BIOL - Biology

Courses numbered 500 to 799 = *undergraduate/graduate*. (Individual courses may be limited to undergraduate students only.) Courses numbered 800 to 999 = *graduate*.

BIOL 502. Vascular Plants (4).
Introduces the structure, reproduction and evolution of the major groups of living and extinct vascular plants. Includes an introduction to flowering plant systematics. Students earning graduate credit perform a primary literature survey on a topic selected in consultation with the instructor and deliver a 30-minute oral presentation to the class. This course has a lab component. Prerequisite(s): BIOL 211, CHEM 212.

BIOL 503. Field Botany (4).
Introduces the field identification of common flowering plants using technical scientific keys, distributional patterns and general principles of taxonomy. In addition to lecture and laboratory activities, numerous field trips develop botanical skills and reinforce principles covered in lecture. Prerequisite(s): BIOL 211, CHEM 212, or instructor's permit.

BIOL 510. Ecosystem Management and Restoration (3).
Examines the design, implementation, and evaluation of land management plans and restoration projects. Restoration case studies covering a wide-array of ecological systems (e.g. grassland, forest, wetland, aquatic and marine) are used to examine the strengths and weakness of different approaches in these contexts with particular attention to key ecological principles and socio-economic realities. Students produce a written management plan for a site in south-central Kansas. *Course includes diversity content*. BIOL 418 is recommended. Prerequisite(s): BIOL 211 or instructor's permission.

BIOL 524. Vertebrate Zoology (3).
Evolution, distribution, natural history and special characters of vertebrate animals. Students earning graduate credit produce a term paper based on the technical literature on a topic chosen in consultation with instructor. Prerequisite(s): BIOL 211, CHEM 212; BIOL 527 is also recommended. Corequisite(s): BIOL 524L.

BIOL 524L. Vertebrate Zoology Lab (2).
Serves as a companion to lecture and dives more into identification, taxonomy and ecology of native Kansas vertebrates and a few select representatives from around the world. Optional field trips explore regional areas of ecological interest (e.g., Cheyenne Bottoms, WSU Field Stations) and include activities such as exploring frog choruses, road cruising and general fieldwork related to sampling and identifying vertebrates. Prerequisite(s): BIOL 211, CHEM 212 . Corequisite(s): BIOL 524.

BIOL 527. Comparative Anatomy (5).
Intensive study of representative chordates emphasizing vertebrate anatomy. Students earning graduate credit complete additional assignments chosen in consultation with the instructor, such as a term paper based on technical literature, dissection of additional animals, etc. Prerequisite(s): BIOL 211 and CHEM 212. Corequisite(s): BIOL 527L.

BIOL 528. Parasitology (4).
Studies the parasites of man and other vertebrate hosts. Students earning graduate credit produce a term paper based on the technical literature on a topic chosen in consultation with the instructor. This course has a lab component. Prerequisite(s): BIOL 211, CHEM 212.

BIOL 530. Applied and Environmental Microbiology (3).
A characterization of the roles of microbes in natural and man-made environments. Discussions of microbial ecology and communities, interrelationships with higher organisms, biogeochemical cycling, biotechnology and bioremediation. Students earning graduate credit produce an additional research paper based on primary literature on a topic chosen in consultation with the instructor. Prerequisite(s): BIOL 204 (no longer offered) or BIOL 211, CHEM 212.

BIOL 532. Entomology (4).
Introduces the morphology, physiology, life cycles, behavior, ecology and economic significance of insects. Students earning graduate credit produce a term paper based on the technical literature on a topic chosen in consultation with the instructor or develop proficiency in a specific taxon by performing an individual systematics project. This course has a lab component. Prerequisite(s): BIOL 211, CHEM 212.

BIOL 534. Human Physiology (3).
Organ systems approach to human physiology. Emphasizes nervous and endocrine control systems and the coordination of body functions. Students earning graduate credit submit a term paper based upon library research on a topic in human physiology chosen in consultation with the instructor. Prerequisite(s): BIOL 211, CHEM 531, or instructor's consent.

BIOL 535. Human Physiology Lab (2).
Empirical approach to human physiology. Students seeking graduate credit submit an additional laboratory report relating the results of a laboratory experiment to those found in the current technical literature. Pre- or corequisite(s): BIOL 534.

BIOL 540. Developmental Biology (4).
Developmental processes in animals emphasizing vertebrates. Centered on the cell interactions controlling differentiation and morphogenesis. Students earning graduate credit complete additional assignments chosen in consultation with the instructor. BIOL 420 recommended. Prerequisite(s): BIOL 211, CHEM 212. Corequisite(s): BIOL 540L.

BIOL 542. Molecular Genetics (3).
Focuses on the rapidly advancing field of genetics. It uses examples from literature to support fundamental knowledge and present the dynamics in the field of modern genetics. Students study the nature of genetic materials, mechanisms in gene expression and regulation, and advanced technology applied in genetic engineering and genome editing. Students are required to present a class seminar based on the technical literature on a topic chosen in consultation with the instructor. Students earning graduate credit are required to produce a term paper. Prerequisite(s): BIOL 419.

BIOL 545. Human Embryology (3).
Covers human development from fertilization through the development of body systems, highlighting the causes, mechanisms and patterns of developmental disorders. Students learn how developmental processes at the molecular, cellular and tissue-scales sequentially unfold to transform the ovum to a fertilized egg, an embryo and a fetus. The knowledge students gain from this course offers a developmental (foundational) perspective of human anatomy and physiology. Prerequisite(s): BIOL 420 or BIOL 540 or instructor's consent.

BIOL 560. Plant Ecology (4).
Students learn how to identify and explain key ecological patterns found in plant populations and communities. Emphasis is on the development of new knowledge by integrating what is known with new empirical tests, models and re-analysis of published data. This course has a lab component. Prerequisite(s): BIOL 418.

BIOL 570. Conservation Biology (3).
Examines the application of fundamental concepts in ecology, evolutionary biology and genetics to the preservation of biological diversity at the levels of genotypes, species and ecosystems. Topics covered include (1) how biologists quantify biological diversity, (2) threats to biological diversity, (3) tools used to evaluate the level of threat to individual species and to design species management plans, and (4) concepts and considerations for preserve design. Decisions

related to biodiversity conservation often have social and economic consequences, students explore these complexities through case studies. Skills developed in this course include critical reading of primary scientific literature, scientific writing and oral presentation. Prerequisite(s): BIOL 418.

BIOL 590. Immunobiology (3).
The nature of antigens and antibodies and their interactions. Includes cellular and humoral aspects of immunologic phenomena. Students earning graduate credit prepare a term paper based on the technical literature on a topic chosen in consultation with the instructor. Prerequisite(s): BIOL 211, CHEM 531.

BIOL 610. Topics in Botany (1-5).
An umbrella course created to explore a variety of subtopics differentiated by letter (e.g., 610A, 610B). Not all subtopics are offered each semester – see the course schedule for availability. Students enroll in the lettered courses with specific topics in the titles rather than in this root course. Prerequisite(s): BIOL 211, CHEM 212 and instructor's consent.

BIOL 610A. Cell and Molecular Biology Lab (1).
Acquire current techniques and experimental approaches for studying cells. Prerequisite(s): departmental approval.

BIOL 610M. Topics in Genetics Lab (1).
Students acquire knowledge in current genetics techniques, and know how to apply that knowledge to analyze genetic data, which helps to improve their trouble shooting and problem solving skills. Prerequisite(s): departmental approval.

BIOL 626. Reproductive Biology (3).
Covers the basic organization and function of vertebrate reproductive systems. Includes current concepts and contemporary research from the molecular to the population level. Students earning graduate credit prepare a term paper based on the technical literature on a topic chosen in consultation with the instructor. BIOL 526 is strongly recommended. Prerequisite(s): BIOL 420.

BIOL 640. Topics in Zoology (1-4).
An umbrella course created to explore a variety of subtopics differentiated by letter (e.g., 640A, 640B). Not all subtopics are offered each semester – see the course schedule for availability. Students enroll in the lettered courses with specific topics in the titles rather than in this root course. Prerequisite(s): BIOL 211, CHEM 212 and instructor's consent.

BIOL 640AA. Ecology Lab (1).
Laboratory explores the principles underlying the interrelationships of living organisms and their environments from the biosphere to the population level of organization. Prerequisite(s): departmental approval.

BIOL 640AB. Human Anatomy (3).
Gives students an understanding of the anatomy of the human body at the 600 level. Emphasis is on the detailed structural anatomy and classification of each of the human body’s organ systems. Students are challenged to begin thinking clinically so as to prepare for a future in the health professions. Includes weekly lectures and laboratories that the student is expected to attend. Corequisite(s): BIOL 640AL.

BIOL 640AC. Endocrinology (3).
Regulation of physiological processes in vertebrates by chemical messengers; hormones and growth factors. Prerequisite(s): BIOL 211, CHEM 212 and instructor's consent.

BIOL 640AI. Applied Hunting and Conservation (1).
An applied learning experience revolving around the culture, ethics and role of the North American Model of Wildlife Management. This experience is specifically geared towards students without hunting experience that plan to enter wildlife or conservation professions. For undergraduate credit only. Prerequisite(s): instructor's consent.

BIOL 640AL. Human Anatomy Lab (2).
The gross and microscopic anatomy of each human body system is examined in lab through the use of models, diagrams, lab activities and dissections. Dissections include fetal pig full dissection and organ dissections of the following sheep organs: brain, eyeball, heart and kidney. Corequisite(s): BIOL 640AB.

BIOL 640CA. Herpetology (3).
Evolution, ecology and natural history of amphibians and reptiles with lab that covers general anatomy and the identification and natural history of all native species of amphibians and reptiles in Kansas. Optional field trips explore regional areas of herpetological interest and include activities such as exploring frog choruses, road cruising and general fieldwork related to sampling theory, sampling techniques, and identification of amphibians and reptiles. Prerequisite(s): BIOL 211 and CHEM 212. Corequisite(s): BIOL 640CL.

BIOL 640CB. Field Vertebrate Zoology (4).
Covers the general evolution, ecology and natural history of Kansas vertebrates. Combines basic natural history of a wide variety of Kansas vertebrate families with general fieldwork, sampling theory, sampling techniques and approaches to taxa-specific identification. Prerequisite(s): BIOL 211 and CHEM 212, or instructor's consent.

BIOL 640CC. Desert Field Ecology (4).
Covers the general evolution, ecology and natural history of desert organisms and their ecosystems. Combines basic natural history of a wide variety of desert organisms with general fieldwork, sampling theory, sampling techniques, and approaches to taxa-specific identification. Prerequisite(s): BIOL 211 and CHEM 212 or instructor's consent.

BIOL 640CD. Collections and Field Experiences in Science Education (3).
Ecological courses are greatly enriched through the incorporation of hands-on engagement with organisms. At the college level, these opportunities are provided through in-class observation of specimens from collections as well as in-the-field use of techniques and handling of live animals. In this course, students get personalized training in managing and using biological collections for education as well as running field experiences for students that reinforce in-class concepts. Prerequisite(s): graduate student standing .

BIOL 640CE. Statistics in Science Education (2).
Ecological courses are greatly enriched through the incorporation of hands-on engagement with organisms. However, formal training in statistics usually takes an approach of learning proofs and hand-calculating formulae without a conceptual connection to the data. This course immerses students in outdoors-based sampling theory and data collection and then requires them to teach statistical concepts. This latter approach of requiring students to teach a concept solidifies the learning process and leads to a deeper understanding of material. Prerequisite(s): departmental or instructor's consent.

BIOL 640CL. Herpetology Lab (1).
Covers general anatomy and the identification and natural history of all native species of amphibians and reptiles in Kansas. Optional field trips explore regional areas of herpetological interest and include activities such as exploring frog choruses, road cruising and general fieldwork related to sampling theory, sampling techniques, and identification of amphibians and reptiles. Prerequisite(s): BIOL 211 and CHEM 212. Corequisite(s): BIOL 640CA.

BIOL 640G. Topics in Neurobiology (3).
The course covers fundamental neuroanatomy, cellular and molecular neuroscience, development, sensory systems, motor systems, and regulatory systems.

BIOL 640OL. ST: General Biology I - Lab (1).
Biology is a laboratory science and the laboratory portion of General Biology I introduces students to experimental methods and scientific communication. Prerequisite(s): departmental approval.

BIOL 640QL. ST: General Biology II - Lab (1).
The laboratory includes a survey of organismal diversity including prokaryotes, protists, fungi, plants and animals. Prerequisite(s): departmental approval.

BIOL 645. Discoveries in Developmental Biology (3).
Covers research milestones in developmental biology. The class discusses primary research articles that reported on seminal discoveries in developmental biology. Prerequisite(s): BIOL 420 or BIOL 540 or instructor's consent.

BIOL 660. Topics in Microbiology (1-4).
An umbrella course created to explore a variety of subtopics differentiated by letter (e.g., 660A, 660B). Not all subtopics are offered each semester – see the course schedule for availability. Students enroll in the lettered courses with specific topics in the titles rather than in this root course. Prerequisite(s): BIOL 330 and instructor's consent.

BIOL 660J. General Microbiology Lab (2).
Hands on general microbiology laboratory skills will be performed, including; microscopy, staining, aseptic and culturing techniques, isolation and identification of bacterial species, and other standard techniques used in microbiology. Prerequisite(s): departmental approval.

BIOL 660K. Astrobiology (3).
Examines primary literature in astrobiology. Students present and discuss reviews of these reports from both a scientific and editorial standpoint. Successful students acquire in-depth knowledge of concepts and methods in astrobiology. Focuses on microbial aspects of astrobiology, including planetary protection, life in extreme environments, habitability and life detection. Topics may vary and extend to long-duration peopled missions, bioregenerative life support systems and microgravity research. Prerequisite(s): BIOL 210, BIOL 211, CHEM 211 and CHEM 212.

BIOL 661. Pathogenic Microbiology (3).
Focuses on those microbes that produce disease. Most coverage is given to those microbes that cause disease in humans, but zoonotic diseases are also covered. In addition to describing the features of each microbe that enable its pathogenesis, attention is given to the distinctive aspects of its epidemiology, its means of spread and effective countermeasures. Prerequisite(s): BIOL 330 or instructor’s consent.

BIOL 662. Virology (3).
Focuses on the following aspects of viruses: structure, function, replication strategy, host cell interactions and mechanism of variability. Additional topics include the coevolution of viruses and their host cells, the unique ecological niche occupied by viruses, and the challenge that viruses present when attempting to draw clear distinctions between living and nonliving entities. Prerequisite(s): BIOL 330 or instructor’s consent.

BIOL 666. Special Topics in Biochemistry (3).
An umbrella course created to explore a variety of subtopics differentiated by letter (e.g., 666A, 666B). Not all subtopics are offered each semester – see the course schedule for availability. Students enroll in the lettered courses with specific topics in the titles rather than in this root course. Prerequisite(s): BIOL 211, CHEM 662 and CHEM 663.

BIOL 666B. Cancer Biology (3).
The basic mechanisms of carcinogenesis are covered by discussing the control of normal and abnormal cell growth in several model systems. Students earning graduate credit also submit a term paper dealing with a specific topic to be determined by discussion with the instructor. Prerequisite(s): BIOL 420.

BIOL 669. Research in Biochemistry (2).
Cross-listed as CHEM 669. Students in the biochemistry field major participate in a biochemistry research project under the direction of a faculty member. Requires a written report summarizing the results. For undergraduate credit only. Repeatable once for credit. Prerequisite(s): BIOL 420, and CHEM 662 or 663, and CHEM 664 and instructor's consent.

BIOL 710. Glycobiology (3).
Introduces glycoprotein biosynthesis, structure and function. Covers the various roles of carbohydrates in modifying protein structure and function. Students earning graduate credit prepare a term paper based on the technical literature on a topic chosen in consultation with the instructor. Prerequisite(s): BIOL 420.

BIOL 725. Biodiversity Analyses (3).
Surveys the theory, principles, metrics and applications of biodiversity sciences including systematics, biogeography and phylogeny. The pervasive role of phylogenetic data in evolutionary biology (e.g., biogeography, coevolution, speciation, conservation) and other fields (e.g., epidemiology, anthropology, agriculture) are highlighted. Species diversity, species radiations, structure of the tree of life, the wealth of comparative data (from genes to proteins and morphology) and the role of systematics in conservation biology are discussed. Offered fall, even years.

BIOL 738. Plant and Animal Interactions (3).
Develops and expands basic ecological and evolutionary concepts presented in earlier biology courses including natural selection, coevolution, population growth and factors structuring ecological communities. Applies these concepts to the study of herbivory, pollination by animals and seed dispersal by animals. Designed to improve students' abilities to read current primary scientific literature critically with particular emphasis on identifying and evaluating evidence for hypotheses in ecology and evolutionary biology. Introduces the peer review process and hones students' scientific writing skills. Students write a mini-review article of a current hypothesis in the field of plant-animal interaction. An oral presentation based on the findings of the mini-review is also required. Prerequisite(s): BIOL 418 or equivalent general ecology course.

BIOL 740. Topics in Graduate Biology (2-4).
An umbrella course created to explore a variety of subtopics differentiated by letter (e.g., 740A, 740B). Not all subtopics are offered each semester – see the course schedule for availability. Students enroll in the lettered courses with specific topics in the titles rather than in this root course. Prerequisite(s): any two of the following three courses - BIOL 418, BIOL 419, BIOL 420; and instructor's consent.

BIOL 740D. Computing for Biologists (3).
Almost anything an organismal biologist does with data can be greatly aided by a few basic bioinformatic tools. This course will introduce a number of these, including regular expressions, interacting with computers via the shell, accessing high-performance computing, basic Python scripting, and the R data analysis environment. Prerequisite(s): at least two of the following - BIOL 418, 419, 420 or instructor approval.

BIOL 740I. Experimental Design (3).
A general overview of critical components of sound experimental design, common mistakes and philosophical differences in approaches.

All students lead 1-2 class discussions on assigned papers. Students earning graduate credit present their own experimental design and lead a class discussion on the approach being used, assumptions and potential weaknesses. Prerequisite(s): any two of the following three courses - BIOL 418, BIOL 419, BIOL 420; or instructor's consent.

BIOL 760. Experimental Molecular Biology Lab (4).
Introduces upper-level undergraduate and graduate students to molecular biology techniques. The methodology primarily involves the manipulation of DNA and the expression of genetic material in prokaryotic and eukaryotic systems. Prerequisite(s): BIOL 419 or BIOL 420.

BIOL 767. Mechanisms of Hormone Action (3).
The mechanism of action of several hormones is described and used to illustrate the major intracellular signal transduction pathways. Includes gonadotropin-releasing hormone, the glycoprotein hormones, luteinizing hormone, follicle-stimulating hormone, chorionic gonadotropin, thyroid-stimulating hormone, steroid hormones, thyroid hormone, activing/inhibin, prostaglandins, insulin and growth hormone. Mostly lectures covering signal transduction pathways. Students write brief summaries of recent research papers related to the current week's lecture topics. Each student makes an oral presentation of a research paper in journal club format. Students earning graduate credit write a term paper describing in detail a hormone not described in class and its mechanism of action. Prerequisite(s): BIOL 420, BIOL 534 and CHEM 662 or their equivalents.

BIOL 773. Statistical Applications in Biology (3).
Introduces experimental designs and statistical analyses that are commonly used in biological research. Focuses on univariate statistical analyses including t-tests, analysis of variance, nonparametric equivalents of ANOVA, linear regression, goodness-of-fit tests and categorical data analysis. Applications to research questions that arise in biological research, including the students' own research, are emphasized. Students also receive training in the use of statistical analysis computer software. Previous enrollment in STAT 370 is recommended.

BIOL 781. Cooperative Education (1-4).
Academic program that expands a student's learning experiences through paid employment in a supervised educational work setting related to the student's major field of study or career focus. Prerequisite(s): acceptance into MS program.

BIOL 797. Departmental Seminar (1).
Forum for the weekly presentation and discussion of research projects performed by invited scientists from outside departments and institutions, departmental faculty and graduate students. All MS degree-bound graduate students are required to attend the seminar each semester and must enroll in the course for credit during two semesters. Students enrolled in the course must attend all seminars presented in the course, fill out an evaluation of each seminar and make one 15 minute professional-meeting style presentation of their research. Repeatable for credit up to 5 credit hours. Prerequisite(s): acceptance into MS program.

BIOL 890. Research (1-5).
Students performing research toward an MS degree in biology should enroll for an appropriate number of hours. A brief written summary of research progress during the semester in which the student is enrolled must be submitted to the student's advisor before a grade is assigned.

BIOL 891. Thesis (1-2).
Student-driven research experience to address a specific research question. Potential topics should be formulated by the student and discussed with their advisor. Students must be enrolled in this course during the semester in which the thesis is defended. Repeatable for credit.