

# BIOLOGY (BIOL)

## Biology Graduate Courses

### BIOL 8010 SEMINAR IN BIOLOGY (1 credit)

A study of current research in any of the divisions of biology. Graduate students will complete this course once for credit.

**Prerequisite(s):** Graduate student in biology and written permission of graduate faculty supervisor. Not open to non-degree graduate students.

### BIOL 8020 INDEPENDENT RESEARCH IN BIOLOGY (1-6 credits)

Research work under supervision of a member of the graduate faculty. May be taken more than once for credit; up to 4 credits for thesis option of M.S. degree and up to 6 credits for the non-thesis option of the M.S. degree.

**Prerequisite(s):** Graduate student in biology and written permission of graduate faculty supervisor. Not open to non-degree graduate students.

### BIOL 8030 EVOLUTION: FROM GENOMES TO ECOSYSTEMS (3 credits)

This course will prepare students to evaluate and discuss evolution as an underlying concept in all of biology. Further, it will provide a comprehensive overview of evolutionary processes related to the evolution of genomes, development, physiology, morphology, behavior, and ecosystems. (Cross-listed with STEM 8030).

**Prerequisite(s):** Courses for graduate admission or equivalent, or with permission of instructor.

### BIOL 8036 SPECIAL TOPICS IN BIOLOGY (3 credits)

A lecture and/or laboratory course for biology majors pertaining to a specific biological topic not available in the regular curriculum. Topics will be developed by individual faculty members reflecting their special interests and expertise. The course may be repeated for credit. (Cross-listed with BIOL 4030).

**Prerequisite(s):** Graduate standing.

### BIOL 8040 TOPICS IN BIOLOGY (1 credit)

Lecture courses for graduate students designed to provide exposure to biological specialties not offered in the regular curriculum.

**Prerequisite(s):** Graduate and permission. Not open to nondegree students. Not open to non-degree graduate students.

### BIOL 8046 SPECIAL TOPICS IN BIOLOGY-LAB (1 credit)

A laboratory course for biology majors pertaining to a specific biological topic not available in the regular curriculum, paired with a BIOL 8036/4030 Special Topics lecture course. Topics will be developed by individual faculty members reflecting their special interests and expertise. The course may be repeated for credit. (Cross-listed with BIOL 4034).

**Prerequisite(s):** Graduate standing.

### BIOL 8060 ADVANCED TOPICS IN BIOLOGY (3 credits)

Lecture and/or laboratory courses for graduate students designed to provide exposure to biological specialties not offered in the regular curriculum.

**Prerequisite(s):** Graduate and permission. Not open to nondegree students.

### BIOL 8070 ADVANCED READINGS IN BIOLOGY (1-3 credits)

An in-depth study of the literature in a limited segment of the biological sciences under the supervision of a graduate faculty member. May be taken more than once for credit up to a total of six credits.

**Prerequisite(s):** Graduate student in biology and written permission of graduate faculty supervisor. Not open to non-degree graduate students.

### BIOL 8106 BIOGEOGRAPHY (3 credits)

This course is intended as an introduction to biogeography, the study of the distribution and evolution of organisms across space and through time. Usually offered every year. (Cross-listed with BIOL 4100, GEOG 4100, GEOG 8106, GEOL 4100, GEOL 8106)

**Prerequisite(s):** BIOL 1450 and 1750 or GEOL 3100 or BIOL 3100, junior-senior.

### BIOL 8116 STATISTICS FOR BIOLOGICAL SCIENCES (4 credits)

Introduction to statistical methods and software used to display, summarize, analyze, and interpret biological and medical data. (Cross-listed with BIOL 4110)

### BIOL 8126 CONSERVATION BIOLOGY (3 credits)

Study of biological diversity at the genetic, species and ecosystem levels, its values, and the factors that threaten it. We will explore the scientific basis of conservation biology and how it can be applied to the maintenance of biological diversity. Usually offered every year. (Cross-listed with BIOL 4120).

**Prerequisite(s):** Graduate student in Biology. Not open to non-degree graduate students.

### BIOL 8136 MOLECULAR GENETICS (4 credits)

A lecture and lab course that explores the frontiers of molecular genetics research. Topics addressed will include DNA replication, gene function, gene expression, genetic manipulation, cloning, mutational analysis, genome sequencing, and epigenetics. Research techniques will include DNA/RNA isolation, PCR, cloning, gel electrophoresis, transgene generation, data analysis, and quantitative rtPCR. Students will get a solid grounding in scientific writing and presentations, as well as reading and assessing primary scientific literature. Lecture, discussion, and laboratory. Usually offered fall semester. (Cross-listed with BIOL 4130)

**Prerequisite(s):** BIOL 2140, 3020 and CHEM 2210 or 2260 or their equivalents. Not open to nondegree students.

### BIOL 8146 CELLULAR BIOLOGY (4 credits)

This course is a modern study of mammalian cell function. Focus will be placed on developing skills in experimental cellular biology. Material covered will include tissue culture techniques, cell staining applications, fluorescent microscopy, determination of gene expression, and high-throughput assay design. (Cross-listed with BIOL 4140)

**Prerequisite(s):** BIOL 2140, 3020 and CHEM 2210 or 2250. Junior or senior undergraduate standing or graduate standing. Must enroll in laboratory section and lecture for this course. Not open to non-degree graduate students.

### BIOL 8150 PROFESSIONAL DEVELOPMENT IN BIOLOGY (2 credits)

This course focuses on developing the skills needed for becoming a successful professional biologist. Students actively participate in developing key research and teaching skills including: developing and writing grant proposals and papers, communicating science to the general public and to professional audiences through oral and poster presentations, constructive reviews of the work of others in the context of teaching and as a working professional, and development of teaching materials and assessments. Professional and ethical norms in research and teaching are discussed throughout the course. By the end of the course, students will be able to evaluate alternative career paths within biology and devise development plans appropriate for those careers.

**Prerequisite(s):** Graduate student in biology and permission of graduate program chair.

### BIOL 8156 CANCER BIOLOGY (3 credits)

The etiology of cancers, differences between types of malignancies, oncogenes and genetic modifiers, treatments, susceptibility, and tumor-induced immunosuppression are discussed. This is an active course focused on inquiry-based learning and the purpose of this course is to provide students a foundation in cancer biology while applying tools learned through cell biology, genetics, and immunology courses. (Cross-listed with BIOL 4150).

**BIOL 8166 BIOINFORMATICS FOR BIOLOGISTS (3 credits)**

This course intends to introduce fundamental concepts in bioinformatics with an emphasis on how to use biological databases and computational tools to solve common bioinformatics problems in biology and biomedicine. The topics consist of sequence database access and searching, sequence alignment and phylogeny, functional prediction of DNA and protein sequences, and genome sequencing and annotation. Students are expected to learn fundamental concepts in bioinformatics and gain extensive experience with the use of bioinformatics analysis tools. (Cross-listed with BIOL 4160).

**Prerequisite(s):** BIOL 2140 Genetics; BIOL 3020 Molecular Biology of the Cell; Or Permission of instructor

**BIOL 8170 ECOSYSTEM ANALYSIS FOR EDUCATORS (3 credits)**

This course is designed for education graduate students who wish to take a field-based biology course that uses an interdisciplinary approach to understanding the ecosystem of the tallgrass prairie. This course engages graduate students in methods reflecting multidisciplinary STEM strategies (e.g. scientific inquiry, modeling, geographic information system mapping, etc.) associated with research taking place at the Glacier Creek Preserve. Graduate students completing this course will develop advanced knowledge of ecology, restoration ecology, and monitoring of prairie habitat restoration. Graduate students will focus on the technical, biogeochemical, ecological and cultural aspects of analyzing and restoring the prairie ecosystem and its various habitats. (Cross-listed with STEM 8170)

**Prerequisite(s):** Graduate Standing or Permission from the Instructor.

**BIOL 8186 FRESHWATER ECOLOGY (4 credits)**

A study of the physical, chemical and biological relationships that serve to establish and maintain plant and animal communities in freshwater environments. (Cross-listed with BIOL 4180, ENVN 4180).

**Prerequisite(s):** Prerequisites: BIOL 1450 and BIOL 1750, junior-senior, or permission of instructor. Registration requirements: Must enroll in lab. Not open to non-degree graduate students.

**BIOL 8190 COMMUNITIES AND ECOSYSTEMS (3 credits)**

Advanced study of populations, communities and ecosystems; may require overnight weekend field trips.

**Prerequisite(s):** BIOL 3340/8345, graduate in biology. Not open to nondegree students.

**BIOL 8200 PLANT ECOLOGY (4 credits)**

Advanced study of plant communities and of individual plant species including relationships with the environment and vegetative dynamics. Emphases on methods of evaluation and analysis. May require overnight field trips.

**Prerequisite(s):** BIOL 3340/8345, graduate in biology. Recommended: BIOL 3530/8535.

**BIOL 8216 FIRE ECOLOGY (3 credits)**

Study of fire in ecosystems including characteristics of fire, effects on flora, fauna and the abiotic environment, and use in maintaining native ecosystems. May include two weekend field exercises. (Cross-listed with BIOL 4210)

**Prerequisite(s):** BIOL 3340; junior, senior, or graduate student

**BIOL 8226 POPULATION BIOLOGY (4 credits)**

Population biology takes a conceptual approach to study the dynamics, ecology, genetics, and evolution of populations. Topics include the growth and regulation of populations, population interactions, selection on individuals and groups, mating systems, and life history evolution. Implications of these topics for areas such as the ecology and evolution of disease, conservation, and resource management will be highlighted. Concepts are reinforced through labs emphasizing interpretation of results from population simulations and the relationship between theory and experimentation in population biology. Usually offered in alternate years. (Cross-listed with BIOL 4220).

**Prerequisite(s):** Graduate student in Biology or permission of instructor

**BIOL 8236 EVOLUTION (3 credits)**

The course emphasizes the general principles of evolution, particularly focusing on evolutionary changes and the mechanisms of evolution (natural selection, gene flow, mutation and genetic drift) that apply to all or most organisms. The course covers micro- and macroevolution, speciation, and human evolution. Students will discover how scientists can learn about what has happened in the evolutionary past and the most common patterns of change (i.e., changes that have characterized various groups of organisms). (Cross-listed with BIOL 4230).

**Prerequisite(s):** Prerequisites are BIOL 2140, junior or senior undergraduate status, Biology graduate status, or permission by the instructor. Not open to non-degree graduate students.

**BIOL 8246 MARINE BIOLOGY (3 credits)**

An introduction to the marine environment, this course explores physical conditions of the ocean including ocean chemistry, salinity, waves and currents, and tides as well as the ecology of planktonic, nektonic and benthic organisms— their communities and environments. Impacts of humans on the marine environment will also be covered. (Cross-listed with BIOL 4240)

**Prerequisite(s):** BIOL 1750

**BIOL 8250 STATISTICAL ANALYSIS AND DESIGN FOR BIOLOGICAL RESEARCH (4 credits)**

This course examines the statistical aspects of the design and analysis of laboratory and field experiments in biology. Basic statistical methods are reviewed and advanced methods presented. Lectures focus on an introduction to the theory behind experimental design and statistical analysis. Labs focus on how to properly complete and interpret statistical analyses, and also focus on how to use the R statistical computer package.

**Prerequisite(s):** Undergraduate course in statistics is recommended. Non-degree students must gain permission of the instructor before enrolling. Not open to non-degree graduate students.

**BIOL 8256 FIELD MARINE BIOLOGY (1 credit)**

This lab is a hands-on introduction to the marine environment using a field trip to the Gulf Coast. Students will observe first-hand examples of local marine habitats and organisms. Students will be required to take a trip to the Gulf Coast of Texas, Louisiana, Mississippi, and Alabama during Spring Break. Students will be required to provide their own basic camping and snorkeling gear. (Cross-listed with BIOL 4250)

**Prerequisite(s):** BIOL 1750, previous or concurrent enrollment in BIOL 4240 and permission of instructor.

**BIOL 8266 BEHAVIORAL ECOLOGY (3 credits)**

Behavioral ecology is the study of behavior from an evolutionary and ecological point of view. Through the integration of research at different organizational levels and the use of many different organisms, behavioral ecology is one of the most integrative fields in biological sciences. This course will provide an introduction to the basic concepts of behavioral ecology and the integrative approaches used in behavioral ecology. Further, the course will train students in critical reading and discussion of primary literature in writing and in an oral setting. (Cross-listed with BIOL 4260)

**Prerequisite(s):** Admission into the graduate college. Not open to non-degree graduate students.

**BIOL 8276 ANIMAL BEHAVIOR (3 credits)**

Behavior of diverse animals for the understanding of the relationships between nervous integration and the behavior manifested by the organism, as well as the evolution and adaptive significance of behavior as a functional unit. (Cross-listed with BIOL 4270, PSYC 4270, PSYC 8276)

**Prerequisite(s):** BIOL 1750 and PSYC 1010 or permission of instructor, junior-senior.

**BIOL 8286 ANIMAL BEHAVIOR LABORATORY (3 credits)**

Laboratory and field studies of animal behavior with an ethological emphasis. Classical laboratory experiences and independent studies will be conducted. (Cross-listed with BIOL 4280, PSYC 4280, PSYC 8286)

**Prerequisite(s):** PSYC 4270 or BIOL 4270 or PSYC 8276 or BIOL 8273. Not open to non-degree graduate students.

**BIOL 8296 NEUROETHOLOGY (3 credits)**

In the field of Neuroethology a major goal is to understand the neural bases of animal behaviors in a natural context. In this course students will investigate how behaviors are generated and modulated by the nervous system in organisms ranging from insects to mammals. We will explore the neural mechanisms underlying a variety of animal behaviors as they interact with their natural environment ranging from sensory perception of the world (e.g. echolocation, electrolocation), to locomotor movements (e.g. flying, swimming), to more complex behaviors (e.g. learning, memory). (Cross-listed with BIOL 4290, NEUR 4290, NEUR 8296, PSYC 8296).

**Prerequisite(s):** Graduate Standing. Not open to non-degree graduate students.

**BIOL 8326 HORMONES & BEHAVIOR (3 credits)**

In this course, students will examine the interaction between hormones, chemical messengers released from endocrine glands, and behavior in both human and animal systems. Methods for studying hormonal issues on behavior will be addressed. This course will provide students in psychology, biology, and related disciplines an understanding of how hormones affect sensory processing, motor activities, and processing of information in the central nervous system. (Cross-listed with BIOL 4320, PSYC 4320, PSYC 8326)

**Prerequisite(s):** Admission to graduate level PSYC program or permission of dept. Not open to non-degree graduate students.

**BIOL 8345 ECOLOGY (4 credits)**

Study of interrelationships between organisms and their biotic and abiotic environment; includes the physical environment, population biology, community dynamics, biotic interactions and evolution. Usually offered Fall, Spring, Summer. (Cross-listed with BIOL 3340).

**Prerequisite(s):** Prerequisites are BIOL 1450 and BIOL 1750; junior-senior or Biology graduate student; or permission by instructor. Not open to non-degree graduate students.

**BIOL 8416 WETLAND ECOLOGY AND MANAGEMENT (3 credits)**

This course will examine the principles and theory of wetland ecology with application towards wetland management and regulation. An interdisciplinary overview of physical, biological and regulatory aspects of wetlands will allow students to synthesize information from their backgrounds in geography, geology and ecology. Definitions, classifications, natural processes and functions of wetland environments will be presented. Labs concentrate on field techniques used to assess specific plant, animal, soil, and hydrological characteristics of wetlands. (Cross-listed with ENVN 4410 and BIOL 4410)

**Prerequisite(s):** BIOL 3340 or instructor permission.

**BIOL 8426 RESTORATION ECOLOGY (3 credits)**

Restoration Ecology examines how people assist with the recovery of ecosystems that have been degraded. The course will examine the theory and application of restoration ecology through lecture, discussion, field trips, and development of a restoration management plan for a degraded ecosystem near Omaha. The course will provide information and resources used by restoration and land management professionals to plan, implement, and manage restorations. (Cross-listed with BIOL 4420, ENVN 4420)

**Prerequisite(s):** Graduate standing.

**BIOL 8446 PLANT PHYSIOLOGY (4 credits)**

A study of plant processes and functions with emphasis on photosynthesis, growth and development, metabolism and mineral nutrition. (Cross-listed with BIOL 4440)

**Prerequisite(s):** BIOL1450, BIOL1750, and CHEM 2210 or CHEM 2250; or permission of instructor.

**BIOL 8450 BIOLOGY EDUCATION RESEARCH METHODS (3 credits)**

In this course, students will learn the methods of conducting pedagogical research in Biology, understand how people learn the concepts, practices, and ways of thinking in science and engineering; understand the nature and development of expertise in a discipline; help identify and measure appropriate learning objectives and instructional approaches that advance students toward those objectives; contribute to the knowledge base in a way that can guide the translation of statistical findings to classroom practice; and identify approaches to make science and engineering education broad and inclusive. Students will work with live data sets to evaluate effective pedagogical approaches in the biology classroom of various audiences (K-16).

**BIOL 8454 VIROLOGY LABORATORY (1 credit)**

A laboratory to accompany virology lecture. This course enables students to work with viruses in the laboratory and to conduct experiments using viral systems. Experimental design, data gathering, data analysis and manuscript writing will be integral parts of the course. The experiments include host cell characterization, viral infection, virus purification from infected cells, viral genome isolation and viral transfection. Sequence analysis and sequence comparison will also be introduced. Laboratory exercises will emphasize fundamental molecular biology techniques and instrumentation. Usually offered in Fall semester. (Cross-listed with BIOL 4454)

**BIOL 8456 VIROLOGY (3 credits)**

A comprehensive course about viruses. The course will address principles of viral infection, virus-host interaction, viral evolution and viral disease processes. Cellular and molecular aspects of viral infection will be the primary focus. This will include examination of viral particles, viral multiplication cycles, regulation of gene expression, viral assembly and viral escape. Viral immunology, viral defenses, viral vaccines and antiviral compounds will also be addressed. Emerging viruses and current viral topics will be a major part of the course. Usually offered in Fall semester. (Cross-listed with BIOL 4450)

**BIOL 8466 COMPARATIVE IMMUNOLOGY (4 credits)**

This course is an exploration of comparative immunology across kingdoms. There will be a strong focus on human as well as mouse immunology. Laboratory sessions require dissections to determine lymphoid anatomy of representative organisms. Samples will be prepared and analyzed using immunological techniques such as flow cytometry. (Cross-listed with BIOL 4460).

**Prerequisite(s):** Two classroom sessions and one laboratory session per week. Graduate standing. Not open to non-degree graduate students.

**BIOL 8496 MEDICINAL USES OF PLANTS (3 credits)**

A scientific study of the biochemical properties and physiological effects of medicinal plants, including their historical uses, current applications to varying systems of the human body, and pathways by which today's potent drugs have transitioned from wild flora. Usually offered Fall semesters of even-numbered years. (Cross-listed with BIOL 4490)

**BIOL 8535 FLORA OF THE GREAT PLAINS (4 credits)**

A study of common vascular plants found in the Great Plains region, including identification, description, and classification techniques and an introduction to the plant communities of Nebraska. Usually offered every Fall and Summer. (Cross-listed with BIOL 3530.)

**Prerequisite(s):** BIOL 1450-1750. Not open to nondegree students.

**BIOL 8606 GIS APPLICATIONS FOR ENVIRONMENTAL SCIENCE (1 credit)**

This course introduces the use of geographic information systems (GIS) and other geospatial tools for work in the fields of environmental science, ecology, and natural resource management. The course will develop a working knowledge of the common software and hardware tools used by ecologists through hands-on projects. (Cross-listed with BIOL 4600, ENVN 4600)

**Prerequisite(s):** BIOL 3340 or permission of instructor.

**BIOL 8645 MOLECULAR MICROBIOLOGY LAB (1 credit)**

This course will train students to perform techniques commonly used in microbiology labs, such as isolation of bacteria, staining of bacterial cells, use of different media, antibiotic susceptibility tests, polymerase chain reactions, and enzymatic assays. (Cross-listed with BIOL 4644).

**Prerequisite(s):** Prerequisites of BIOL 2140 and BIOL 3020 and either BIOL 3830/8835 or BIOL 4640/8646 prior or concurrent.

**BIOL 8646 MOLECULAR MICROBIOLOGY (3 credits)**

This course will cover the diversity observed in genomes, molecules, structures, metabolism, and regulation observed in microorganisms with a focus on bacteria and Archaea. Usually offered Fall semesters. (Cross-listed with BIOL 4640).

**Prerequisite(s):** Prerequisites are BIOL 2140 and BIOL 3020 or equivalents. Not open to non-degree graduate students.

**BIOL 8654 BIOCHEMISTRY I LABORATORY (1 credit)**

A laboratory course to help integrate the concepts learned in biochemistry lecture with the development of biochemical laboratory skills including experimental design, data analysis, presentation of results and communication of scientific information, with a focus on formal instruction in journal-style writing and notebook skills. There is an emphasis on protein properties, including enzyme activity. Fulfills the third writing course requirement for students majoring in chemistry when NSCI 3940 and another approved laboratory course have been completed with a C- or better. (Fall) (Cross-listed with BIOL 4654, CHEM 4654, CHEM 8654).

**BIOL 8656 BIOCHEMISTRY I (3 credits)**

A comprehensive introduction to biochemistry emphasizing: structure-function relationships for proteins, carbohydrates, lipids, and nucleic acids; protein purification; enzyme kinetics and mechanisms; membranes and membrane transport; carbohydrate metabolism including glycolysis, the citric acid cycle and oxidative phosphorylation; and important applications of thermodynamics and the properties of water to living systems. (Fall) (Cross-listed with BIOL 4650, CHEM 4650, CHEM 8656).

**Prerequisite(s):** CHEM 2260 and CHEM 2274; and either CHEM 2400 or BIOL 3020, all with a C- or better. Other comparable courses taken at accredited colleges or universities are acceptable. BIOL 8654 must be taken concurrently.

**BIOL 8664 BIOCHEMISTRY II LABORATORY (1 credit)**

A laboratory course to help integrate the concepts learned in Biochemistry II lecture with the development of biochemical laboratory skills, to gain practical experience in experimental design, data analysis, presentation of results and communication of scientific information, with a focus on formal instruction in journal-style writing and notebook skills. There is an emphasis on nucleic acid properties. Fulfills the third writing course requirement for students majoring in chemistry when NSCI 3940 and another approved laboratory course have been completed with a C- or better. (Spring) (Cross-listed with BIOL 4664, CHEM 4664, CHEM 8664).

**BIOL 8666 BIOCHEMISTRY II (3 credits)**

A continuation of the study of the structure and function of biomolecules and biochemical reactions with an emphasis on metabolism of carbohydrates, lipid, amino acids and nucleotides, and the chemistry of signal transduction and genetic information transfer. (Spring) (Cross-listed with BIOL 4660, CHEM 4660, CHEM 8666).

**Prerequisite(s):** CHEM 8656 and CHEM 8654 or BIOL 8656 and BIOL 8654 with a grade of B- or better. BIOL 8664 must be taken concurrently.

**BIOL 8685 BIOLOGY OF AFRICA (3 credits)**

Biology of Africa (3) Introduction to the plants, animals, and habitats of Africa. Although other groups are included, this course will focus on the large mammals of east Africa and will pay particular attention to elephant reproduction and biology. Other topics include Serengeti migrations, hippos, lions and other large cats, reptiles, and human evolution. Usually offered alternate Spring semesters. (Cross-listed with BIOL 3680).

**BIOL 8695 BIOLOGY OF AFRICA LAB (1 credit)**

BIOL 3690/8695 Biology of Africa (1) A Hands-on introduction to the major plants and animals of east Africa using a field trip to South Africa. Students will observe, first hand, examples of the flora and fauna of the African savannah, partake in research on elephant reproductive biology, and observe historic African tribal culture.. Students will be required to take a trip to South Africa including Johannesburg, Hoedspruit, Kruger National Park, and Skukuza. Students will be required to register their travel plans through Education Abroad. Usually offered alternate Summer semesters. Students enrolled in this course must have taken BIOL 3680/8685 during the spring semester immediately prior to this class, or have taken it some semester prior. (Cross-listed with BIOL 3690).

**Prerequisite(s):** Previous or concurrent enrollment in BIOL 3680/BIOL 8685 lecture.

**BIOL 8716 TOXICOLOGY (3 credits)**

An overview of the fundamentals of toxicology. Concepts include the dose-response relationship, absorption, distribution and excretion of toxicants, and the biotransformation of xenobiotics. Emphasis will be given to metals, pesticides, pharmaceutical compounds, chemical carcinogenesis and endocrine disruption. Usually offered Fall. (Cross-listed with BIOL 4710)

**Prerequisite(s):** CHEM 2210 or 2260 and BIOL 1750, BIOL 3020 or equivalent.

**BIOL 8735 FAUNA OF THE GREAT PLAINS (3 credits)**

A survey of the common animal groups found in the Great Plains, including their evolution, ecology, distribution and specific adaptations to the environment of the temperate North American grasslands.

**Prerequisite(s):** BIOL 1750. Not open to nondegree students.

**BIOL 8736 VERTEBRATE ENDOCRINOLOGY (4 credits)**

An overview of the fundamentals of vertebrate endocrinology. Concepts include: the mammalian hypothalamus-pituitary system, the endocrinology of mammalian reproduction, the mammalian adrenal glands, endocrine disruption, endocrinology and metabolism. (Cross-listed with BIOL 4730)

**Prerequisite(s):** BIOL 1750, BIOL 3020 or equivalent. Not open to non-degree graduate students.

**BIOL 8746 ANIMAL PHYSIOLOGY (3 credits)**

An overview of the fundamentals of animal physiology. Concepts include: the physiology of nerve and muscle function, endocrine function, cardiovascular and respiratory function, oxygen and carbon dioxide delivery by the blood, and osmoregulation and excretion. The course is comparative in nature, including examples from humans, mammals, vertebrates and invertebrate animals. Usually offered Spring. (Cross-listed with BIOL 4740.)

**BIOL 8760 CLINICAL REASONING (3 credits)**

This is an intensive class in which students will translate biological concepts into solving case-based scenarios in clinical medicine. Relevant readings will prepare students to address these challenges in small-group settings. Intended as an advanced preparatory course for healthcare professionals or students desiring exposure to clinical decision-making. Usually offered during Summer semester.

**Prerequisite(s):** Molecular Biology; Microbiology or Immunology; plus instructor approval.

**BIOL 8766 GENOME TECHNOLOGY AND ANALYSIS (3 credits)**

This course will introduce the latest genome sequencing technologies and their broad applications in biology and medicine. Students will learn how genome sequencing is conducted by different platforms and obtain practical experience of how to use bioinformatics tools for genome analysis. Students are expected to be able to perform sequence analysis efficiently and interpret the results properly. (Cross-listed with BIOL 4760)

**Prerequisite(s):** BIOL2140 Genetics; or Permission of instructor

**BIOL 8770 CLINICAL READINGS (3 credits)**

This course is a rigorous study of current biomedical, translational, and clinical primary literature spanning a wide range of human health and disease.

**Prerequisite(s):** Graduate and written permission of graduate faculty member.



**BIOL 8786 VERTEBRATE ZOOLOGY (4 credits)**

A study of the general biology of the subphylum vertebrata including the morphology, anatomy, physiology and ecology of vertebrate representatives. (Cross-listed with BIOL 4780)

**Prerequisite(s):** Prerequisites are BIOL 1450, BIOL 1750, and Junior or Senior standing.

**BIOL 8796 MAMMALOLOGY (4 credits)**

The biology of mammals, including their evolution, functional morphology, physiology, ecology, zoogeography, behavior, classification and identification, with emphasis on North American groups. Field trips. Usually offered in alternate years. (Cross-listed with BIOL 4790)

**Prerequisite(s):** BIOL 1450, BIOL 1750, junior or senior standing. Must enroll in laboratory section.

**BIOL 8826 INTRODUCTION TO ENVIRONMENTAL LAW & REGULATIONS (3 credits)**

Seminar on environmental law and regulation. The course will address federal regulations, implementing instructions, legal principles and requirements. The major federal environmental laws, air and water quality, solid and hazardous waste, and pollution prevention and remediation will be discussed. Usually offered Fall semesters.

**Prerequisite(s):** Junior-senior and permission.

**BIOL 8835 BIOLOGY OF PATHOGENIC MICROORGANISMS (3 credits)**

This course will cover diseases commonly caused by microorganisms and the features of the microorganisms that cause those diseases. The course will also cover terms used to describe infections, their transmission and their occurrence, and the defenses of humans against infections. The goal of the course is to provide students with the knowledge to be able to diagnose common infectious diseases based on symptoms and test results. Usually offered in Spring semesters. (Cross-listed with BIOL 3830).

**Prerequisite(s):** BIOL 2140 or BIOL 2440 or BIOL 3240 or the equivalent, or by instructor permission. Not open to non-degree graduate students.

**BIOL 8836 DEVELOPMENTAL GENETICS (2 credits)**

This course considers experimental approaches in developmental genetics and provides students with first-hand experience in laboratory techniques used in developmental genetics. (Cross-listed with BIOL 4830)

**Prerequisite(s):** This course considers experimental approaches in developmental genetics and provides students with first-hand experience in laboratory techniques used in developmental genetics.

**BIOL 8846 HERPETOLOGY (4 credits)**

The biology of amphibians and reptiles, including their evolution, classification, anatomy, physiology, ecology, distribution and identification, with emphasis on North American groups. Methods for studying herptiles are examined. Usually offered in Spring semesters of even years. (Cross-listed with BIOL 4840).

**Prerequisite(s):** Prerequisites are BIOL 1450, BIOL 1750 and Junior-Senior standing. Must enroll in lab. Not open to non-degree graduate students.

**BIOL 8856 DEVELOPMENTAL BIOLOGY (3 credits)**

This course explores principles underlying the development of multicellular organisms, stressing the environmental, genetic, molecular, cellular, tissue, and evolutionary mechanisms of animal development. Usually offered once per year. (Cross-listed with BIOL 4850)

**BIOL 8866 COMPARATIVE GENOMICS (3 credits)**

This course will introduce fundamental concepts in genomics and genome comparison. Students will learn how genomes are constructed, how they evolve, how individual genomes are unique, and what genomic knowledge means in terms of human health and medicine. (Cross-listed with BIOL 4860)

**BIOL 8876 MOLECULAR AND CELLULAR NEUROBIOLOGY (3 credits)**

This course presents foundational topics in molecular and cellular neurobiology in the context of how the nervous system is functionally organized. Topics include: nervous system cell types and their subcellular organization; electrical properties of neurons and glia; energy metabolism and biochemistry of the brain; intra- and intercellular neuronal signaling; the regulation of gene expression in neuronal cells; synaptic plasticity; and how these are altered in disease. (Cross-listed with BIOL 4870, NEUR 4870, NEUR 8876).

**Prerequisite(s):** NEUR 1500, or both NEUR 1520 and NEUR 1540, or BIOL 3020, or permission of instructor.

**BIOL 8896 GENES, BRAIN, AND BEHAVIOR (3 credits)**

This course will evaluate the complex interaction between an organism's genome and neural activity pattern in the nervous system as related to behavior. In this course students will explore how changes in gene expression (allelic variants, epigenetics, differential regulation) and gene networks within neural tissue can reciprocally influence behaviors such as communication, foraging, reproduction, and cognition. (Cross-listed with BIOL 4890, NEUR 4890, NEUR 8896, PSYC 8896)

**Prerequisite(s):** Graduate standing. Not open to non-degree graduate students.

**BIOL 8946 ENTOMOLOGY (4 credits)**

The study of insects; their classification, morphology, physiology, behavior, life histories, ecology and evolution. (Cross-listed with BIOL 4940)

**Prerequisite(s):** BIOL 1450, BIOL 1750. Junior or Senior standing.

**BIOL 8966 ADVANCED GENETICS (3 credits)**

An in-depth consideration of topics in genetics, including the conceptual and molecular definition of a gene, cytogenetics, mutation, population genetics, developmental genetics, gene regulation and the application of genetics to other areas of biology. (Cross-listed with BIOL 4960).

**Prerequisite(s):** BIOL 2140 and BIOL 3020 and concurrent enrollment or completion of either CHEM 3650 or CHEM 4610 or CHEM 4650 or BIOL 4650, or permission of the instructor.

**BIOL 8976 ADVANCED BOTANY (4 credits)**

Advanced Botany examines plant structures (cells, tissues, and organs) and their connections with plant functions (growth, reproduction, photosynthesis, respiration, and dispersal). Topics covered include energy metabolism, development and morphogenesis, genetics, ecology, and the latest in plant taxonomy and phylogeny, keeping students on the forefront of cutting-edge botanical research. In lab, students conduct activities such as dissecting plant organs, making microscope slides, and conducting plant-based experiments, using plants from the local area, from native Great Plains collections, and from around the world and grown in the greenhouse. Students compare and contrast both physiological and morphological adaptations to varying environments. (Cross-listed with BIOL 4970, ENVN 4970).

**Prerequisite(s):** Graduate Standing

**BIOL 8986 ORNITHOLOGY (4 credits)**

An introduction to the general biology of birds, including their anatomy, physiology, behavior, ecology, classification and identification with emphasis on North American groups. Usually offered in alternate years. (Cross-listed with BIOL 4980)

**Prerequisite(s):** BIOL 1750.

**BIOL 8990 THESIS (1-6 credits)**

An original and independent research project written under the supervision of a faculty thesis advisory committee.

**Prerequisite(s):** Graduate student in biology and written permission of graduate faculty supervisor. Not open to non-degree graduate students.