

BIOLOGICAL SCIENCES (BIOS)

BIOS 802 Cancer Biology

Crosslisted with: BIOS 402

Prerequisites: BIOS 206 and Senior standing

Description: Principles of cancer genetics, cancer prevention, and new methods for diagnosis and therapy. Fundamentals of the cell and molecular events that lead to human cancer.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Grade Pass/No Pass Option

BIOS 803 Principles of Evolution

Description: Micro- and macroevolutionary patterns and processes. Population genetics, evolutionary ecology, speciation, phylogenetic systematics, and biogeographic patterns of extant and extinct taxa.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Grade Pass/No Pass Option

BIOS 804 Principles of Behavioral Ecology

Description: Introduction to the ecology and evolution of animal behavior.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Grade Pass/No Pass Option

Prerequisite for: BIOS 962

BIOS 805 Principles of Ecology

Description: Ecological principles at the populations, community, and ecosystem levels. Population growth, meta-population dynamics, competitive and predatory interactions, temporal and spatial variation in community food webs, trophic cascades, patterns and mechanisms underlying species diversity, ecosystem processes, nutrient cycling, and global change.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Grade Pass/No Pass Option

BIOS 806 Insect Ecology

Crosslisted with: BIOS 406, ENTO 406, ENTO 806

Prerequisites: BIOS/NRES 220 and 222.

Description: Biotic and abiotic factors as they influence insect development, behavior, distribution, and abundance.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Grade Pass/No Pass Option

BIOS 808 Functional Histology

Crosslisted with: BIOS 408, VBMS 408, VBMS 808

Prerequisites: BIOS 101 and 101L or LIFE 120 and 120L; BIOS 213 or ASCI 240 or ASCI 340.

Description: Microscopic anatomy of the tissues and organs of major vertebrate species, including humans. Normal cellular arrangements of tissues and organs as related to their macroscopic anatomy and function, with reference to sub-cellular characteristics and biochemical processes. Functional relationships among cells, tissues, organs and organ systems, contributory to organismal well being. General introduction to pathological processes and principles underlying some diseases.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Grade Pass/No Pass Option

Course and Laboratory Fee: \$15

BIOS 809 Professionalism

Notes: Pass/No Pass only.

Description: Discussion of skills needed to be a professional scientist including: writing, submitting, editing, and revision of journal articles and grant proposals; preparation of oral and poster presentations; and ethical issues in research and teaching.

Credit Hours: 1

Max credits per semester: 1

Max credits per degree: 1

Grading Option: Pass No-Pass

BIOS 812 Human Genetics

Crosslisted with: BIOS 412

Prerequisites: BIOS 206 and Senior standing

Description: Genetic basis of human variation, with emphasis on methods of applying genetic principles to humankind. Genetic ratios in pooled data; population and quantitative genetics; consanguinity; polygenic inheritance; blood types; sex linkage; linkage and crossing over; sex determination; visible chromosome variation; mutation; heredity and environment; eugenics; anthropological genetics; molecular genetics and molecular basis of disease; human genome project.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Grade Pass/No Pass Option

BIOS 816 Biodiversity Conservation

Crosslisted with: BIOS 416

Prerequisites: BIOS 207 or NRES 220

Description: Basic conservation science theory and conservation decision making tools which are essential for making effective decisions for biodiversity conservation. Topics include systematic conservation planning, population viability analysis, risk assessment, and applying those tools to real conservation problems.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Grade Pass/No Pass Option

Course and Laboratory Fee: \$10

BIOS 818 Advanced Genetics

Crosslisted with: BIOS 418

Prerequisites: BIOS 206 and Senior standing

Description: In-depth study of the principles and methodology of genetics, with emphasis on *Drosophila*: multiple alleles and complex loci, linkage and recombination, chromosome rearrangements, fine structure analysis, sex determination, recombinant DNA, and gene function in development.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Grade Pass/No Pass Option

BIOS 820 Molecular Genetics

Crosslisted with: BIOS 420, VBMS 820, MBIO 420

Prerequisites: BIOS 206 and Senior standing

Description: Molecular basis of genetics. Gene structure and regulation, transposable elements, chromosome structure, DNA replication, and repair mechanisms and recombination.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Grade Pass/No Pass Option

Prerequisite for: AGRO 963, HORT 963, PLPT 963; BIOS 945; BIOS 964, VBMS 964; FDST 908B

BIOS 821 Microbial Diversity

Crosslisted with: BIOS 421, MBIO 421

Prerequisites: BIOS 206 and BIOS 312 and Senior Standing.

Description: Diversity of microbial cell composition, structure, and function enabling movement, metabolism, symbiosis, and adaptation using bacterial, fungal, algal, and viral examples. A physiological, biochemical and molecular approach used throughout.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Grade Pass/No Pass Option

BIOS 822 Comparative Physiology

Crosslisted with: BIOS 422

Prerequisites: BIOS 213

Description: Comprehensive survey of comparative physiology with emphasis on the diversity of adaptations in basic physiological systems and the effects of environmental parameters upon such systems. Comparative physiology of osmoregulation, temperature regulation, metabolism, muscle, central nervous function, and sensory function.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Grade Pass/No Pass Option

Course and Laboratory Fee: \$10

BIOS 823 Quaternary Paleoclimatology and Paleoecology

Crosslisted with: BIOS 423, GEOL 423, GEOL 823

Prerequisites: 12 hrs GEOL or BIOS.

Description: Analysis and interpretation of the Quaternary period's paleoecological data. Patterns of long-term climate variation. Distribution patterns and responses of organisms and ecosystems to Quaternary environmental change.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Grade Pass/No Pass Option

BIOS 824 Biogeochemical Cycles

Crosslisted with: BIOS 424, GEOL 424, GEOL 824

Prerequisites: CHEM 109A and 109L or CHEM 113A and 113L; 12 hrs GEOL or BIOS.

Description: Chemical cycling at or near the earth's surface, emphasizing interactions among the atmosphere, biosphere, geosphere and hydrosphere. Modern processes, the geological record, and human impacts on elemental cycles.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Grade Pass/No Pass Option

BIOS 825 Plant Biotechnology

Crosslisted with: BIOS 425

Prerequisites: BIOS 206.

Description: Introduction to the use of plants for basic and applied purposes by deliberate manipulation of their genomes; techniques in plant genetic engineering; manipulations of plant development and metabolism; engineering pest, disease, and stress resistance; plants as bioreactors; and environmental and social impacts of plant biotechnology.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Grade Pass/No Pass Option

BIOS 826 Systems Biology

Crosslisted with: BIOS 426

Prerequisites: LIFE 120 and LIFE 121 or BIOS 101; STAT 218 or STAT 380 or EDPS 459 or PSYC 350 or ECON 215.

Notes: BIOS 206 and CSCE 155T are recommended, but not required.

Description: Fundamentals of the analysis of high throughput experiments to understand complex biological systems. Principles and methods such as next generation sequencing, protein-protein interaction networks, regulatory networks, and biological data mining and integration. Emerging research in new biotechnology and data analysis in biomedical and life sciences.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Grade Pass/No Pass Option

BIOS 827 Practical Bioinformatics Laboratory

Crosslisted with: BIOS 427

Prerequisites: BIOS 206

Notes: No computer programming skill is required.

Description: Basic knowledge and skills needed for general bioinformatics, genomics and proteomics analyses. Various computational analyses including database search, sequence alignment, phylogenetic reconstruction, gene prediction/mining, microarray data analyses and protein structure analyses.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Grade Pass/No Pass Option

BIOS 829 Phylogenetic Biology**Crosslisted with:** BIOS 429**Prerequisites:** BIOS 207 and Senior standing**Description:** Principles of phylogenetic inference and emphasis on the application of phylogenetic hypotheses in biology and the biomedical sciences. How inferences derived from phylogenetic trees can be applied in different areas of biological investigation including systematics, biogeography, conservation biology, molecular evolution, genome structure, epidemiology, population biology, ecology, character evolution, behavior, and macroevolution.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Grade Pass/No Pass Option**BIOS 830 Communicating Science through Outreach****Crosslisted with:** BIOS 430**Prerequisites:** BIOS 207.**Notes:** Students must have at least one afternoon available for running a middle school science club (typically between 3-5pm). Background checks required.**Description:** Introduction to science communication, formal versus informal science education, and best practices in informal science education. Review of state and national science standards and how students learn. Introduction to informal science practitioners and facilities in Nebraska. Role playing and development and implementation of hands on, inquiry-based science activities. Training in evaluation and assessment.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**Offered:** FALL/SPR**BIOS 831 Biochemistry I: Structure and Metabolism****Crosslisted with:** BIOC 431, BIOC 831, BIOS 431, CHEM 431, CHEM 831**Prerequisites:** LIFE 120 with a grade of C or better; CHEM 252 or CHEM 262 with a grade of C or better.**Notes:** BIOS 206 or PLAS 215 is recommended. First course of a two-semester, comprehensive biochemistry course sequence.**Description:** Structure and function of proteins, nucleic acids, carbohydrates and lipids; nature of enzymes; major metabolic pathways of catabolism; and biochemical energy production.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**Offered:** FALL/SPR**Prerequisite for:** AGRO 810, BIOC 810, HORT 810; ASCI 820; ASCI 917;

ASCI 925, NUTR 925; ASCI 926, NUTR 926; ASCI 927, NUTR 927; BIOC 305; BIOC 390; BIOC 432, BIOC 832, BIOS 432, CHEM 432, CHEM 832, BIOS 832; BIOC 433, BIOC 833, BIOS 433, BIOS 833, CHEM 433, CHEM 833; BIOC 433H; BIOC 440; FDST 470, FDST 870; NUTR 450; NUTR 455; NUTR 820, NUTR 420; NUTR 821; PLAS 434, BIOC 434, BIOS 434, CHEM 434, AGRO 834, BIOC 834, BIOS 834, CHEM 834; VBMS 410; VBMS 805; VBMS 950

BIOS 832 Biochemistry II: Metabolism and Biological Information**Crosslisted with:** BIOC 432, BIOC 832, BIOS 432, CHEM 432, CHEM 832**Prerequisites:** BIOC 431/831 with a grade of C or better; BIOS 206 or PLAS 215 with a grade of C or better.**Notes:** Continuation of BIOC 431/831.**Description:** Major metabolic pathways of anabolism, structural and biochemical aspects of biological information flow and use in biotechnology.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**Offered:** FALL/SPR**Prerequisite for:** ASCI 949, BIOC 949, NUTR 949; BIOC 435; BIOC 932, BIOS 932, CHEM 932; BIOC 933, BIOS 933, CHEM 933; BIOC 934, BIOS 934, CHEM 934; BIOC 935, BIOS 935, CHEM 935; BIOC 998; VBMS 919; VBMS 950; VBMS 951**BIOS 833 Biochemistry Laboratory****Crosslisted with:** BIOC 433, BIOC 833, BIOS 433, CHEM 433, CHEM 833**Prerequisites:** BIOC 431/831 or parallel; or CHEM 435/835.**Description:** Introduction to techniques used in biochemical and biotechnology research, including measurement of pH, spectroscopy, analysis of enzymes, chromatography, fractionation of macromolecules, electrophoresis, and centrifugation.**Credit Hours:** 2**Max credits per semester:** 2**Max credits per degree:** 2**Grading Option:** Grade Pass/No Pass Option**Offered:** FALL/SPR**Prerequisite for:** BIOC 437, BIOC 837, BIOS 437, BIOS 837; BIOC 898**Course and Laboratory Fee:** \$50**BIOS 834 Plant Biochemistry****Crosslisted with:** PLAS 434, BIOC 434, BIOS 434, CHEM 434, AGRO 834, BIOC 834, CHEM 834**Prerequisites:** BIOC/BIOS/CHEM 431/831.**Description:** Biochemical metabolism unique to plants. Relationships of topics previously acquired in general biochemistry to biochemical processes unique to plants. Biochemical mechanisms behind physiological processes discussed in plant or crop physiology.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**BIOS 835 Evolutionary Medicine****Crosslisted with:** BIOS 435**Prerequisites:** BIOS 207 and senior standing**Description:** Application of evolutionary tools to biomedical questions. Managing the evolution of drug resistance and pathogen virulence. Evolutionary principles of vaccine design. Emerging infectious disease. Human evolutionary history. Life-history trade-offs in human evolution. Parent-offspring and parent-parent conflict. Mismatch hypothesis. Hygiene hypothesis.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**Offered:** SPRING

BIOS 836 Macroecology**Crosslisted with:** BIOS 436**Prerequisites:** BIOS 207**Description:** Species-area relationships, latitudinal gradients in species richness, abundance diversity relationships, ecological scaling relationships with body size, community assembly, evolutionary dynamics, climate change, and human impacts on the ecology of the Anthropocene.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**BIOS 837 Research Techniques in Biochemistry****Crosslisted with:** BIOC 437, BIOC 837, BIOS 437**Prerequisites:** BIOC/BIOS/CHEM 433/833.**Description:** Methods approach to systems biology analysis. Molecular identification and quantification employing techniques such as mass spectrometry, chromatography, electrophoretic fractionation, transcriptomics, proteomics and metabolomics. Data and pathway analysis with computational methods.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Grade Pass/No Pass Option**Prerequisite for:** VBMS 919**Course and Laboratory Fee:** \$50**BIOS 839 Dynamics of Biochemical and Biological Networks****Crosslisted with:** BIOC 439, BIOC 839, BIOS 439**Prerequisites:** BIOS 206 or PLAS 215; BIOC 401 or BIOC 431**Notes:** Letter grade only.**Description:** To introduce and integrate, students in biochemistry and other life sciences, to the field of computational modeling of biochemical and biological network systems into a seamless curriculum.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Offered:** SPRING**Prerequisite for:** ASCI 949, BIOC 949, NUTR 949; BIOC 932, BIOS 932, CHEM 932; BIOC 933, BIOS 933, CHEM 933; BIOC 998**BIOS 840 Microbial Physiology****Crosslisted with:** BIOS 440, VBMS 840, MBIO 440, VBMS 440**Prerequisites:** BIOS 312; BIOS 313 or BIOS 314.**Description:** Molecular approaches to the study of prokaryotic cell structure and physiology, including growth, cell division, metabolism, and alternative microbial life styles.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**Course and Laboratory Fee:** \$20**BIOS 841 Pathogenic Microbiology****Crosslisted with:** BIOS 441, VBMS 441, VBMS 841**Prerequisites:** BIOS 312**Description:** Fundamental principles involved in host-microorganism interrelationships. Identification of pathogens, isolation, propagation, mode of transmission, pathogenicity, symptoms, treatment, prevention of disease, epidemiology, and methods of control.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**Offered:** SPRING**Prerequisite for:** VBMS 805; VBMS 949**Course and Laboratory Fee:** \$25**BIOS 842 Endocrinology****Crosslisted with:** ASCI 442, ASCI 842, BIOS 442, VBMS 842**Prerequisites:** A course in vertebrate physiology and/or biochemistry.**Description:** Mammalian endocrine glands from the standpoint of their structure, their physiological function in relation to the organism, the chemical nature and mechanisms of action of their secretory products, and the nature of anomalies manifested with their dysfunction.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**BIOS 843 Immunology****Crosslisted with:** BIOS 443, VBMS 843, MBIO 443, VBMS 443**Prerequisites:** BIOS 206; CHEM 251 or CHEM 255 or CHEM 261.**Description:** Fundamental consideration of cellular and humoral mechanisms of immunity, the structure and function of immunoglobulins, antigen-antibody interactions; hypersensitivity; transplantation and tumor immunity; immune and autoimmune disorders.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**Prerequisite for:** VBMS 852; VBMS 908; VBMS 910; VBMS 948; VBMS 949**BIOS 844 Earth and Environmental Microbiology****Crosslisted with:** BIOS 444, GEOL 444, GEOL 844**Prerequisites:** 3 hours of BIOS or 3 hours of LIFE; 3 hours of CHEM**Description:** An introduction into the role that microorganisms play and have played in natural and man-made environments. Topics covered include microbial diversity and physiology in soil, sediment, and water; microbes in Earth history; biogeochemical cycling; mineral formation and dissolution; biodegradation and bioremediation; biotechnology.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option

BIOS 845 Food Microbiology**Crosslisted with:** BIOS 445, FDST 405, FDST 805**Prerequisites:** BIOS 312**Notes:** BIOC 401 or BIOC 431 recommended**Description:** Nature, physiology, and interactions of microorganisms in foods. Introduction to food-borne diseases, the effect of food processing systems on the microflora of foods, principles of food preservation, food spoilage, and foods produced by microorganisms. Food plant sanitation and criteria for establishing microbial standards for food products.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**Offered:** FALL/SPR**Prerequisite for:** BIOS 446, BIOS 846, FDST 406, FDST 806; FDST 424, FDST 824; FDST 425, FDST 825; FDST 455L, FDST 855L, MBIO 455L; FDST 460, FDST 860; FDST 867; FDST 875; FDST 877; FDST 908B**BIOS 846 Food Microbiology Laboratory****Crosslisted with:** BIOS 446, FDST 406, FDST 806**Prerequisites:** Parallel in FDST 405/805/BIOS 446/846.**Description:** The microorganisms in foods and the methods used to study them.**Credit Hours:** 2**Max credits per semester:** 2**Max credits per degree:** 2**Grading Option:** Grade Pass/No Pass Option**Course and Laboratory Fee:** \$40**BIOS 849 Woody Plant Growth and Development****Crosslisted with:** HORT 849, NRES 849**Prerequisites:** CHEM 251 and AGRO 325**Description:** Plant growth and development specifically of woody plants as viewed from an applied whole-plant physiological level. Plant growth regulators, structure and secondary growth characteristics of woody plants, juvenility, senescence, abscission and dormancy.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**BIOS 850 Biology of Wildlife Populations****Crosslisted with:** BIOS 450, NRES 450, NRES 850**Prerequisites:** NRES 311; MATH 104 or above; STAT 218 or equivalent**Description:** Principles of population dynamics. Management strategies (for consumptive and nonconsumptive fish and wildlife species) presented utilizing principles developed.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Grade Pass/No Pass Option**Offered:** SPRING**BIOS 851 Invertebrate Paleobiology****Crosslisted with:** GEOL 451, BIOS 451, GEOL 851**Prerequisites:** At least one of: GEOL 103, GEOL 105, LIFE 121**Description:** Overview of the key traits, relationships and evolutionary dynamics of invertebrate animals over Earth's history, particularly over the Phanerozoic (i.e., the last 540 million years). Emphasis on the use of invertebrate fossil record to test ideas about long term evolutionary patterns as well as learning the histories and basic anatomies of major invertebrate taxa.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**Offered:** SPRING**BIOS 852 Field Epidemiology****Crosslisted with:** BIOS 452**Prerequisites:** LIFE 121; LIFE 121L; three hours of BIOS**Notes:** Offered summers only at Cedar Point Biological Station.**Description:** Principles of epidemiology and the role in modern medicine. Combination of theory and practice with living populations.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Grade Pass/No Pass Option**Offered:** SUMMER**Prerequisite for:** VBMS 949**Experiential Learning:** Fieldwork**BIOS 853 Predator Ecology****Crosslisted with:** BIOS 453**Prerequisites:** BIOS 207 or NRES 220**Description:** Conservation and management of native and invasive predators. Functional and numerical responses. Evolution of predator-prey interactions. Optimal foraging. Modeling predator-prey population dynamics. Trophic cascades. Prey defenses against predation.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Grade Pass/No Pass Option**Offered:** SUMMER**Experiential Learning:** Fieldwork**BIOS 854 Ecological Interactions****Crosslisted with:** BIOS 454, NRES 454, NRES 854**Prerequisites:** LIFE 121; LIFE 121L; BIOS 207 or NRES 220; Senior Standing**Description:** Nature and characteristics of populations and communities. Interactions within and between populations in community structure and dynamics. Direct and indirect interactions and ecological processes, competition, predation, parasitism, herbivory, and pollination. Structure, functioning and persistence of natural communities, foodweb dynamics, succession, and biodiversity.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded

BIOS 856 Mathematical Models in Biology**Crosslisted with:** BIOS 456, NRES 456, NRES 856**Prerequisites:** LIFE 120; LIFE 120L; LIFE 121; LIFE 121L; MATH 107**Description:** Biological systems, from molecules to ecosystems, are analyzed using mathematical techniques. Strengths and weaknesses of mathematical approaches to biological questions. Brief review of college level math; introduction to modeling; oscillating systems in biology; randomness in biology; review of historically important and currently popular models in biology.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**BIOS 857 Ecosystem Ecology****Crosslisted with:** BIOS 457, GEOL 457, GEOL 857**Prerequisites:** BIOS 207 and CHEM 110A and 110L and Senior standing**Description:** Processes controlling the cycling of energy and elements in ecosystems and how both plant and animal species influence them. Human-influenced global and local changes that alter these cycles and ecosystem functioning.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Grade Pass/No Pass Option**Prerequisite for:** BSEN 954, NRES 954**BIOS 859 Limnology****Crosslisted with:** BIOS 459, NRES 459, NRES 859**Prerequisites:** BIOS 207 or NRES 220; CHEM 106A & CHEM 106L or CHEM 110A & CHEM 110L**Description:** Physical, chemical, and biological processes that occur in fresh water. Organisms occurring in fresh water and their ecology; biological productivity of water and its causative factors; eutropication and its effects.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Grade Pass/No Pass Option**Offered:** SPRING**Course and Laboratory Fee:** \$85**BIOS 860 Soil Microbial Ecology****Crosslisted with:** PLAS 460, BIOS 460, NRES 460, SOIL 460, AGRO 860, NRES 860**Prerequisites:** Senior standing.**Notes:** Recommend having a strong science background, including courses from the agronomic, environmental, microbiology, engineering or medicine disciplines.**Description:** Soil from a microbe's perspective-growth, activity and survival strategies; principles governing methods to study microorganisms and biochemical processes in soil; mechanisms controlling organic matter cycling and stabilization with reference to C, N, S, and P; microbial interactions with plants and animals; and agronomic and environmental applications of soil microorganisms.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**Offered:** SPRING**BIOS 862 Animal Behavior****Crosslisted with:** BIOS 462**Prerequisites:** BIOS 206, 207 and Senior Standing**Description:** Introduction to animal behavior stressing the ethological approach. Anatomical and physiological bases of behavior, ontogenetic and phylogenetic observations, and the relations of animal behavior studies to genetics, ecology, taxonomy, and evolution.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**BIOS 865 Behavioral Neuroscience****Crosslisted with:** BIOS 465, PSYC 465, PSYC 865**Prerequisites:** PSYC 273**Description:** Relationship of physiological variables to behavior, an introduction to laboratory techniques in neuropsychology.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**BIOS 866 Advanced Methods in Neurobiology****Crosslisted with:** BIOS 466**Prerequisites:** LIFE 120**Notes:** BIOS 206 and BIOS 213 are recommended.**Description:** Examination of current technologies and methodologies used in neuroscience pertaining to medical, laboratory, and industrial applications across several organisms.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**Offered:** SPRING**BIOS 871 Plant Systematics****Crosslisted with:** BIOS 471**Prerequisites:** LIFE 121 and LIFE 121L.**Description:** Overview of the diversity of plants and algae, with emphasis on phylogenetic relationships, the evolution of important physical and genomic characteristics, principles of plant classification and identification, and modern methods of plant molecular systematics. Lab work on taxonomic analysis and plant identification.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Grade Pass/No Pass Option**Course and Laboratory Fee:** \$15**BIOS 874 Herpetology****Crosslisted with:** BIOS 474, NRES 474, NRES 874**Prerequisites:** NRES/BIOS 386**Description:** Fossil and living amphibians and reptiles. Anatomy, classification, ecology and evolution.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Grade Pass/No Pass Option**Offered:** FALL**Course and Laboratory Fee:** \$50

BIOS 875 Avian Biology

Crosslisted with: BIOS 475, NRES 471, NRES 871

Prerequisites: LIFE 121 & LIFE 121L

Notes: May also be offered at Cedar Point Biological Station.

Description: Biology of birds emphasizing the behavior and ecology of this group. Topics include avian diversity, systematics & evolutionary history, flight, foraging, migration, communication, reproductive biology, population ecology and conservation biology.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Grade Pass/No Pass Option

Experiential Learning: Fieldwork

BIOS 875L Avian Biology Laboratory

Crosslisted with: BIOS 475L

Prerequisites: Parallel registration in BIOS 475/875

Description: Avian field identification in diverse prairie, riparian, and montane habitats. Individual studies of foraging behavior, territoriality, anti-predator behavior, mating systems, or nesting ecology.

Credit Hours: 1

Max credits per semester: 1

Max credits per degree: 1

Grading Option: Grade Pass/No Pass Option

BIOS 876 Mammalogy

Crosslisted with: BIOS 476, NRES 476, NRES 876

Prerequisites: 8 hrs BIOS; BIOS/NRES 386 or NRES 311.

Notes: May also be offered at Cedar Point Biological Station. Field trips are required and may occur outside of scheduled class time. Lab and field time emphasize diversity of mammalian families and species identification of Nebraska mammals.

Description: Evolution, natural history, ecology, and functional morphology of planetary mammals and mammals of the Northern Great Plains.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Grade Pass/No Pass Option

Course and Laboratory Fee: \$25

BIOS 877 Bioinformatics and Molecular Evolution

Crosslisted with: BIOS 477

Prerequisites: BIOS 206 or parallel; CHEM 251 or CHEM 255 or CHEM 261.

Notes: Statistics course recommended.

Description: Pairwise and multiple alignments, sequence similarity and domain search, distance estimation, phylogenetic methods, gene mining, protein classification and structure. Algorithms used in bioinformatics as well as fundamental concepts of molecular evolution that underlie various bioinformatics methods.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Grade Pass/No Pass Option

BIOS 878 Plant Anatomy

Crosslisted with: BIOS 478, PLAS 478, AGRO 878, HORT 878

Prerequisites: 8 hrs biological sciences

Description: Development, structure, and function of tissues and organs of the higher plants. Relationships of structure to physiology and ecology of plants.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Grade Pass/No Pass Option

BIOS 880 Ecology and Evolution of Arachnids

Crosslisted with: BIOS 480

Prerequisites: BIOS 207 or NRES 220

Description: Ecology and evolutionary biology of living arachnids.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Grade Pass/No Pass Option

BIOS 885 Aquatic Insects

Crosslisted with: BIOS 485, ENTO 402, ENTO 802, NRES 402, NRES 802

Prerequisites: 12 hrs biological sciences.

Description: Biology and ecology of aquatic insects.

Credit Hours: 2

Max credits per semester: 2

Max credits per degree: 2

Grading Option: Grade Pass/No Pass Option

Prerequisite for: BIOS 485L, BIOS 885L, ENTO 402L, ENTO 802L, NRES 402L, NRES 802L

BIOS 885L Identification of Aquatic Insects

Crosslisted with: BIOS 485L, ENTO 402L, ENTO 802L, NRES 402L, NRES 802L

Prerequisites: Parallel ENTO 802, NRES 402/802, BIOS 485/885.

Description: Identification of aquatic insects to the family level.

Credit Hours: 1

Max credits per semester: 1

Max credits per degree: 1

Grading Option: Grade Pass/No Pass Option

Course and Laboratory Fee: \$25

BIOS 887 Field Parasitology

Crosslisted with: BIOS 487

Prerequisites: LIFE 120; LIFE 120L; LIFE 121; LIFE 121L

Notes: BIOS 207 or NRES 220 recommended. Offered summers only at Cedar Point Biological Station.

Description: Animal host-parasite relationships, epizootiology, ecology, host distribution, classification, and life cycle stages of animal parasites.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Grade Pass/No Pass Option

Experiential Learning: Fieldwork

BIOS 889 Ichthyology**Crosslisted with:** BIOS 489, NRES 489, NRES 889**Prerequisites:** LIFE 120 and LIFE 121**Notes:** May also be offered at Cedar Point Biological Station.**Description:** Fishes, their taxonomy, physiology, behavior, and ecology. Dynamics of fish stocks and factors regulating their production.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Grade Pass/No Pass Option**Course and Laboratory Fee:** \$20**Experiential Learning:** Research**BIOS 891 Special Topics in Biological Sciences****Crosslisted with:** BIOS 491**Prerequisites:** BIOS 206 or BIOS 207**Description:** Topics vary.**Credit Hours:** 1-4**Min credits per semester:** 1**Max credits per semester:** 4**Max credits per degree:** 9**Grading Option:** Grade Pass/No Pass Option**BIOS 899 Masters Thesis****Prerequisites:** Admission to masters degree program and permission of major adviser**Credit Hours:** 1-10**Min credits per semester:** 1**Max credits per semester:** 10**Max credits per degree:** 99**Grading Option:** Grade Pass/No Pass Option**BIOS 915 Graduate Seminar****Prerequisites:** Permission**Credit Hours:** 1-3**Min credits per semester:** 1**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**BIOS 915A Genetics, Cellular and Molecular Biology (GCMB)****Credit Hours:** 1-3**Min credits per semester:** 1**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**BIOS 915B Graduate Seminar - Behavioral Ecology****Credit Hours:** 1-3**Min credits per semester:** 1**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**BIOS 915E Graduate Seminar - Ecology, Evolution and Behavior (EEBE)****Credit Hours:** 1-3**Min credits per semester:** 1**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**BIOS 915N Population Ecology****Credit Hours:** 1-3**Min credits per semester:** 1**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**BIOS 915P Graduate Seminar - Parasitology****Credit Hours:** 1-3**Min credits per semester:** 1**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**BIOS 920 Viral Evolution****Description:** The mechanisms by which DNA and RNA viruses evolve. The relationships between virulence, attenuation and host selection. Transfer of genetic material between virus and host. Evolution of HIV leading to escape from immunologic pressure or drug selection.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**BIOS 922 Viral Oncology****Description:** Viral oncogenes and the cellular pathways that they influence. The mechanisms by which DNA and RNA viruses cause cancer. Discovery of novel tumor viruses.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**BIOS 932 Proteins****Crosslisted with:** BIOC 932, CHEM 932**Prerequisites:** BIOC/BIOS/CHEM 832 or BIOC/BIOS/CHEM 839**Description:** Protein structure and function.**Credit Hours:** 2**Max credits per semester:** 2**Max credits per degree:** 2**Grading Option:** Grade Pass/No Pass Option**BIOS 933 Enzymes****Crosslisted with:** BIOC 933, CHEM 933**Prerequisites:** BIOC/BIOS/CHEM 432/832, or BIOC/BIOS/CHEM 839**Description:** Kinetics regulation and reaction mechanisms of enzymes.**Credit Hours:** 2**Max credits per semester:** 2**Max credits per degree:** 2**Grading Option:** Grade Pass/No Pass Option**BIOS 934 Genome Dynamics and Gene Expression****Crosslisted with:** BIOC 934, CHEM 934**Prerequisites:** BIOC/BIOS/CHEM 832**Description:** Detailed examination of dynamic control mechanisms of genome maintenance and gene regulation. Mechanisms of transcription, translation, and replication based on analysis of current and seminal literature.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option

BIOS 935 Metabolic Function and Dysfunction**Crosslisted with:** BIOC 935, CHEM 935**Prerequisites:** BIOC/CHEM/BIOS 432/832 and permission**Description:** Current metabolic research at the bioenergetic, metabolomic, and molecular level. The normal metabolic processes that go awry in cancer, obesity, and oxidative stress.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**BIOS 942 Genetics, Genomics, and Bioinformatics of Prokaryotes****Crosslisted with:** VBMS 942**Description:** Prokaryotic gene regulation, DNA exchange, DNA recombination and repair, comparative prokaryotic genomics and computer-based methods of analysis.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**BIOS 945 RNA Biology****Prerequisites:** BIOS 820**Description:** Role of RNA in regulation of gene expression and in determining genome structure. Regulation of mRNA stability and function, RNA as regulatory molecules and enzymes, and computer-based methods of analysis.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**BIOS 947 Industrial Microbiology and Biotechnology****Notes:** BIOS 840 recommended.**Description:** Biosynthetic activity of bacteria, yeasts, and fungi, including genetically engineered organisms: antibiotic, amino acid, enzyme, and vitamin production; polysaccharides, steroid transformation, microbes as food sources, microbial insecticides, petroleum microbiology, fermentation engineering, and mass production of microbial cells.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**BIOS 952 Likelihood & Bayesian Ecology****Notes:** NRES/STAT 803 recommended.**Description:** Covers the use of maximum likelihood and Bayesian analysis in analyzing ecological data broadly defined. A conceptual understanding of the statistical tools is emphasized as well as a practical experience of conducting the analysis using real data and current software.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**Offered:** FALL**BIOS 960 Biosystematics and Nomenclature****Crosslisted with:** ENTO 960**Description:** Methods and principles of systematics and nomenclature.**Credit Hours:** 2-3**Min credits per semester:** 2**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**BIOS 962 Animal Communication****Prerequisites:** BIOS 804**Description:** Course work in physics recommended. Advanced introduction to the evolution of animal communication. Addresses evolution of signal structure (including acoustic, visual, electrical, and chemical signals), environmental effects on signal transmission, and the evolution of receiver responses to signals.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**BIOS 964 Signal Transduction****Crosslisted with:** VBMS 964**Prerequisites:** BIOS 820.**Description:** Molecular basis of genetics in eukaryotes. Gene structure and regulation, transposable elements, chromosome structure, DNA replication and repair mechanisms and recombination.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**BIOS 967 Introduction to R for Biological Sciences****Description:** Gain practical knowledge of the R programming language for statistical analysis, graphics, data management and simulations in the biological sciences.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**BIOS 996 Research****Prerequisites:** Permission of instructor and departmental Graduate Committee**Description:** Research other than thesis.**Credit Hours:** 3-10**Min credits per semester:** 3**Max credits per semester:** 10**Max credits per degree:** 10**Grading Option:** Grade Pass/No Pass Option**BIOS 998 Special Topics in the Life Sciences****Prerequisites:** Permission**Description:** Reviews of specialized subject areas. Subject dependent on student demand and availability of staff.**Credit Hours:** 1-24**Min credits per semester:** 1**Max credits per semester:** 24**Max credits per degree:** 24**Grading Option:** Grade Pass/No Pass Option**BIOS 999 Doctoral Dissertation****Prerequisites:** Admission to doctoral degree program and permission of supervisory committee chair**Credit Hours:** 1-24**Min credits per semester:** 1**Max credits per semester:** 24**Max credits per degree:** 99**Grading Option:** Grade Pass/No Pass Option