

Biological Sciences

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Administration:

Head of the Department: Eric Stabb
Director of Graduate Studies: Peter Okkema

Program Codes:

20FS1072MS (MS)
20FS1072PHD (PhD)

The Department of Biological Sciences offers work leading to the Doctor of Philosophy and the Master of Science degrees in Biological Sciences. Areas of research include cell biology, development, ecology, evolution, genetics, molecular biology, neurobiology, and plant biology. The Interdepartmental Concentration in Neuroscience is available to qualified PhD students.

Admission and Degree Requirements

- [MS in Biological Sciences](#)
- [PhD in Biological Sciences](#)

BIOS 416. Natural Products. 3 or 4 hours.

Biogenetic approach to secondary metabolites. General principles and selected studies of phenolic compounds, terpenes, alkaloids, and other interesting natural products. Course Information: Same as CHEM 456. 3 undergraduate hours. 4 graduate hours. Prerequisite(s): One year of organic chemistry.

BIOS 420. Genomics. 3 hours.

Theoretical background in genomics with practical experience in obtaining and analyzing large scale Next Generation Sequencing (NGS) datasets using high capacity computational resources. Course Information: Extensive computer use required. Prerequisite(s): BIOS 220 or BIOS 230; or consent of the instructor. Recommended background: STAT 101 or STAT 130 or BIOS 112.

BIOS 427. Ecosystem Ecology. 3 or 4 hours.

Flow of energy and matter between the environment and biological organisms including biological interactions that govern the cycling of water, carbon and nutrients at various spatial and temporal scales. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): BIOS 230.

BIOS 430. Evolution. 4 hours.

Focuses on empirical evolutionary data and theory, with an intro to data science, modeling, simulations in R programming language; it covers the history of evolution, population genetics, the species problem, biodiversity, macroevolution. Course Information: Extensive computer use required. Prerequisite(s): BIOS 120 AND either BIOS 220 or consent of the instructor. Recommended background: BIOS 230. Class Schedule Information: To be properly registered, students must enroll in one Lecture-Discussion and one Laboratory.

BIOS 431. Plant and Animal Interactions. 3 hours.

Ecology of plant and animal interactions. In-depth reading and discussion of primary literature on herbivory and plant defense and pollination, seed dispersal and protection mutualisms. Course Information: Prerequisite(s): BIOS 230.

BIOS 435. Plant Evolution. 3 hours.

Examines the history of plant life in a rigorous survey of plant genetics, factors that influence diversity of form and function, the astonishing diversity of plant sexual systems, and conservation. Course Information: Prerequisite(s): BIOS 230.

BIOS 437. Topics in Tropical Ecology. 3 hours.

Introduction to the character of tropical ecosystems. In-depth reading and discussion of one or more current topics. Course Information: Prerequisite(s): BIOS 230.

BIOS 443. Animal Physiological Systems Laboratory. 3 hours.

Discussion and laboratory exploration of mammalian physiological systems, including immune, endocrine, cardiac, vascular, nervous, pulmonary, renal, and digestive systems. Course Information: Animals used in instruction. Prerequisite(s): Credit or concurrent registration in BIOS 343; or Credit or concurrent registration in BIOS 340; or consent of the instructor. Class Schedule Information: To be properly registered, students must enroll in one Lecture, one Laboratory, and one Lecture-Discussion.

BIOS 446. Evolution and Human Disease. 3 hours.

Pathogen evolution, transmission of infectious disease, host response to pathogens, drug resistance in pathogens, and cancer progression/treatment are examined in light of natural selection, phylogenetics, coevolution, and population genetics. Course Information: Prerequisite(s): BIOS 230. Recommended background: BIOS 220.

BIOS 450. Advanced Microbiology. 3 hours.

Comprehensive analysis of metabolic, ecological, genomic, and functional diversity among the major groups of microorganisms. Relationship between microbial diversity and biogeochemistry in the environment, human/animal hosts, and engineered systems. Course Information: Prerequisite(s): BIOS 350.

BIOS 452. Biochemistry I. 4 hours.

Chemistry of proteins, nucleic acids, carbohydrates and lipids. Course Information: Same as CHEM 452. Prerequisite(s): Credit or concurrent registration in CHEM 234. Class Schedule Information: To be properly registered, students must enroll in one Discussion/Recitation and one Lecture.

BIOS 454. Biochemistry II. 4 hours.

Continues Biological Sciences 452. Carbohydrate and lipid metabolism, electron transport. Metabolism of amino acids, nucleic acids, proteins. Biosynthesis of macromolecules and regulation of macromolecular synthesis. Course Information: Same as CHEM 454. Prerequisite(s): BIOS 452 or CHEM 452. Class Schedule Information: To be properly registered, students must enroll in one Discussion/Recitation and one Lecture.

BIOS 458. Biotechnology and Drug Discovery. 3 or 4 hours.

Molecular and gene therapy, using small molecules including antisense, aptamers, and proteins. Structure-based drug design. Structural bioinformatics and drug discovery program. High-throughput screening. Combinatorial chemistry technology. Course Information: Same as CHEM 458. 3 undergraduate hours. 4 graduate hours. Prerequisite(s): BIOS 352 or CHEM 352; or Credit or concurrent registration in BIOS 452 or Credit or concurrent registration in CHEM 452; or consent of the instructor.

BIOS 466. Principles of Paleontology. 3 hours.

Theory and methods of evolutionary paleobiology; includes paleoecology, functional morphology, and major features of organic evolution. Course Information: Same as EAES 466. Prerequisite(s): EAES 360 or consent of the instructor. Class Schedule Information: To be properly registered, students must enroll in one Laboratory-Discussion and one Lecture.

BIOS 473. Soils and the Environment. 4 hours.

Soil science, emphasizing local soils and parent materials, soil classification and mapping, soil physics, soil gases and greenhouse gas emissions, soil chemistry and biogeochemistry, soil-plant interactions, and soil invertebrates. Course Information: Same as EAES 473. Field work required. Recommended background: Introductory courses in Chemistry and Biology are recommended. Coursework in EAES (such as EAES 101 and/or 111) is preferred.

BIOS 475. Neural Engineering I: Introduction to Hybrid Neural Systems. 3 or 4 hours.

Modeling and design of functional neural interfaces for in vivo and in vitro applications, electrodes and molecular coatings, neural prostheses and biopotential control of robotics. Course Information: Same as BME 475. 3 undergraduate hours. 4 graduate hours. Prerequisite(s): BIOE 472 or BME 472.

BIOS 480. Introduction to Modern Biostatistics with R. 3 hours.

An in-depth intro to research design, data visualization, and modern univariate statistics, from basic linear model to generalized linear models and linear mixed-effects models. Course Information: Extensive computer use required. All work done in the open-source R statistical computing language. Prerequisite(s): MATH 170 or MATH 180 or STAT 130. Class Schedule Information: To be properly registered, students must enroll in one Lecture-Discussion and one Laboratory.

BIOS 482. Molecular and Developmental Neurobiology Laboratory. 3 hours.

A hands-on laboratory course designed to explore the most recent neurotechniques and how they are being used to advance knowledge of the brain. Model organism use will be restricted to small invertebrates (*C. elegans*). Course Information: Prerequisite(s): BIOS 286; or PSCH 262.

BIOS 483. Neuroanatomy. 4 hours.

Organization of the nervous system, with an emphasis on mammals. Course Information: Same as PSCH 483 and NEUS 483. Animals used in instruction. Prerequisite(s): BIOS 272 or BIOS 286 or BIOS 325 or PSCH 262; or consent of the instructor. Class Schedule Information: To be properly registered, students must enroll in one Laboratory and one Lecture.

BIOS 484. Neuroscience I. 3 hours.

Neuroscience as an integrative discipline. Neuroanatomy of vertebrates, neural development, cellular neurobiology, action potential mechanisms, synaptic transmission and neuropharmacology. Course Information: Same as PHIL 484 and PSCH 484. Prerequisite(s): BIOS 286 or PSCH 262.

BIOS 485. Neuroscience II. 3 hours.

Integrative neuroscience, including sensory and motor systems; learning, memory, and language; pathology of nervous systems; philosophical perspectives, and modeling. Course Information: Same as PHIL 485 and PSCH 485. Prerequisite(s): BIOS 286 or PSCH 262.

BIOS 486. Animal Behavior and Neuroethology. 4 hours.

Neural and behavioral mechanisms of environmental information processing and interaction throughout the animal kingdom. Laboratory emphasizing a research project with journal style lab report, essay on assigned topic, occasional field trips required. Course Information: Animals used in instruction. Prerequisite(s): One course in neuroscience, animal physiology, or animal behavior. Class Schedule Information: To be properly registered, students must enroll in one Laboratory and one Lecture.

BIOS 489. Cellular Neurobiology Laboratory. 3 hours.

Recording from and analyzing the activity of nerve cells, neuronal networks, and other electrically excitable tissues. Course Information: Prerequisite(s): BIOS 286 or the equivalent.

BIOS 490. Topics in Ecology and Evolution. 3 or 4 hours.

In-depth analysis of advanced topics in ecology and evolution, involving reading primary literature, term paper, student presentations and critical discussion. Credit varies according to topic offered. Course Information: 3 undergraduate hours. 4 graduate hours. May be repeated. Students may register in more than one section per term. Prerequisite(s): BIOS 230; or Graduate standing or consent of the instructor.

BIOS 518. Geobiology. 4 hours.

Interactions between microorganisms and minerals, preservation of organisms and biofilms, influence of microorganisms in biogeochemical cycles, microorganisms on early Earth, life in extreme environments, the dark biosphere, and astrobiology. Course Information: Same as EAES 518. Recommended background: Basic knowledge of biology, chemistry, and earth sciences at the level of introductory college courses in each subject.

BIOS 520. Topics in Genetics. 2 hours.

Discussion of selected topics of current interest in genetics. Course Information: May be repeated. Students may register in more than one section per term. Prerequisite(s): BIOS 220 and BIOS 221 and consent of the instructor.

BIOS 523. Biology of MicroRNAs and other Small RNAs. 2 hours.

History, overview and biology of small RNA pathways, including microRNAs, siRNAs, RNA interference, roles in various biological processes, implication in disease pathophysiology, and potential therapies. Course Information: Same as ANAT 523. Prerequisite(s): Consent of the instructor.

BIOS 524. Molecular Biology Principles and Methods. 5 hours.

Guided reading and critical evaluation of foundational and current research topics in biochemistry and molecular biology. Course Information: Prerequisite(s): Graduate standing; or consent of the instructor.

BIOS 525. Principles and Methods in Cell Biology. 5 hours.

Guided reading and critical evaluation of foundational and current research topics in cell biology. Course Information: Prerequisite(s): BIOS 524; and graduate standing; or consent of the instructor.

BIOS 526. Molecular and Genetic Analysis of Development. 3 hours.

Examines developmental mechanisms used in animal model systems. Course Information: Same as BCMG 526. Prerequisite(s): Graduate standing or consent of the instructor.

BIOS 527. Cellular and Systems Neurobiology. 3 hours.

Molecular and cellular properties of ion channels in neurons and sensory cells and their relationship to brain and sensory systems. Course Information: Same as ANAT 527 and NEUS 527. Prerequisite(s): Credit in one neuroscience course or consent of the instructor.

BIOS 528. Current Literature in Cell Biology. 3 hours.

Topics in cell biology. Course Information: Prerequisite(s): BIOS 522 and BIOS 524; and graduate standing; and consent of the instructor. Corequisites: Requires concurrent registration in BIOS 525.

BIOS 530. Population Ecology. 3 hours.

Life histories, population processes and interactions, and theories of distribution and abundance. Course Information: Prerequisite(s): BIOS 220 and BIOS 221 and BIOS 330 and BIOS 331 and consent of the instructor.

BIOS 531. Introduction to Ecology and Evolution I. 3 hours.

Concepts, techniques, and skills needed for research in ecology and evolution. Course Information: Prerequisite(s): Consent of the instructor.

BIOS 532. Introduction to Ecology and Evolution II. 3 hours.

Evolutionary and physiological research. Course Information: Prerequisite(s): Consent of the instructor.

BIOS 533. Analyzing Ecological Data: Philosophies, Approaches, and Techniques. 4 hours.

Differing philosophies of study design and data analysis in ecological research. Emphasis on the use of the R language for statistical computing to implement a suite of techniques for analyzing univariate and multivariate data. Course Information: Extensive computer use required. Prerequisite(s): BIOS 480; or consent of the instructor.

BIOS 534. Ecology of Biodiversity. 3 hours.

Causes and consequences of different levels of species diversity across a broad spectrum of systems. Core approaches and concepts of community ecology. Application of theory and empirical findings to conserving, managing and restoring biodiversity. Course Information: Prerequisite(s): Consent of the instructor. Recommended Background: Undergraduate courses in basic ecology, calculus, and introductory statistics; at least one graduate course from the following: BIOS 530, BIOS 535, CME 521, UPP 554, or similar courses at UIC or other institutions.

BIOS 539. Seminar in Ecology and Evolution. 0-1 hours.

Graduate student and faculty seminars on selected topics in ecology and evolution. Credit is given only upon completion of a seminar presentation. Course Information: Satisfactory/Unsatisfactory grading only. May be repeated.

BIOS 548. Capstone Project in Landscape, Ecological and Anthropogenic Processes. 4 hours.

Interdisciplinary capstone project course that explores a "real-world" environmental issue selected by the students and approved by the faculty. Students will conduct research and analysis collaboratively and develop solutions and recommendations. Course Information: Same as CME 548 and EAES 548. Prerequisite(s): Grade of B or better in BIOS 540 or Grade of B or better in CME 540 or Grade of B or better in EAES 540 or Grade of B or better in UPP 555; and Grade of B or better in BIOS 546 or Grade of B or better in CME 546 or Grade of B or better in EAES 546 or Grade of B or better in UPP 555; and Grade of B or better in BIOS 547 or Grade of B or better in CME 547 or Grade of B or better in EAES 547 or Grade of B or better in UPP 555. Class Schedule Information: To be properly registered, students must enroll in one Lecture-Discussion and one Studio.

BIOS 552. Chemical Biology. 4 hours.

Major trends and recent developments in research at the interface of chemistry and biology. Course Information: Same as CHEM 552.

BIOS 559. Special Topics in Biochemistry. 3-4 hours.

Selected topics of current interest in biochemistry. Course Information: Same as CHEM 559. May be repeated. Students may register in more than one section per term. Prerequisite(s): CHEM 454 or BIOS 454 or consent of the instructor.

BIOS 560. Topics in Paleontology. 3-4 hours.

In-depth analysis of current problems and issues in paleontology, involving reading primary literature, student presentations, and critical discussions. Course Information: Same as EAES 560. May be repeated if topics vary. Prerequisite(s): Consent of the instructor.

BIOS 582. Methods in Modern Neuroscience. 2 hours.

Underlying principles and applications of techniques used to analyze nervous system organization and function. Behavioral, electrophysiological, anatomical, and biochemical approaches are considered. Course Information: Same as NEUS 582. Animals used in instruction.

BIOS 584. Foundations of Neuroscience I. 3 hours.

Provides a core understanding of modern neuroscience. Focuses on topics in cell and molecular neuroscience. Taught by faculty from multiple units. Course Information: Same as NEUS 501. Recommended background: Credit or concurrent registration in GCLS 503.

BIOS 585. Foundations of Neuroscience II. 3 hours.

A core understanding of modern neuroscience. Focus is on topics in systems, cognitive and behavioral neuroscience. Will be taught by faculty from multiple units. Continuation of NEUS 501. Course Information: Same as NEUS 502. Prerequisite(s): NEUS 501 or BIOS 584. Recommended background: Credit or concurrent registration in NEUS 403.

BIOS 586. Cell and Molecular Neurobiology. 3 hours.

Structure and function of voltage-dependent and neurotransmitter-gated ion channels; the role of these ion channels in synaptic transmission, synaptic modification, and neuromodulation. Course Information: Same as ANAT 586. Prerequisite(s): BIOS 442 or consent of the instructor.

BIOS 592. Research Seminar. 1-2 hours.

Presentation of student research with an emphasis on problem-solving and theoretical implications. Course Information: Satisfactory/Unsatisfactory grading only. May be repeated. Prerequisite(s): Consent of instructor.

BIOS 593. Introduction to Laboratory Research. 2-6 hours.

A hands-on, in-depth introduction to selected research topics and laboratory techniques designed for the beginning graduate student. Course Information: Satisfactory/Unsatisfactory grading only. May be repeated. Students may register in more than one section per term. Prerequisite(s): Consent of the instructor.

BIOS 594. Special Topics in Biological Sciences. 1-2 hours.

Selected aspects in biological sciences. Credit varies according to the seminar offered. Course Information: May be repeated. Students may register in more than one section per term.

BIOS 595. Departmental Seminar. 0 hours.

Weekly seminar by staff and invited speakers. Required of graduate students every semester. Course Information: Satisfactory/Unsatisfactory grading only. May be repeated.

BIOS 597. Project Research. 2-8 hours.

Guided research projects on selected topics in specific fields of advanced modern biology. Not to be used for thesis research. Course Information: Satisfactory/Unsatisfactory grading only. May be repeated. Students may register in more than one section per term. Prerequisite(s): Consent of the instructor.

BIOS 598. Master's Thesis Research. 0-16 hours.

Independent research in specialized projects under the direction of a faculty member with appropriate graduate standing, leading to completion of master's thesis. Course Information: Satisfactory/Unsatisfactory grading only. May be repeated. Prerequisite(s): Consent of the instructor.

BIOS 599. Doctoral Thesis Research. 0-16 hours.

Independent research on specialized topics under the direction of a faculty member with appropriate graduate standing, leading to completion of Ph.D. thesis. Course Information: Satisfactory/Unsatisfactory grading only. May be repeated. Prerequisite(s): Consent of the instructor.