

Biological Sciences (BIOS)

BIOS 102. Biological Sciences First-Year Seminar. 1 hour.

Seminar course designed to introduce first-year students in the Biological Sciences major to departmental resources and opportunities that will promote student success. Course Information: Satisfactory/Unsatisfactory grading only. Prerequisite(s): Open only to freshmen.

BIOS 104. Biology for Non-majors. 4 hours.

Origin and diversity of life; genetics, evolution, ecology and ecosystems; energy flow; photosynthesis; human anatomy and physiology; development of biological ideas; and biology, biotechnology and human society. Course Information: Credit is not given for BIOS 104 if the student has credit in BIOS 100 or BIOS 101 or BIOS 110 or BIOS 120. Animals may be used in instruction. Class Schedule Information: To be properly registered, students must enroll in one Laboratory-Discussion and one Lecture. *Natural World - With Lab course.*

BIOS 110. Biology of Cells and Organisms. 4 hours.

Introductory biology at the molecular, cellular, and organismal level. Topics include: Scientific skills, biological chemistry, cell structure and function, metabolism, cell division, molecular genetics, diversity, anatomy and physiology. Course Information: Previously listed as BIOS 100. Animals used in instruction. THIS COURSE IS INTENDED FOR SCIENCE MAJORS. BIOS 110 and BIOS 120 may be taken in any order. Credit is not given for BIOS 110 if the student has credit in BIOS 100. Credit is not given for BIOS 104 if the student has credit in BIOS 100, BIOS 101, BIOS 110 or BIOS 120. Class Schedule Information: To be properly registered, students must enroll in one Lecture and one Laboratory-Discussion. *Natural World - With Lab course.*

BIOS 112. Program Design I in the Context of Biological Problems. 3 hours.

Introduction to programming using Biology as the context for programming in a high-level language; control structures, variables, simple and aggregate data types; problem-solving techniques; biology topics include central dogma and genetics. Course Information: Same as CS 112. Credits is not given for CS 112, if student has credit in CS 111 or CS 113. Course Schedule Information: To be properly registered, students must enroll in one Laboratory and one Lecture-Discussion.

BIOS 120. Biology of Populations and Communities. 4 hours.

Introductory biology at the level of populations and communities. Topics include: Scientific skills, evolution, Mendelian and population genetics, biological diversity, and ecological systems including ecosystem processes and human impacts. Course Information: Previously listed as BIOS 101. Animals used in instruction. This course is intended for science majors. BIOS 110 and BIOS 120 may be taken in any order. Credit is not given for BIOS 120 if the student has credit in BIOS 101. Credit is not given for BIOS 104 if the student has credit in BIOS 100, BIOS 101, BIOS 110 or BIOS 120. Class Schedule Information: To be properly registered, students must enroll in one Lecture-Discussion and one Laboratory-Discussion. *Natural World - With Lab course.*

BIOS 184. The Basics of Neuroscience. 1 hour.

Introduction to the scientific study of the brain and behavior. Overview of neuroscience as an integrative discipline. Course Information: Same as PHIL 184 and PSCH 184. Satisfactory/Unsatisfactory grading only.

BIOS 196. Biology Colloquium. 2 hours.

Combines in-class seminars with off-campus day and weekend field trips, with the goal of introducing students to different areas of the Biological Sciences, and alternate career options. Course Information: May be repeated up to 1 time(s). Field trips required at a nominal fee. Prerequisite(s): Major in biological sciences, biochemistry, or neuroscience.

BIOS 199. Introduction to Research. 1 hour.

An introduction to research for students interested in becoming biology majors. Credit is contingent on approval by the research supervisor of a written report that is also submitted to the Biology colloquium faculty adviser. Course Information: 1 hour. Satisfactory/Unsatisfactory grading only. May be repeated. Prerequisite(s): Approval of the department. Class Schedule Information: To be properly registered, students must enroll in one Conference and one Laboratory.

BIOS 220. Genetics. 3 hours.

Principles of genetics, gene and chromosome structure, gene expression, inheritance of complex traits, Mendelian and non-Mendelian inheritance, genomes, and genetic engineering. Course Information: Prerequisite(s): BIOS 100 or BIOS 110; and BIOS 101 or BIOS 120. Class Schedule Information: To be properly registered, students must enroll in one Lecture-Discussion and one Lecture.

BIOS 222. Cell Biology. 3 hours.

The physiological processes that govern cell function. Topics include enzyme kinetics, metabolism, membranes, membrane transport, electrical and chemical signaling, intracellular motors, motility, and junctions. Prerequisite(s): BIOS 100 or BIOS 110.

BIOS 230. Evolution and Ecology. 3 hours.

Molecular and ecological basis of evolutionary change through adaptation or natural selection to explain diversity of species, behaviors, populations, communities and ecosystems and how these interactions are affected by the changing environment. Prerequisite(s): BIOS 101 or BIOS 120.

BIOS 236. Animal Behavior. 3 hours.

Examine the proximate and ultimate causes of animal behavior; neural and hormonal mechanisms; diversity of behavior and their relationship to an organism's ecology and evolution. Course Information: Prerequisite(s): BIOS 101 or BIOS 120.

BIOS 237. The Human Skeleton. 4 hours.

Examination of the human skeleton, emphasizing bone identification and functional anatomy. Course Information: Same as ANTH 237. Class Schedule Information: To be properly registered, students must enroll in one Laboratory and one Lecture.

BIOS 272. Comparative Vertebrate Anatomy. 4 hours.

Comparative vertebrate anatomy through the analysis of varying morphological features of hard and soft tissues. Course Information: Animals used in instruction. Prerequisite(s): BIOS 100 or BIOS 110; and BIOS 101 or BIOS 120. Class Schedule Information: To be properly registered, students must enroll in one Laboratory and one Lecture.

BIOS 286. The Biology of the Brain. 3 hours.

Survey of basic neurobiology. Brain structure, chemistry, development and control of behavior (sensation, movement, emotions, memory, cognition, sex). Course Information: Prerequisite(s): BIOS 100 or BIOS 110.

BIOS 294. Special Topics in Biological Sciences. 1-5 hours.

Selected topics in the Biological Sciences. Course Information: May be repeated. Students may register for more than one section per term.

BIOS 296. Directed Instruction. 2 hours.

Leadership opportunity for upper-division students who wish to assist with the biology colloquium. Course Information: May be repeated to a maximum of 4 hours. Field trips required at a nominal fee. Students will be required to submit a final report describing their leadership activities and experiences. Prerequisite(s): BIOS 196 and approval of the department. To be properly registered, students must enroll in one Lecture-Discussion and one Practice.

BIOS 299. Honors Biology. 1 hour.

An additional hour of related work for students registered in another course in Biological Sciences. Course Information: May be repeated. Prerequisite(s): Membership in Honors College, or, for superior students, approval of the department; and registration in a Biological Sciences course (except BIOS 391 or BIOS 399) and consent of the instructor. Open only to freshmen, sophomores, and juniors. *Honors course.*

BIOS 305. Plant Evolutionary Ecology. 3 hours.

Fundamental aspects of plant structure and function, plant-environment interactions, and how they shape biodiversity, with an emphasis on their evolutionary context. Prerequisite(s): BIOS 230.

BIOS 310. Genetics Laboratory. 2 hours.

Advanced laboratory techniques in gene inheritance, expression and regulation using genetic engineering, molecular biology and bioinformatic and statistical analysis to study Mendelian, microbial, molecular, human and population genetics. Course Information: Previously listed as BIOS 221. Animals used in instruction. Credit is not given for BIOS 310 if student has credit in BIOS 221. Prerequisite(s): Credit or concurrent registration in BIOS 220.

BIOS 312. Cell Biology Laboratory. 2 hours.

Laboratory training in advanced cell biology methods used in research and clinical settings. Microscopy, protein extraction and quantification, immunoassays, cell culture, experimental design, data analysis and scientific writing are emphasized. Course Information: Previously listed as BIOS 223. Credit is not given for BIOS 312 if the student has credit in BIOS 223. Prerequisite(s): Credit or concurrent credit in BIOS 222.

BIOS 320. Developmental Biology. 3 hours.

Principles governing growth and differentiation from the molecular to the organismic level. Course Information: Prerequisite(s): BIOS 220.

BIOS 321. Developmental Biology Laboratory. 3 hours.

Laboratory problems in developmental biology. Course Information: Animals used in instruction. Prerequisite(s): Credit or concurrent registration in BIOS 320.

BIOS 323. Molecular Biology Laboratory. 3 hours.

Modern molecular biology techniques used in the isolation and functional analysis of genes. Bioinformatics, gene cloning, gene fusions and expression assays will be used in the analysis of the gene isolation and analysis. Course Information: Prerequisite(s): BIOS 220.

BIOS 325. Human Embryology. 3 hours.

Major events in human development between fertilization and birth. The developmental origins of adult body structure and function, normal anatomical variations, and congenital malformations. Course Information: Prerequisite(s): BIOS 100 or BIOS 110.

BIOS 326. Embryology Laboratory. 1 hour.

Examination of histological sections of mammalian embryos. Identification of cells and tissues from their microscopic appearance, reading serial sections. Prerequisite(s): Credit or concurrent registration in BIOS 325.

BIOS 331. General Ecology Laboratory. 3 hours.

Field and laboratory data collection for hypothesis testing; required field trips to representative plant communities. Course Information: Animals used in instruction. Required field trips on Saturdays. Prerequisite(s): BIOS 101 or BIOS 120. Class Schedule Information: To be properly registered, students must enroll in one Laboratory and one Practice.

BIOS 336. Animal Behavior Laboratory. 3 hours.

Field and laboratory data collection for hypothesis testing in animal behavior. Course Information: Animals used in instruction. Field trip required at a nominal fee. Field work required. Prerequisite(s): Credit or concurrent registration in BIOS 236.

BIOS 340. Environmental Physiology. 3 hours.

The performance of an organism or group of organisms in the context of their natural environment and their evolutionary background. The organism as an integrated system rather than a collection of cellular or organ processes. Course Information: Prerequisite(s): BIOS 100 or BIOS 110; and BIOS 101 or BIOS 120.

BIOS 343. Animal Physiological Systems. 3 hours.

How the human body works including digestive, neuromuscular, sensory, respiratory, excretory, endocrine and cardiovascular systems using examples across animal species and human case studies. Course Information: Previously listed as BIOS 240. Credit is not given for BIOS 343 if student has credit in BIOS 240. Prerequisite(s): BIOS 100 or BIOS 110; and BIOS 101 or BIOS 120. Recommended background: BIOS 222.

BIOS 350. General Microbiology. 3 hours.

An introduction to the morphology, staining, genetics, physiology and biochemistry of microbial life. Medical significance of bacteria, archaea, fungi, protozoa, algae and helminthes. The significance of viruses, prions, and viroids. Prerequisite(s): BIOS 100 or BIOS 110; and Credit or concurrent registration in CHEM 130 or CHEM 230 or CHEM 232. Recommended background: BIOS 101 or BIOS 120.

BIOS 351. Microbiology Laboratory. 2 hours.

Laboratory experience with aseptic and pure culture techniques; staining and microscopy of microorganisms; identification of unknown bacteria; control of microbial growth; antibiotics; medical microbiology. Prerequisite(s): Credit or concurrent registration in BIOS 350.

BIOS 352. Introductory Biochemistry. 3 hours.

Structure and function of cellular constituents; enzymology; metabolism of carbohydrates, lipids, amino acids, nucleotides; molecular biology of biosynthesis of proteins and nucleic acids. Course Information: Same as CHEM 352. No credit given for BIOS 352 if student has credit in BIOS 452 or BIOS 454 or CHEM 452 or CHEM 454. No credit toward the degree in biochemistry. Prerequisite(s): BIOS 100 or BIOS 110; and BIOS 101 or BIOS 120; and CHEM 230 or CHEM 232.

BIOS 360. Introduction to Paleontology. 4 hours.

The morphology, ecology, and relationships of fossil organisms. Basic principles of paleontology, including evolution, paleoecology and functional morphology. Course Information: Same as EAES 360. Field trip required at a nominal fee. One day field trip to collect fossils. Prerequisite(s): EAES 101 or EAES 111; or BIOS 100 or BIOS 110; and BIOS 101 or BIOS 120. Class Schedule Information: To be properly registered, students must enroll in one Laboratory and one Lecture.

BIOS 365. Human Ecological Systems. 3 hours.

Human-environmental interactions and feedbacks (positive and negative) and the ecological basis for health and sustainability of human-dominated landscapes. Case studies of real-world environmental issues. Course Information: Prerequisite(s): BIOS 101 or BIOS 120 or EAES 101 or PSCH 100 or SOC 100; or consent of the instructor.

BIOS 386. Seminar on Neurobiology. 2 hours.

Reading and discussion of both classic and recent research papers that are important in neurobiology. Course Information: Prerequisite(s): BIOS 286 or PSCH 262.

BIOS 391. Independent Study. 1 hour.

Individual study not covered in standard courses under close supervision of a faculty member. Credit is contingent on approval by research supervisor of a written report that is submitted to the department. Course Information: Satisfactory/Unsatisfactory grading only. May be repeated. Students may register in more than one section per term. A maximum of 5 hours of BIOS 391 and/or BIOS 399 may be credited toward the department undergraduate major requirements. Prerequisite(s): Minimum of 2.00 grade point average in biological sciences courses and consent of the instructor. Class Schedule Information: This course counts toward the limited number of independent study hours accepted toward the degree and the major.

BIOS 399. Independent Research. 2 hours.

Individual research. Credit is contingent on approval by the research supervisor of a written report that is submitted to the department. Course Information: Satisfactory/Unsatisfactory grading only. May be repeated. Students may register in more than one section per term. A maximum of 5 hours of BIOS 391 and/or BIOS 399 may be credited toward the department undergraduate major requirements. Prerequisite(s): Minimum of 2.00 grade point average in biological sciences courses, approval of the department, and consent of the instructor. Recommended background: Junior standing. Class Schedule Information: This course counts toward the limited number of independent study hours accepted toward the degree and the major.

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): Grade of C or better in CHEM 230; or 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 455. Introduction to Landscape Ecology. 3 hours.

Uses a combination of lectures, discussions, and hands-on activities to introduce the concepts and methods of landscape ecology. We will discuss how landscape ecology can be applied to solving current environmental problems. Course Information: Extensive computer use required. Prerequisite(s): BIOS 230; or BIOS 331.

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 Biological Sciences. 3 or 4 hours.

In-depth analysis of advanced topics in molecular, cellular, biomedical, ecology and evolution and neuroscience involving reading primary literature, term paper, student presentations and critical discussion. 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 BIOS 220; or BIOS 222; or Graduate standing; or consent of the instructor.