AND CIRCADIAN RHYTHMS.**

(3)

This course provides an introduction to the fields of sleep and circadian rhythms including the underlying neuroanatomy, neurophysiology, and the molecular and genetic underpinnings of sleep and circadian behaviors. The medical and societal relevance of these areas will also be emphasized. Considerable time will be spent reading and analyzing the primary literature in these fields, including student presentations of selected articles. Prereq: BIO 304; BIO 315; BIO 350 (or equivalent).

### **BIO 508 EVOLUTION.**

(3)

Mechanisms of evolutionary change, with a brief summary of historical evolution, especially of the Metazoa. Prereq: BIO 304 or ASC/ABT 360.

### **BIO 510 RECOMBINANT DNA TECHNIQUES LABORATORY.**

(4)

An introduction to the construction, isolation, and analysis of recombinant DNA clones, with emphasis on practical experience in basic techniques. Lecture, one hour; laboratory; six hours per week. Prereq: BIO 304 and BCH 401G, or BCH 501 or BCH 502 or equivalent.

### **BIO 515 GENERAL CELL BIOLOGY.**

(3)

An integrative, analytical study of the cell as the basic unit of biological structure and function, with emphasis on eukaryotes. Lecture, discussions with readings in some original literature. Prereq: BIO 315 or BCH 401G or equivalent and consent of instructor. (Same as MI 515.)

### **BIO 520 BIOINFORMATICS.**

(3)

An introduction to computer analysis of macromolecular structure information. This course describes how to access, process, and interpret structural information regarding biological macromolecules as a guide to experiments in biology. Prereq: BIO 315 or BIO 304 or BCH 401 or BCH 501 or BCH 502 or BIO 510 or consent of instructor. (Same as INF 520.)

### **BIO 529 DEVELOPMENTAL BIOLOGY.**

(3)

An introduction to the principles of developmental biology, particularly of animals, including genetic and environmental control of development at the molecular, cellular, and physiological levels. Prereq: BIO 304 and BIO 315, or graduate standing in life sciences, or consent of instructor.

### **BIO 530 BIOGEOGRAPHY AND CONSERVATION.**

(3)

An introduction to the geographic patterning of biological diversity, exploring its origins, dynamics, and present trends. Examines the interplay among physical conditions, ecological interactions, evolutionary processes, and the historical movements of organisms and land masses as they have combined to affect the distribution of species, with particular attention to the application of biogeographic knowledge to current problems of species loss and conservation. Prereq: Two semesters of introductory biology or physical geography, or consent of the instructor. (Same as GEO 530.)

### **BIO 535 COMPARATIVE NEUROBIOLOGY AND BEHAVIOR.**

(3)

The course consists of an introduction to neurophysiology and study of the neural basis of sensory processing and motor patterns. A comparative analysis of the neurobiological basis of behavioral responses will be made, utilizing a broad range of vertebrates and invertebrates. Prereq: BIO 350 or consent of instructor. (Same as PGY 535.)

### **BIO 542 HISTOLOGY.**

(5)

An in-depth study of vertebrate cell and tissue structure and function. Human tissue is emphasized. Some knowledge of biochemistry, physiology, and anatomy is desirable. The laboratory involves study of prepared microscope slides. Lecture, three hours; laboratory, four hours per week. Prereq: BIO 315 or consent of instructor.

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**BIO 550 COMPARATIVE PHYSIOLOGY. (3)**

Physiological mechanisms by which animals cope with different environmental stresses. Osmoregulation, respiration, temperature regulation and tolerance, sensory reception, circulation, etc. Prereq: One year college chemistry, BIO 350 or equivalent, one year college physics or consent of instructor.

**BIO 551 LIFE CYCLE ECOLOGY OF FLOWERING PLANTS. (4)**

The effect of physical and biotic factors on plants and environment. Physiological, morphological and anatomical adaptations of plants to the physical factors of the environment are emphasized. Some of the laboratory exercises are carried out in the field. Lecture, three hours; laboratory, two hours. Prereq: BIO 325 or consent of instructor.

**BIO 553 FISH BIOLOGY. (4)**

This course explores the biology of fishes from an evolutionary perspective. Lectures cover physiology, functional morphology, ecology, population biology, behavior, evolutionary relationships, and fisheries biology. Laboratory exercises include development of a fish collection; experiments in fish physiology, behavior and ecology; computer modeling of problems in fisheries biology; and field trips. Lecture, three hours; laboratory, two hours per week. Prereq: BIO 150, 151, 152 and 153 or consent of instructor.

**BIO 555 VERTEBRATE ZOOLOGY. (5)**

An intensive survey of the vertebrate classes with emphasis on trends and processes in evolution, classification, phylogeny, ecology, and adaptations in morphology and behavior. Lecture, three hours; laboratory, four hours per week. Prereq: BIO 150, 151, 152, 153 or consent of instructor.

**BIO 556 COMMUNICATION BIOLOGY. (3)**

Animals sense and respond to numerous signals from their environment by using sensory modalities attuned to visual, auditory, chemical, and electromagnetic cues. This course is an in-depth examination of the physiological bases of sensory input and the interactive, motor system-mediated, behavioral repertoires exhibited by different species in response to such inputs. Prereq: BIO 325 or BIO 350.

**BIO 559 ORNITHOLOGY. (4)**

A study of the life histories, habits, identification, structure, adaptations, and physiology of birds. Special emphasis upon migrations, songs, nests and economic importance of our native birds. Lecture, field excursions, laboratory studies. Prereq: BIO 104, 105 or BIO 150, 151, 152, 153 or consent of instructor.

**BIO 560 ENVIRONMENTAL PHYSIOLOGY AND TOXICOLOGY. (4)**

Emphasis will be placed on the physiological and toxicological effects of chemicals on natural biota, including considerations at cellular, organismal, population, and community levels. This will include assimilation and metabolism of pollutants by animal species, with emphasis upon biochemical and physiological mechanisms involved in stress-induced responses and stress reduction. Additional areas of concern will include the transport, fate, and effects of chemical stressors on structure and function of biotic communities and will include introductions to ecotoxicology and environmental regulatory strategies. Lecture, three hours; recitation, two hours per week. Prereq: BIO 350 or PGY 502 or equivalent or consent of instructor. (Same as TOX 560.)

**BIO 561 INSECTS AFFECTING HUMAN AND ANIMAL HEALTH. (3)**

Discussion of arthropod parasites and disease vectors. Topics include an overview of disease transmission and public health, epidemiology, vector biology, important arthropod groups and their control. Prereq: One year of biology. (Same as ENT 561.)

**BIO 563 PARASITOLOGY. (4)**

Protozoan, helminth and arthropod parasites of man and domestic animals, emphasis on etiology, epidemiology, methods of diagnosis, control measures, and life histories. Techniques for host examination and preparation of material for study. Prereq: BIO 150, 151, 152, 153 or consent of instructor. (Same as ENT 563.)

**BIO 564 INSECT TAXONOMY. (4)**

A study of insect taxonomy including the collection, preparation, and identification of adult insect specimens. Prereq: Consent of instructor. (Same as ENT 564.)

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**BIO 567 APPLICATIONS OF GENETICS.**

(4)

Course covers genetic concepts with an emphasis on interpretation and analysis of molecular and population genetic data using examples from the entomological literature. Prereq: ABT 360 or BIO 304 or equivalent and an introductory statistics course.

**BIO 568 INSECT BEHAVIOR.**

(3)

The principles of animal behavior will be stressed using insects as examples. Physiology, mechanisms, behavioral ecology and evolution of insect behavior will be covered. Prereq: One year of biology. (Same as ENT 568.)

**BIO 573 MYCOLOGY.**

(4)

A survey of the physiology, morphology, life histories, taxonomy and evolutionary relationships of the various groups comprising the fungi. Lecture, three hours; laboratory, two hours. Prereq: BIO 106, 107 or BIO 152, 153.

**BIO 575 PLANT ANATOMY AND MORPHOLOGY.**

(4)

A survey of the diverse structural features of plants and their functional and phylogenetic significance. Emphasis will be on the adaptive design of modern vascular plants as a response to natural and artificial selection. Lecture, three hours; laboratory, two hours per week. Prereq: Introductory biology sequence (six hours) or consent of instructor.

**BIO 582 VIROLOGY.**

(3)

Physical, chemical and biological properties of viruses. Modes of replication and control of gene product formation displayed by representative plant, animal, and bacterial viruses. Prereq: BIO 304 and biochemistry or equivalent strongly recommended, or consent of instructor.

**BIO 595 IMMUNOBIOLOGY.**

(2)

Laboratory in immunology and serology. Preparation, standardization, and uses of biological products; serology. Laboratory, four hours. Prereq: BIO/MI 494G or concurrently; or consent of instructor. (Same as MI 595.)

**BIO 601 SPECIAL TOPICS IN MOLECULAR AND CELLULAR GENETICS.**

(1)

Each semester five distinguished scientists visit the UK campus to deliver a series of three formal lectures each and participate in numerous informal contacts with graduate students. The emphasis is on the presentation of the most current advances (often unpublished) in selected topics in molecular and cellular genetics. May be repeated to a maximum of six credits. (Same as BCH/MI/PLS/PPA 601.)

**BIO 605 EMPIRICAL METHODS IN ECOLOGY AND EVOLUTION.**

(2)

This course provides students with hands-on experience in a diverse array of modern research methods used by ecologists and evolutionary biologists, including techniques used in: molecular genetics, chemical ecology, behavioral studies, motion analyses, using high-speed video, image analyses for morphometrics and color, and field techniques in both aquatic and terrestrial systems. Lecture, one hour; laboratory, three hours per week. Prereq: BIO 325 or FOR 340 or ENT 665, or consent of instructor. (Same as ENT/FOR 605.)

**BIO 606 CONCEPTUAL METHODS IN ECOLOGY AND EVOLUTION.**

(3)

This course provides students with hands-on experience in a diverse array of conceptual research techniques used by ecologists and evolutionary biologists. The focus will be on optimization methods used for predicting animal and plant behaviors and life histories, and on methods for assessing population trends and dynamics. Mathematical techniques used will include graphical analyses, matrix algebra, calculus, and computer simulations. The latter part of the course will consist of collaborative modeling projects, in which small groups of students will work with the instructor to address an important contemporary research problem and will report their results in a public talk and a project writeup. Prereq: One year of calculus and BIO 325 or FOR 340 or ENT 665, or consent of instructor. (Same as ENT/FOR 606.)

**BIO 607 ADVANCED EVOLUTION.**

(2)

This course covers advanced topics in evolution, concentrating on questions central to the understanding of general evolutionary processes. Phenomena occurring both within populations (e.g., selection, inheritance, population subdivision) and between populations (e.g., gene flow, competition) will be addressed. Special attention will be given to modern research approaches and techniques including quantitative genetics, measurement of selection, phylogenetic analyses of comparative data and molecular systematics. Prereq: One year of calculus, genetics (BIO 304 or BIO 461) and BIO 508 or consent of instructor. (Same as ENT/FOR 607.)

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**BIO 608 BEHAVIORAL ECOLOGY AND LIFE HISTORIES. (2)**

This course uses an evolutionary approach to examine behavior and life histories. Topics addressed include: the optimality approach, constraints on optimality, kin and group selection, predator and prey behaviors, social and mating behaviors, and life history evolution. Prereq: BIO 325 and one semester of calculus; or consent of instructor. (Same as ENT/FOR 608.)

**BIO 609 POPULATION AND COMMUNITY ECOLOGY. (3)**

This course discusses the processes that determine population distributions and dynamics and community structure for both plants and animals. Topics addressed include: population regulation and population stability, community diversity and stability, ecological succession, population interactions (competition, predation, mutualism), coevolution, and the effects of spatial and temporal heterogeneity on population and community patterns. Prereq: BIO 325 or FOR 340 or consent of instructor. (Same as ENT/FOR 609.)

**BIO 611 BIOPATHOLOGY. (3)**

The course will examine the mechanisms by which various biological, chemical and physical agents injure susceptible hosts and the complex biochemical and immunological reactions which occur in response to injury. The host defense mechanisms will be illustrated by an analysis of selected human diseases and animal model systems with particular emphasis on the events at the molecular and cellular level. Prereq: BCH 502 or concurrent, BIO/MI 494G or equivalent and consent of instructor. (Same as MI 611.)

**BIO 612 BIOLOGY OF AGING. (3)**

A multidisciplinary discussion of how the process of aging affects biological systems. Coverage will be quite broad and includes topics such as subcellular and cellular aging, genetics, immunology, anatomy and physiology, animal model of aging, etc. Prereq: Enrollment in the doctoral program in Gerontology or a biomedical science department or consent of instructor. (Same as ANA/GRN/PGY 612.)

**BIO 615 MOLECULAR BIOLOGY. (3)**

An integrative and functional approach to the regulatory aspects of DNA, RNA and proteins in prokaryotic and eukaryotic cells. Lectures and discussions with readings in original literature. Prereq: A course in genetics (e.g. BIO 304) and a course in nucleic acids and elementary molecular biology (e.g. BCH 502) or consent of instructor. (Same as BCH/MI 615.)

**BIO 618 MOLECULAR NEUROBIOLOGY. (4)**

This course provides knowledge base and analytical skills in the field of molecular neurobiology. An in-depth introduction to current technologies, their rationale and limitations, will be the focus to address normal brain function and neuropathological conditions. Prereq: BCH 501, 502, NEU 605, or consent of instructor. (Same as ANA/MI/PGY 618.)

**BIO 619 CYTOGENETICS. (4)**

Classical, biochemical and molecular studies of the structure and function of eukaryotic chromosomes. Emphasis is placed on the effects of variation in chromosome type, structure and number on Mendelian genetics and in plant and animal breeding. Lecture, three hours; laboratory, two hours. Prereq: ABT/ASC/ENT 360 or BIO 304. (Same as PLS 619.)

**BIO 620 PLANT MOLECULAR BIOLOGY. (3)**

This course is intended to be a treatment of current concepts of plant molecular biology. It will be a literature-based course, supplemented by handouts and reading lists. The course will deal as much as is possible with topics that are unique to plants. Current aspects of molecular biology that are relevant to the course content will be covered in the first part of the course; however, these lectures will not be a review of topics that should have been retained from introductory genetics and biochemistry courses. Also, they will not be a substitute for a molecular biology course. Prereq: One semester of undergraduate genetics and biochemistry or consent of instructor. (Same as PLS 620.)

**BIO 621 TOPICS IN MODERN BIOLOGY (Subtitle required). (1-3)**

A course for students in the biological and related sciences to be taught on various topics by specialists in their fields. Designed to give the student the most up-to-date information on the various topics. May be repeated to a maximum of nine credits under different subtitles. Prereq: Consent of instructor.

**BIO 622 PHYSIOLOGY OF PLANTS I. (3)**

A physiological/biochemical treatment of central topics in modern plant physiology. Topics will include: plant-cell biology, ion transport, water and translocation, respiration and photosynthesis. Prereq: BIO 430G or equivalent or consent of coordinator. Prereq or concur: BCH 607. (Same as FOR/PLS 622.)

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**BIO 623 PHYSIOLOGY OF PLANTS II. (3)**

A physiological/biochemical treatment of central topics in modern plant physiology. Topics will include: plant hormones, an introduction to plant biotechnology, senescence and abscission, stress physiology, phytochrome-photomorphogenesis-phototropism nitrogen and sulfur metabolism. Prereq: BIO 430G or equivalent or consent of coordinator. Prereq or concur: BCH 607. (Same as FOR/PLS 623.)

**BIO 625 INSECT-PLANT RELATIONSHIPS. (3)**

This course examines the natural history, ecology, and evolution of insect/plant relationships. Topics include mechanisms and theory of plant defense, behavioral and physiological adaptations of herbivorous insects, pollination biology, multitrophic-level interactions, causes of insect outbreaks, and applications to managed ecosystems. Critical reading and discussion of current literature is emphasized. Prereq: Two years of college-level biology. (Same as ENT 625.)

**BIO 632 ADVANCED CELL BIOLOGY I. (3)**

A molecular level treatment of cell structure and function derived from current experimental approaches. Eukaryotes will be stressed. Topics will usually include membrane structure and function, the cytoskeleton and the extracellular matrix, and bioenergetics. Lectures and discussions with reading in the original literature. Prereq: BIO 304 or equivalent; coreq: BCH 501 or equivalent or consent of instructor.

**BIO 633 ADVANCED CELL BIOLOGY II. (3)**

This course is a companion to BIO 632. Topics will usually include a molecular level discussion of gene structure, gene expression, and gene regulation, followed by the cell and molecular biology of cell proliferation, development, and differentiation. Lectures and discussions with reading in the original literature. Prereq: BIO 304 or equivalent, BCH 501 or equivalent or consent of instructor.

**BIO 635 INSECT PHYSIOLOGY. (4)**

Study of insect physiological processes including development, digestion, reproduction, respiration, excretion, hormones and immunity. Opportunity to learn techniques used in insect physiology and molecular biology. Prereq: Consent of instructor. (Same as ENT 635.)

**BIO 636 INSECT MOLECULAR BIOLOGY. (4)**

Principles of insect molecular biology. Analysis of insect development, reproduction, behavior, immunity, transgenic insects and insecticide resistance at the molecular level. Hands-on experience with molecular biology techniques. Prereq: ENT/BIO 635 or consent of instructor. (Same as ENT 636.)

**BIO 638 DEVELOPMENTAL NEUROBIOLOGY. (3)**

An explanation of the processes which contribute to the development of the nervous system. Neurophysiological, cell biological and molecular approaches to cell differentiation, neuronal pathfinding and synapse formation and stabilization will be explored and discussed. Examples will be drawn from both vertebrate and invertebrate preparations. Prereq: BIO 535 or consent of instructor. (Same as ANA/PGY/PSY 638.)

**BIO 650 ANIMAL PHYSIOLOGY LABORATORY. (2)**

Hands-on laboratory exercises in animal physiology. Prereq: Previous or concurrent enrollment in BIO 550. (Same as PGY 650.)

**BIO 665 INSECT ECOLOGY. (3)**

The biotic and physical factors influencing the distribution and abundance of insects and insect populations. Prereq: Consent of instructor. (Same as ENT 665.)

**BIO 667 INVASIVE SPECIES BIOLOGY. (3)**

This course will examine circumstances that allow introduced species to become invasive, how invasive species threaten our resources, and approaches to minimizing the incidence and impact of invasions. Prereq: Graduate standing or consent of instructor. (Same as ENT/FOR 667.)

**BIO 684 PHYLOGENETIC SYSTEMATICS. (3)**

Theory and methods of phylogenetic analysis and cladistics will be explained. Applications of phylogenetic analysis, such as historical biogeography, biological classification, and testing of ecological hypotheses will be explored. (Same as ENT 684.)

BIO

Biology

- BIO 685 ADVANCED IMMUNOBIOLOGY. (3)**  
An introductory level graduate course surveying current trends in immunology including the organization and structure of cells relevant to immunity, immunochemistry, types of immune responses, cellular immunology, immunogenetics and immunopathology. Prereq: BCH 401G, or BCH 501 or 502 or equivalent or consent of instructor. (Same as MI 685.)
- BIO 720 MICROBIAL STRUCTURE AND FUNCTION. (3)**  
Molecular basis of structure and function in unicellular microbes. Molecular genetic and structural approaches to the analysis of bacterial architecture growth, division, and differentiation. Prereq: (to reflect appropriate IBS course). (Same as MI 720 and OBI 720.)
- BIO 740 MAMMALIAN RADIATION BIOLOGY. (2)**  
The physical and biological sequelae of radiation effects will be discussed emphasizing human and mammalian responses and radiation health. Emphasis will be for health and medical workers. Prereq: Must have consent of instructor, BIO/RM 540 or RM 546 or equivalent background. (Same as RM 740.)
- BIO 748 MASTER'S THESIS RESEARCH. (0)**  
Half-time to full-time work on thesis. May be repeated to a maximum of six semesters. Prereq: All course work toward the degree must be completed.
- BIO 749 DISSERTATION RESEARCH. (0)**  
Half-time to full-time work on dissertation. May be repeated to a maximum of six semesters. Prereq: Registration for two full-time semesters of 769 residence credit following the successful completion of the qualifying exams.
- BIO 767 DISSERTATION RESIDENCY CREDIT. (2)**  
Residency credit for dissertation research after the qualifying examination. Students may register for this course in the semester of the qualifying examination. A minimum of two semesters are required as well as continuous enrollment (Fall and Spring) until the dissertation is completed and defended.
- BIO 768 RESIDENCE CREDIT FOR MASTER'S DEGREE. (1-6)**  
May be repeated to a maximum of 12 hours.
- BIO 769 RESIDENCE CREDIT FOR DOCTOR'S DEGREE. (0-12)**  
May be repeated indefinitely.
- BIO 770 SEMINAR IN BIOLOGY. (1)**  
Reports and discussions of current research and literature in biology. Required of all graduate students. May be repeated to a maximum of 8 credits. Prereq: Graduate standing in biological sciences.
- BIO 772 SEMINAR IN MICROBIOLOGY. (0-1)**  
Review of current literature in microbiology; presentation of papers on work in progress in the department or on assigned topics; reports on meetings of national and international scientific and professional societies and symposia. Required of all graduate students. Two hours per week. May be repeated nine times for a maximum of 10 credits. (Same as MI 772.)
- BIO 773 SEMINAR IN PLANT PHYSIOLOGY. (1)**  
Reports and discussions on various topics in plant physiology. May be repeated for a maximum of eight credits.
- BIO 782 ADVANCED VIROLOGY. (3)**  
Current trends in virology. Typical topics include DNA tumor viruses, RNA tumor viruses, persistent virus infections, and interference. Emphases of molecular mechanisms. Prereq: BIO 582. Adequate biochemistry and genetics strongly recommended, or consent of instructor. (Same as VS 782.)
- BIO 795 RESEARCH IN BIOLOGY. (1-9)**  
Independent research work in biology. May be repeated to a maximum of 24 credits. Prereq: Graduate standing in biological sciences.
- BIO 798 RESEARCH IN MICROBIOLOGY. (1-9)**  
May be repeated to a maximum of 24 credits. Prereq: Consent of instructor. (Same as MI 798.)