# Biological Sciences (BIOS)

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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Crosslisted with</th>
<th>Prerequisites</th>
<th>Description</th>
<th>Credit</th>
<th>Max per semester</th>
<th>Max per degree</th>
<th>Format</th>
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<tbody>
<tr>
<td>BIOS 802</td>
<td>Cancer Biology</td>
<td>BIOS 402</td>
<td>BIOS 206 and Senior standing.</td>
<td>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.</td>
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<tr>
<td>BIOS 803</td>
<td>Principles of Evolution</td>
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<td>Micro- and macroevolutionary patterns and processes. Population genetics, evolutionary ecology, speciation, phylogenetic systematics, and biogeographic patterns of extant and extinct taxa.</td>
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<tr>
<td>BIOS 804</td>
<td>Principles of Behavioral Ecology</td>
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<td>Introduction to the ecology and evolution of animal behavior.</td>
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<td>BIOS 805</td>
<td>Principles of Ecology</td>
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<td>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, tropic cascades, patterns and mechanisms underlying species diversity, ecosystem processes, nutrient cycling, and global change.</td>
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<tr>
<td>BIOS 806</td>
<td>Insect Ecology</td>
<td>BIOS 406, ENTO 406, ENTO 806</td>
<td>BIOS/NRES 220 and 222</td>
<td>Biotic and abiotic factors as they influence insect development, behavior, distribution, and abundance.</td>
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<tr>
<td>BIOS 807</td>
<td>Biology of Cells and Organelles</td>
<td>BIOS 407</td>
<td>BIOS 206</td>
<td>Regulation and timing of macromolecular synthesis during the cell cycle; the genetic autonomy of mitochondria and chloroplasts.</td>
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<td>BIOS 808</td>
<td>Functional Histology</td>
<td>BIOS 408, VBMS 408, VBMS 808</td>
<td>BIOS 101 and 101L or LIFE 120 and 120L or BIOS 112; BIOS 213 or ASCI 240. BIOS 315 recommended</td>
<td>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 organizational well being. General introduction to pathological processes and principles underlying some diseases.</td>
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<td>BIOS 809</td>
<td>Professionalism</td>
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<td>Discussion of skills needed to be a professional scientist including: writing, submitting, editing, and revision of journal articles and grant proposals; preparation or oral and poster presentations; and ethical issues in research and teaching.</td>
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<tr>
<td>BIOS 810</td>
<td>Plant Molecular Biology</td>
<td>AGRO 810, BIOC 810, HORT 810</td>
<td>AGRO 215 or BIOS 206; BIOC 831 or permission</td>
<td>Molecular genetic basis of biological function in higher plants. Genome organization, gene structure and function, regulation of gene expression, recombinant DNA, and genetic engineering principles. Material taken primarily from current literature.</td>
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<td>BIOS 811</td>
<td>Plant Tissue Culture</td>
<td>HORT 811, NRES 811</td>
<td>BIOS 109; AGRO 325 which includes CHEM 109, 110; or equivalent</td>
<td>Survey of techniques used in plant cell, tissue and organ culture, including current research. Laboratory emphasizes practical manipulation of plant cells, tissues, and organs, including examples from woody and herbaceous plant species.</td>
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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
Format: LEC

BIOS 813 Animal Physiology I
Crosslisted with: VMED 645, ASCI 845, VBMS 845
Prerequisites: Undergraduate courses in biochemistry, biology and physiology.
Notes: Primarily for students in animal or biological sciences or veterinary medicine.
Description: Mammalian physiology and cellular mechanisms. Physiology of the cell, embryology, and neuro-sensory, neuromuscular, endocrine, and reproductive systems.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC

BIOS 814 Animal Physiology II
Crosslisted with: VMED 646, ASCI 846, VBMS 846
Prerequisites: ASCI/VBMS 845 or BIOS 813
Notes: ASCI/VBMS 846/BIOS 814/VMED 646 is designed for students in animal or biological sciences or veterinary medicine.
Description: Mammalian physiology and cellular mechanisms. Physiology of the digestive, cardiovascular, respiratory, and renal systems.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC

BIOS 815 Developmental Biology
Crosslisted with: BIOS 415
Prerequisites: BIOS 206.
Description: Survey of topics in developmental biology, both animal and plant development.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

BIOS 816 Biodiversity Conservation
Crosslisted with: BIOS 416
Prerequisites: BIOS 207 or BIOS 220/NRES 220 and BIOS 222/NRES 222.
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
Format: LEC

BIOS 817 Plant-Water Relations
Crosslisted with: AGRO 807, NRES 807
Prerequisites: AGRO 325 or equivalent; MATH 106 recommended
Description: Quantitative study of water relations in the soil-plant-atmosphere system. Basic physical processes, which describe the movement of water in the soil and the atmosphere, and the physiological processes, which describe water movement inside of the plant. Stomata physiology and the effects of internal water deficits on photosynthesis, respiration, nitrogen metabolism, cell division and cell enlargement. Results from integrative models used to study the relative importance of environmental versus physiological factors for several plant-environment systems.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

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
Format: LEC

BIOS 819 Behavioral Neuroscience
Crosslisted with: BIOS 419, PSYC 465, PSYC 865
Prerequisites: PSYC 273 or PSYC 373 or BIOS 373.
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
Format: LEC

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
Format: LEC
Prerequisite for: 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
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<td>BIOS 822</td>
<td>Comparative Physiology</td>
<td>BIOS 422</td>
<td>BIOS 213</td>
<td><strong>Description:</strong> 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.</td>
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<td>BIOS 825</td>
<td>Plant Biotechnology</td>
<td>BIOS 425</td>
<td>BIOS 206</td>
<td><strong>Description:</strong> 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.</td>
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<td>BIOS 826</td>
<td>Systems Biology</td>
<td>BIOS 426</td>
<td>LIFE 120 and LIFE 121, or BIOS 101 or equivalent; STAT 218 or equivalent.</td>
<td><strong>Description:</strong> 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.</td>
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<td>BIOS 827</td>
<td>Practical Bioinformatics Laboratory</td>
<td>BIOS 427</td>
<td>BIOS 206 or equivalent.</td>
<td><strong>Prerequisites:</strong> BIOS 206 or equivalent. <strong>Description:</strong> 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.</td>
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<td>BIOS 828</td>
<td>Perl Programming for Biological Applications</td>
<td>BIOS 428</td>
<td>LIFE 120 and LIFE 121</td>
<td><strong>Prerequisites:</strong> LIFE 120 and LIFE 121. <strong>Description:</strong> Computer programming, using Perl, as applied to biological sciences, bioinformatics, computational biology, and genomics.</td>
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<td>BIOS 829</td>
<td>Phylogenetic Biology</td>
<td>BIOS 429</td>
<td>BIOS 207 and Senior standing.</td>
<td><strong>Prerequisites:</strong> BIOS 207 and Senior standing. <strong>Description:</strong> 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.</td>
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<td>BIOS 831</td>
<td>Structure and Metabolism</td>
<td>BIOS 431/831</td>
<td>BIOC 431/831 with a grade of C or better, BIOS 206 or AGRO 215.</td>
<td><strong>Prerequisites:</strong> CHEM 252 or CHEM 262 with a grade of C or better. LIFE 120 and BIOS 206 are recommended.  <strong>Notes:</strong> First course of a two-semester, comprehensive biochemistry course sequence. <strong>Description:</strong> Structure and function of proteins, nucleic acids, carbohydrates and lipids; nature of enzymes; major metabolic pathways of catabolism; and biochemical energy production.</td>
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<td>BIOS 832</td>
<td>Metabolism and Biological Information</td>
<td>BIOS 432/832</td>
<td>BIOC 431/831 with a grade of C or better, BIOS 206 or AGRO 215.</td>
<td><strong>Prerequisites:</strong> BIOS 432/832, BIOS 432, CHEM 432, CHEM 832 <strong>Notes:</strong> Continuation of BIOC 431/831. <strong>Description:</strong> Major metabolic pathways of anabolism, structural and biochemical aspects of biological information flow and use in biotechnology.</td>
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<td>BIOS 833</td>
<td>Biochemistry Laboratory</td>
<td>BIOS 433/833</td>
<td>BIOC 433, BIOS 833, BIOS 433, CHEM 833, CHEM 833</td>
<td><strong>Prerequisites:</strong> BIOC 433/833 (or concurrent enrollment) or CHEM 435/835. <strong>Description:</strong> Introduction to techniques used in biochemical and biotechnology research, including measurement of pH, spectroscopy, analysis of enzymes, chromatography, fractionation of macromolecules, electrophoresis, and centrifugation.</td>
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</table>
BIOS 834 Plant Biochemistry
Crosslisted with: AGRO 434, BIOC 434, BIOS 434, CHEM 434, AGRO 434, BIOC 834, BIOS 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
Format: LEC

BIOS 836 Quaternary Paleoclimatology and Paleoeoclogy
Crosslisted with: BIOS 436, GEOL 423, GEOL 823
Prerequisites: 12 hrs GEOL or BIOS.
Description: Analysis and interpretation of the Quaternary period's paleocological 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
Format: LEC

BIOS 837 Research Techniques in Biochemistry
Crosslisted with: BIOC 437, BIOC 837, BIOC 837
Prerequisites: BIOC/BIOS/ CHEM 433/833, or permission.
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
Format: LEC

BIOS 838 Biogeochemical Cycles
Crosslisted with: BIOS 438, GEOL 424, GEOL 824
Prerequisites: CHEM 109 or 113; 12 hrs geology or biological sciences.
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
Format: LEC

BIOS 839 Dynamics of Biochemical and Biological Networks
Crosslisted with: BIOC 439, BIOC 839, BIOC 439
Prerequisites: BIOC 206, BIOC 321 or BIOC 431 (or equivalent).
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
Format: LEC

BIOS 840 Microbial Physiology
Crosslisted with: BIOS 440, VBMS 840, Mbio 440
Prerequisites: BIOS 312 and either 313 or 314, or permission.
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
Format: LEC

BIOS 841 Pathogenic Microbiology
Crosslisted with: BIOS 441, VBMS 441, VBMS 441H, VBMS 841
Prerequisites: BIOS 312 and either 313 or 314, or permission.
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
Format: LEC

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
Format: LEC

BIOS 843 Immunology
Crosslisted with: BIOS 443, VBMS 843, Mbio 443
Prerequisites: BIOS 206 and one semester organic chemistry.
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
Format: LEC
Prerequisite for: VBMS 910

BIOS 844 Geomicrobiology
Crosslisted with: BIOS 444, GEOL 444, GEOL 844
Prerequisites: 3 hours biological sciences and 3 hours chemistry.
Description: Lectures and discussions of primary literature regarding microorganisms and their role transforming Earth through geologic time.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
BIOS 845 Food Microbiology
Crosslisted with: BIOS 445, FDST 405, FDST 805
Prerequisites: BIOS 312; CHEM 251; BIOC 321.
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
Format: LEC
Prerequisite for: FDST 460, FDST 860; 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
Format: LAB

BIOS 847 Soil Microbiology
Crosslisted with: AGRO 460, BIOS 447, NRES 460, SOIL 460, AGRO 860, NRES 860
Prerequisites: One semester microbiology; one semester biochemistry or organic chemistry.
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
Format: LAB

BIOS 848 Human Growth and Development
Crosslisted with: ANTH 448, ANTH 848, BIOS 448
Prerequisites: ANTH 242 and 242L, or BIOS 101 and 101L.
Description: Biological diversity from an evolutionary perspective. The history of the study of human physical growth and biological principles of growth. Genetic, epigenetic and hormonal effects on human and other mammal growth patterns, and environmental factors that influence growth. Effects of nutrition, disease, socio-economic status, pollution, etc. Unique features of human growth in its various stages. How anthropologists interpret variation in growth patterns among human populations and the possible adaptive significance of this variation.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Biological Anthropology

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
Format: LEC

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
Format: LEC
Offered: SPRING

BIOS 852 Field Epidemiology
Crosslisted with: BIOS 452
Prerequisites: LIFE 120 and LIFE 121 and one additional 200-level life science course; or permission
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
Format: LEC

BIOS 853 Predator Ecology
Crosslisted with: BIOS 453
Prerequisites: BIOS 207 or NRES 220
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC

BIOS 854 Ecological Interactions
Crosslisted with: BIOS 454, NRES 454, NRES 854
Prerequisites: LIFE 121 & 121L, BIOS 207 or BIOS 220 and 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
Format: LEC
BIOS 855 Great Plains Flora
Crosslisted with: BIOS 455
Prerequisites: LIFE 120 and LIFE 121
Description: Plant identification. Field study of the flora in various habitats. Field trips include grassland and woodland vegetation of this region.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC

BIOS 856 Mathematical Models in Biology
Crosslisted with: BIOS 456, NRES 456
Prerequisites: Junior standing; major in the biological sciences; MATH 106 or 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
Format: LEC

BIOS 857 Ecosystem Ecology
Crosslisted with: BIOS 457, GEOL 457, GEOL 857
Prerequisites: BIOS 207 and CHEM 110 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
Format: LEC

BIOS 859 Limnology
Crosslisted with: BIOS 459, NRES 459, NRES 859, WATS 459
Prerequisites: 12 hrs BIOS, including BIOS/NRES 220/BIOS220x; two semesters CHEM.
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; eutrophication and its effects.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC

BIOS 860 Advanced Limnology
Crosslisted with: NRES 866
Prerequisites: NRES 859 or equivalent
Description: In-depth consideration of selected areas of limnology including stream limnology, primary production, secondary production, nutrient cycling, and eutrophication.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

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
Format: LEC

BIOS 864 Fisheries Biology
Crosslisted with: BIOS 464, NRES 464, NRES 864
Prerequisites: BIOS/NRES 489/889 or equivalent.
Description: Biology of fishes. Factors that affect fishes in the natural environment. Techniques used in the analysis and management of fish populations.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

BIOS 868 Field Animal Behavior
Crosslisted with: BIOS 468
Prerequisites: LIFE 120 and LIFE 121
Notes: BIOS 207 or BIOS 220 recommended. Offered summers only at Cedar Point Biological Station.
Description: Behavior of animals. Stresses methods for testing evolutionary hypotheses under field conditions with emphasis on foraging behavior, animal communication, and animal social systems.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC

BIOS 870 Prairie Ecology
Crosslisted with: BIOS 470
Prerequisites: BIOS 207 or equivalent.
Description: Structure, function, and distribution of communities. Interaction of different species with their biotic and abiotic environments.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC

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.
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<tr>
<td>BIOS 874</td>
<td>Herpetology</td>
<td>BIOS 474, NRES 474, NRES 874</td>
<td>Prerequisites: BIOS/NRES 386 and permission. BIOS 388 recommended. Description: Fossil and living amphibians and reptiles. Anatomy, classification, ecology and evolution.</td>
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<tr>
<td>BIOS 875</td>
<td>Avian Biology</td>
<td>BIOS 475</td>
<td>Prerequisites: LIFE 121 &amp; 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 &amp; evolutionary history, flight, foraging, migration, communication, reproductive biology, population ecology and conservation biology.</td>
<td>3</td>
<td>LEC</td>
</tr>
<tr>
<td>BIOS 878</td>
<td>Plant Anatomy</td>
<td>BIOS 478</td>
<td>Prerequisites: 8 hrs biological sciences, BIOS 109 recommended. 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</td>
<td>4</td>
<td>LEC</td>
</tr>
<tr>
<td>BIOS 879</td>
<td>Plant Growth and Development</td>
<td>AGRO 325; BIOS 478/878; CHEM 252 or BIOL/BIOS/ CHEM 431/831</td>
<td>Description: Processes involved in plant growth and development, seed formation, dormancy, germination, differential growth, flowering, and senescence. The role of extrinsic factors (e.g. light, water, and gravity) and intrinsic factors (e.g. hormones, pigments, and energy sources) on these processes.</td>
<td>3</td>
<td>LEC</td>
</tr>
<tr>
<td>BIOS 880</td>
<td>Ecology and Evolution of Arachnids</td>
<td>BIOS 480</td>
<td>Prerequisites: BIOS 207 or BIOS 220 Description: Ecology and evolutionary biology of living arachnids.</td>
<td>4</td>
<td>LEC</td>
</tr>
<tr>
<td>BIOS 882</td>
<td>Field Entomology</td>
<td>BIOS 482, ENTO 411, ENTO 811</td>
<td>Prerequisites: 12 hrs biological sciences. Description: Field course in insect taxonomy and biology emphasizing field collection, specimen preparation, classification, and insect natural history.</td>
<td>4</td>
<td>LEC</td>
</tr>
<tr>
<td>BIOS 884</td>
<td>Physiology of Exercise</td>
<td>BIOS 484, NUTR 484, NUTR 884</td>
<td>Prerequisites: 12 hrs biological sciences, including BIOS 213 or equivalent; BIOS 214 or equivalent. Description: Effects of physical activity on the circulatory, respiratory, and other physiological processes.</td>
<td>3</td>
<td>LEC</td>
</tr>
<tr>
<td>BIOS 885</td>
<td>Aquatic Insects</td>
<td>BIOS 485, ENTO 402, ENTO 802, NRES 402, NRES 802</td>
<td>Prerequisites: 12 hrs biological sciences. Description: Biology and ecology of aquatic insects.</td>
<td>2</td>
<td>LEC</td>
</tr>
</tbody>
</table>
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
Format: LAB

BIOS 886 Advanced Topics in Biophysical Chemistry
Crosslisted with: BIOC 486, BIOC 886, BIOS 486, CHEM 486, CHEM 886
Prerequisites: CHEM 471/871 or 481/881.
Description: Applications of thermodynamics to biochemical phenomena, optical properties of proteins and polynucleotides, and kinetics of rapid reactions.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

BIOS 887 Field Parasitology
Crosslisted with: BIOS 487
Prerequisites: LIFE 120 and LIFE 121
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
Format: LEC

BIOS 888 Natural History of the Invertebrates
Crosslisted with: BIOS 488
Prerequisites: LIFE 120 and LIFE 121
Description: Field course in invertebrate community relations stressing on-site observation of community components, natural history, and interactions.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC

BIOS 889 Ichthyology
Crosslisted with: BIOS 489, NRES 489, NRES 889
Prerequisites: LIFE 120 and LIFE 121
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
Format: LEC

BIOS 897 Special Topics in Biological Sciences
Crosslisted with: BIOS 497
Prerequisites: LIFE 120 and LIFE 121; and permission
Description: Topics vary by term.
Credit Hours: 1-4
Min credits per semester: 1
Max credits per semester: 4
Max credits per degree: 24
Format: LEC

BIOS 898 Independent Research in Biological Sciences
Crosslisted with: BIOS 498
Prerequisites: LIFE 120 and LIFE 121; and permission.
Notes: Four credit hours may be counted toward the undergraduate BIOS major. Before registering, arrangements must be made with a School of Biological Sciences faculty member to reach an agreement on the scope and to determine the amount of credit for the project.
Description: Independent study and laboratory or field investigation of a specific problem.
Credit Hours: 1-8
Min credits per semester: 1
Max credits per semester: 8
Max credits per degree: 8
Format: IND

BIOS 899 Masters Thesis
Prerequisites: Admission to masters degree program and permission of major adviser
Credit Hours: 1-10
Max credits per semester: 1
Max credits per semester: 10
Max credits per degree: 99
Format: IND

BIOS 910 Developmental Genetics
Prerequisites: General genetics or equivalent
Description: Effects of various mutations on developing biological systems. Mechanisms by which the abnormal genome expresses its pheno-type. Special consideration to vertebrate organisms.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

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
Format: LEC

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
Format: LEC

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
Format: LEC

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
Format: LEC
BIOS 915M Graduate Seminar - Microbiology  
Credit Hours: 1-3  
Min credits per semester: 1  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC

BIOS 915N Population Ecology  
Credit Hours: 1-3  
Min credits per semester: 1  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC

BIOS 915P Graduate Seminar - Parasitology  
Credit Hours: 1-3  
Min credits per semester: 1  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC

BIOS 915W Graduate Seminar - Evolutionary Biology  
Credit Hours: 1-3  
Min credits per semester: 1  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC

BIOS 916 Research Seminar  
Description: Aimed at improving research design in evolutionary biology. Experience with presenting scientific ideas, as well as help with specific project.  
Credit Hours: 1  
Max credits per semester: 1  
Max credits per degree: 10  
Format: LEC

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  
Format: LEC

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  
Format: LEC

BIOS 924 Molecular Phylogenetics  
Prerequisites: Permission  
Description: Theory and methodology of phylogenetic inference based on molecular characters (mainly DNA sequences). Population genetic principles and analysis of microsatellite loci. Emphasis on project design, data analysis, and hypothesis testing. Training on current computer programs for phylogenetic analysis acquired.  
Credit Hours: 4  
Max credits per semester: 4  
Max credits per degree: 4  
Format: LEC

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  
Format: LEC

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  
Format: LEC

BIOS 934 Genome Dynamics and Gene Expression  
Crosslisted with: BIOC 934, CHEM 934  
Prerequisites: BIOC/BIOS/CHEM 832 or permission  
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  
Format: LEC

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  
Format: LEC

BIOS 942 Genetics, Genomics, and Bioinformatics of Prokaryotes  
Crosslisted with: VBMS 942  
Prerequisites: BIOS 241 and 312, or permission  
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  
Format: LEC
BIOS 945 RNA Biology
Prerequisites: BIOS 820 or permission
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
Format: LEC

BIOS 947 Industrial Microbiology and Biotechnology
Prerequisites: BIOS 312 or equivalent, BIOS 831 or 840 recommended, or permission
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
Format: LEC

BIOS 949 Biochemistry of Nutrition
Crosslisted with: ASCI 949, BIOC 949, NUTR 949
Prerequisites: BIOC 832 or 839, or permission
Notes: Offered odd-numbered calendar years.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

BIOS 950 Medical Molecular Virology
Crosslisted with: VBMS 950
Prerequisites: BIOS/CHM/BIOC 431/831 and 432/832; VBMS 852
Notes: Offered odd-numbered calendar years.
Description: Current topics in molecular virology relevant to the natural history and pathogenesis of viral diseases of humans and animals.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

BIOS 951 Quantitative Analysis in Biology
Prerequisites: Permission
Description: Surveys the kinds of quantitative problems that arise in biological research, particularly in field-oriented disciplines such as ecology, evolution and behavior, and the quantitative methods used to solve them. Practical learning of the strengths and weaknesses of different methods through the analysis of biological data on microcomputers.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC

BIOS 953 Advanced Population Ecology
Prerequisites: Permission
Description: Ecological phenomena in populations. Quantitative description of population processes, life history strategies, foraging theory, resource interactions, population dynamics of competition and predation, and selected current topics in population ecology. Research methodology and historical development of the field as well as analysis, criticism, and synthesis of current research in the area.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

BIOS 955 Advanced Behavioral Ecology
Prerequisites: Previous course work in ecology or behavioral comparative psychology
Description: Evolution of behavioral attributes of animals with respect to ecological conditions. Overview of the field and area of active research.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

BIOS 956 Biochemical Adaptation
Prerequisites: Permission; a course in biochemistry is strongly recommended
Description: Major aspects of molecular/physiological adaptation in plants and animals including the evolution of metabolic pathways, enzyme function, and gene regulation.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

BIOS 957 Networks in Ecology and Evolution
Description: Fundamentals of network theory as it applies to ecology and evolution. A conceptual foundation for analyzing relational data focusing on ecological and social networks in non-human animals.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

BIOS 958 Genetic Ecology
Prerequisites: Background in genetics and ecology
Description: Interplay of genetics and ecology. Genetic basis of adaptation to environmental conditions and particularly the variety of ways in which this may occur.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

BIOS 959 Advanced Community Ecology
Prerequisites: Permission
Description: Ecological and evolutionary forces responsible for patterns of numbers and types of species which coexist and form ecological communities. Mathematical models, coevolution, random processes, historical background, and examination of biotic interactions responsible for the observed patterns. Emphasis on critique and synthesis of current theory in light of empirical evidence.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
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
Format: LEC

BIOS 962 Animal Communication
Prerequisites: Course work in ecology and/or evolution and/or animal behavior; or permission
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
Format: LEC

BIOS 963 Genetics of Host-Parasite Interaction
Crosslisted with: AGRO 963, HORT 963, PLPT 963
Prerequisites: BIOS 820; and permission
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

BIOS 964 Signal Transduction
Crosslisted with: VBMS 964
Prerequisites: BIOS 832, BIOS 820 or equivalent, or permission
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
Format: LEC

BIOS 966 Advanced Viral Pathogenesis
Crosslisted with: VBMS 966
Prerequisites: BIOS 843; VBMS 852 or equivalent introductory course in virology or experience
Description: Advanced analysis on the mechanisms of cell and tissue damage by viruses, the spread of viruses through the body, and the host response.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

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
Format: LEC

BIOS 968 Seminar in Plant Pathology
Crosslisted with: PLPT 968, AGRO 968, HORT 968
Prerequisites: Permission
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Format: LEC

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
Format: IND

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
Format: LEC

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
Format: IND