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 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 24 or above or MA 109, and past or concurrent enrollment in CHE 105.

BIO 152 PRINCIPLES OF BIOLOGY II. (3)
The second semester of an integrated one-year sequence (BIO 148 and 152) that is designed to develop understanding and appreciation for the biocomplexity of multicellular eukaryotes, with emphasis on animals and terrestrial plants. Structure and function relationships will be explored at many levels of organization. Prereq: C or better in BIO 148 or permission of Department.

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 180 SPECIAL TOPICS IN BIOLOGY (INTRODUCTORY LEVEL): (Subtitle required). (1-4)
Interdisciplinary, topical or experimental course in introductory biology. Subtitle required. May be repeated for a maximum of 12 credit hours under different subtitles. Lecture and/or laboratory and/or recitation and/or seminar. Prereq: Determined by instructor.

***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 148.

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 198 SCHOLARS BIOLOGY RESEARCH. (2)
Biology 198 is one of the Scholars courses for biology majors in the Department of Biology Scholars Program. This course is designed to provide a solid introduction to 21st century bioscience research. Students will learn how to critically read, interpret, understand and discuss original literature. Students will learn how to discuss data and information from the original literature appropriately, develop reasonable hypotheses from current 21st century bioscience problems and provide plausible conclusions and presentations in regard to those problems using original information and data. Lastly, the course is designed to equip students with the necessary skills to participate and succeed in an upper level research experience. The course substitutes for BIO 155 for BIOLOGY majors. Prereq: ACT 30 or Reading/Math SAT of 1320 or Reading/Math/Writing SAT of 1980, and declared biology major, and a min High School GPA of 3.5.

BIO Biology

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 the interactions between humans and microorganisms, especially bacteria and viruses, the use of antimicrobial agents, microbial antibiotic resistance, and the structural, functional, and evolutionary relationships among microorganisms. 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 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 302 INTRODUCTION TO NEUROSCIENCE. (3)
This introductory course is designed to provide students with a basic understanding, at the physiological, cellular and molecular levels, of how the nervous system functions to create behavior. It will also introduce students to the consequences of abnormal system functioning brought about by either disease or injury. Prereq: BIO 152 or equivalent or permission of instructor.

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, "evo-devo", and evolutionary medicine. Taught on campus (lecture: three hours; recitation, three hours) or online. 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.

BIO 305 INTRODUCTION TO NEUROSCIENCE TECHNIQUES. (4)
This introductory laboratory course will provide students with practical knowledge and hands-on experience in basic behavioral, anatomical and physiological techniques used by laboratory scientists in the investigation of the nervous system. It is designed as a gateway to independent research experiences in working neuroscience laboratories. Prereq: BIO 302 Introduction to Neuroscience or equivalent.

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 304 or ABT 360 or ENT 360 and CHE 230 or CHE 236.

BIO 309 MICROBIOLOGY LABORATORY. (2)
This course includes laboratory exercises that are designed to illustrate processes central to microbiology and to familiarize students with basic skills required for working with microorganisms in a safe environment. Students will become familiar with isolating, culturing, and identifying microorganisms, and with molecular techniques used to study and manipulate microbes. Prereq: BIO 304 or ABT 360 or ENT 360 and CHE 230 or CHE 236 or consent of instructor.

BIO 310 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. Students will develop a basic understanding of how these plant attributes relate to oganismic 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. Prereq: BIO 152.

BIO Biology

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 148 and BIO 152, or equivalent introductory biology sequence; and BIO 304 or equivalent genetics course; or consent of instructor.

BIO 337 MATHEMATICAL MODELING IN THE LIFE SCIENCES. (3)
This course introduces mathematical modeling in biology and other life science disciplines using discrete and continuous tools and techniques, including difference equations and differential equations. Students will learn to construct, analyze, and simulate models and interpret the results within their biological context. Prereq: A grade of B or better in MA 114 (Calculus II) or MA 138 (Calculus II with Life Science Applications) or consent of department. (Same as MA 337.)

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 148, BIO 152, BIO 155 or BIO 198,CHE 105 (or CHE 109 and CHE 110) and CHE 107 or consent of instructor. This course is a Graduation Composition and Communication Requirement (GCCR) course in certain programs, and hence is not likely to be eligible for automatic transfer credit to UK.

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 floralistic 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 148/152).

BIO 380 SPECIAL TOPICS IN BIOLOGY (INTERMEDIATE LEVEL) (Subtitle required). (1-4)
Interdisciplinary, topical or experimental course in intermediate (300-level) biology. Subtitle required. May be repeated for a maximum of 12 credit hours under different subtitles. Lecture and/or laboratory and/or recitation and/or seminar. Prereq: Determined by instructor.

BIO Biology

BIO 394 RESEARCH IN NEUROSCIENCE. (1-3)
An independent research project in an area of neuroscience under the direction of a faculty mentor. A research contract signed by the student and the faculty research mentor must be approved by the Director of Undergraduate Studies (Neuroscience). May be repeated to a maximum of 12 credits, but a maximum of only 6 credits may be used to satisfy the requirements of the minor or major in Neuroscience. Prereq: BIO 152 and BIO 302 or PSY 312.

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 Department of Biology 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 the satisfy the requirements of a BS or BA in Biology. Prereq: BIO 148, BIO 152 and BIO 155 or equivalent. Completion of at least one of the Biology core courses (Cell Biology, Evolution, Genetics, Physiology, Ecology) is strongly recommended.

BIO 397 RESEARCH IN MICROBIOLOGY. (1-3)
An independent research project in an area of microbiology under the direction of a faculty mentor. The research may be conducted in the Department of Biology or in other microbiological 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 Microbiology. Prereq: BIO 308 and BIO 309.

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 404 ADVANCED GENETICS. (3)
This course in contemporary genetic analysis emphasizes experimental approaches to biological questions in a variety of eukaryotic organisms. The course includes discussion of the application of methodologies spanning a wide range of genetics, including classical, molecular, quantitative and genome-wide approaches. Primary scientific literature is investigated to understand the development and application of these methods. The course is intended to provide a good working understanding of current genetic techniques, how to select appropriate approaches to modern biological problems, and how to interpret results of genetic analyses. Prereq: BIO 304 (Introductory Genetics) or equivalent or consent of the instructor is required. BIO 315 (Cell Biology) or equivalent is recommended, but not required.

BIO 405 HUMAN GENETICS. (3)
This course will survey selected topics relevant to the understanding of the diversity and complexity of human genetics and genetic diseases, and will explore some of the contemporary methodologies used to identify genes underlying human genetic diseases. This course will also cover modern methods for genome analysis since the human genome sequence forms the foundation of current human genetics in research and medicine. Prereq: Grade of C or better in BIO 304 or permission of instructor.

#BIO 410 VERTEBRATE ENDOCRINOLOGY. (3)
This course is designed to provide students with a broad understanding of vertebrate endocrinology. Course topics will include the various classes of hormones, sources and synthesis of hormones, receptors and target tissues, mechanisms of action and regulation, and methods used in endocrinology and behavioral endocrinology. Details of classical endocrine systems will be explored. The last third of the course will focus on neuroendocrinology and how hormones influence the development and activation of behavior in humans and animal models. Prereq: BIO 302 or BIO 315 or BIO 350.

#BIO 418 ECOLOGICAL GENETICS. (3)
Ecological genetics resides at the interface of ecology, evolution, and genetics. At the heart of ecological genetics lie two components of adaptive evolution: genetic variation in phenotypic traits and natural selection on phenotypes. In this course, students will explore basic concepts in population and quantitative genetics and apply these to the analysis of genetic and phenotypic data. This course provides a conceptual link between courses focused on genetics and molecular biology and courses focused on whole organisms and their ecology. Prereq: BIO 303 and BIO 304 or equivalent, or consent of the instructor.

BIO Biology

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 148 and BIO 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 148 and BIO 152, or equivalent. Additional prereq(s) may be identified by instructor when topic is selected. This course is a Graduation Composition and Communication Requirement (GCCR) course in certain programs, and hence is not likely to be eligible for automatic transfer credit to UK.

BIO 426 NEUROSCIENCE SEMINAR (Subtitle required). (1)
This seminar course develops effective analysis, presentation and discussion skills required of science majors by exploring one neuroscience topic in detail. Prereq: Determined by instructor.

BIO 427 SEMINAR IN MICROBIOLOGY (Subtitle required). (1)
This seminar course develops effective analysis, presentation, writing and discussion skills required of life science majors by exploring various microbiological topics. Prereq: Senior standing recommended. BIO 308 and BIO 309 or equivalent. Additional prereq(s) may be identified by instructor when topic is selected.

***BIO 429 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 or equivalent, or consent of instructor.

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, BIO 152, BIO 155 or BIO 198 (or equivalent); CHE 230 and CHE 231 (or equivalent) or consent of instructor.

BIO 440 COMPARATIVE AND FUNCTIONAL ANATOMY. (4)
Comparative and Functional Neuroanatomy explores the cellular bases for sensory, integrative and motor neuroscience from an evolutionary perspective, delineating common features of all nervous systems ranging from cnidarian nerve nets to ventral nerve cords of most invertebrates to the chordate/vertebrate central nervous systems. Discovery of the common features of nervous structure in model system organisms with the human brain will provide students a perspective on the value of model systems for future study. Functional analyses of nervous system structures will enable students to identify anatomical bases for neural function and behavior. Prereq: BIO 302 or consent of instructor.

#BIO 445 THE BIOLOGY OF SEX. (3)
What is sex? Who has sex? What is sex for? This course is about the biological aspects of sex and gender, two of the most powerful forces in nature. We will explore the early evolution of sexual exchange of DNA and the emergence of genders. We will also discover the mechanisms by which gender is assigned across a vast array of different organisms and the amazing variability of sexual activity, ranging from duplicitous orchids to the rapacious passions of giant squid. Ultimately, we will explore the biological aspects of human sexuality in the context of its evolutionary origins and compare them to our closest relatives, the great apes. Readings in journal articles and a book will be complemented by short videos and discussions. Prereq: BIO 148 and BIO 152 or equivalent, or consent of instructor.

BIO Biology

BIO 446 NEUROPHYSIOLOGY LABORATORY. (3)
This course will focus on experimentation in neurophysiology. The generation of receptor potentials in sensory neurons will be measured in addition to action potentials in axons. Pharmacological experimentation of ionotropic and metabotropic receptors subtypes and second messengers signaling will be conducted. The key role of ion channels and transporters in regulation of the membrane potential will be examined. The concept of electrochemical equilibrium will be introduced and the quantitative examination of the equilibrium membrane potential will include discussion of Goldman and Nernst equations and their applications. The mechanisms of action potential generation, as a result of synaptic and receptor stimulation within a neural cell, will be measured. Lecture and laboratory. Prereq: BIO 302 or BIO 350 or consent of instructor.

BIO 447 ANIMAL SENSES. (3)
Advanced study on how animals use sensory abilities to communicate, navigate, and detect prey, predators and mates. Focus will be on extreme and unusual sensory systems such as echolocation, electroreception, and magnetoreception, as well as vision, smell, touch, and hearing. Prereq: BIO 350 or PGY 412G or permission 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.)

BIO 495G BACTERIAL PATHOGENESIS. (3)
This course will examine the pathogenic mechanisms used by bacteria to cause human disease. Bacterial virulence factors and host susceptibility factors will be discussed, with an emphasis on understanding the techniques that can be used to identify these traits in newly emerging pathogens. Prereq: BIO 308, BIO 315, BCH 401 recommended. Or permission of instructor. (Same as MI 495G.)

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 SYSTEMS, CELLULAR AND MOLECULAR PHYSIOLOGY. (5)
PGY/BIO 502 is a team-taught, lecture-based course that provides an integrated in-depth understanding of the physiology and pathophysiology of the human cardiovascular, digestive, endocrine, neural, renal and respiratory organ systems. Lectures are supplemented with assigned readings, hands-on demonstrations, and problem-oriented study sessions. Prereq: An introductory physiology course (for example PGY 206), and an understanding of fundamental undergraduate-level chemical and physical concepts is recommended but not required. (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 or BIO 302 or consent of instructor.

BIO Biology

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 509 BRAINS AND BUDS: NEUROSCIENCE OF POLLINATION. (3)
Pollinators have tremendous agricultural and societal value, and to a neuroscientist, they showcase principles of cognition in the real world. Pollinator species present exquisite examples of co-evolution, physiological and dietary specialization, navigation in complex landscapes, collective decision-making processes, and the behavioral consequences of environmental toxins and disease. In this course, we will use pollinator species (honey bees and other insects, as well as vertebrate pollinators) to explore how critical features of pollination intersect at the level of brain function, covering important neuroscience topics including sensory ecology and evolution, neural energetics, mechanisms of addiction and reward, molecular neuroscience, cognition, and learning and memory. Prereq: Students must have at least Junior standing in a life sciences discipline, or permission from instructor. (Same as ENT 509.)

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. Graduate students will be given first preference in course enrollment. Lecture, one hour; laboratory, 6 hours per week. Prereq: BIO 304 and BIO 315 or equivalent with consent of instructor.

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 525 ADVANCED ECOLOGY. (3)
BIO 525 is intended to bring students with a baseline knowledge of ecology to a deeper understanding of and experience with the way that ecological studies are conceived, conducted, analyzed and interpreted. BIO 525 is a series of modules that introduce students to the field site and most basic methods and then to a set of research systems for which the group is challenged to come up with the study design, analysis, and interpretation. These modules will address important issues in contemporary ecology and will build on what students learned in previous undergraduate ecology courses. Prereq: BIO 325 (Ecology) or equivalent.

BIO 527 STEM CELLS, TISSUE ENGINEERING, AND REGENERATIVE MEDICINE. (3)
The course will provide students with knowledge from a broad range of topics related to stem cells, tissue engineering and regenerative medicine, including: an historical perspective of these fields, contemporary use of stem cells in medicine, introduction to different concepts in regenerative medicine, research in tissue engineering and biomaterials, and societal issues surrounding stem cells and regenerative medicine. Prereq: BIO 315 and BIO 304.

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 Biology

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.

BIO 550 ADVANCED 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 148, BIO 152, BIO 155 or BIO 198 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 148, BIO 152, BIO 155 or BIO 198, 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 148, BIO 152, BIO 155 or BIO 198, 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.

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: 3 credits of basic biology (BIO 103 or BIO 148 or equivalent) or permission of instructor. (Same as CPH/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 148, BIO 152, BIO 155 or BIO 198, or consent of instructor. (Same as ENT 563.)

BIO Biology

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.)

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 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 580 SPECIAL TOPICS IN BIOLOGY (ADVANCED LEVEL): (Subtitle required). (1-4)
Interdisciplinary, topical or experimental course in advanced (500-level) biology. Subtitle required. May be repeated for a maximum of 12 credit hours under different subtitles. Course format: variable – Lecture and/or laboratory and/or recitation and/or seminar. Prereq: Determined by 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. (Same as MI 582.)

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 604 GENETIC ANALYSIS. (3)
This course in contemporary genetic analysis emphasizes experimental approaches to biological questions in a variety of eukaryotic organisms. The course includes discussion of the application of methodologies spanning a wide range of genetics, including classical, molecular, quantitative and genome-wide approaches. Primary scientific literature is investigated to understand the development and application of these methods. The course is intended to provide a good working understanding of current genetic techniques, how to select appropriate approaches to modern biological problems, and how to interpret results of genetic analyses. Prereq: BIO 304 (Introductory Genetics) or equivalent or consent of the instructor is required. BIO 315 (Cell Biology) or equivalent is recommended, but not required.

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 Biology

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.)

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 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)
This course will develop the student's ability to critically read and evaluate the primary literature in selected areas of molecular biology; various experimental systems and techniques are discussed. While there is some lecture, the time will be predominately spent in class discussions of the primary literature. Prereq: An advanced course in molecular biology and genetics (e.g. IBS 602) or consent of instructor. (Same as BCH/MI 615.)

#BIO 618 ECOLOGICAL GENETICS. (3)
Ecological genetics resides at the interface of ecology, evolution, and genetics. At the heart of ecological genetics lie two components of adaptive evolution: genetic variation in phenotypic traits and natural selection on phenotypes. In this course, students will explore advanced concepts in population and quantitative genetics and apply these to the analysis of genetic and phenotypic data. This course provides an in-depth conceptual link between courses focused on genetics and molecular biology and courses focused on whole organisms and their ecology. Prereq: Graduate standing in a life sciences program, or consent of instructor.

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.)

BIO Biology

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 629 DEVELOPMENTAL BIOLOGY. (3)
An examination of 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 or equivalent introductory genetics course and graduate standing, or consent of instructor.

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 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. (3)
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 IMMUNOBIOLOGY, INFECTION AND INFLAMMATION. (3)
An introductory level graduate course surveying current trends in immunology including the organization of the immune system, cells important for immunity and inflammation; types of immune responses, cellular immunology, molecular immunology, self-nonself discrimination, vaccines and immune mediated diseases. Prereq: BCH 401G, or BCH 501 or 502, IBS 501 or equivalent or consent of the course director. (Same as MI 685.)

BIO 707 CONTEMPORARY TOPICS IN IMMUNOLOGY. (3)
This course will deal with controversial and evolving areas of immunology. Lectures in a given topic will be accompanied by student discussion of contemporary literature. Prereq: MI 685 or equivalent or consent of instructor. (Same as MI 707.)

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 Biology

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.)