

# SCHOOL OF BIOLOGICAL SCIENCES

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## General Information

The School of Biological Sciences (SBS) was established in 2022 and brought together the formerly separate academic units of Biology and Microbiology and Plant Biology. The programs that are currently housed within the SBS began soon after the University of Oklahoma was founded, and the first Ph.D. degree awarded by OU was through the program in Biology. Faculty research and the graduate programs in the SBS have internationally-recognized strengths in areas of animal behavior, aquatic biology, biodiversity and conservation biology, cell signaling, development and regeneration, community ecology, evolutionary biology, genetics and genomics, life history and breeding systems, neural bases of behavior, organismal biology, organismal systems biology, plant ecology, anaerobic microbiology and ecology, molecular biology, ecosystem-scale processes, and environmental genomics. The SBS features several core research areas including Aquatic Biology, Biology of Behavior, Ecology and Evolutionary Biology (EEB), Geographical Ecology, Molecular, Cellular, and Developmental Biology, and Anaerobic Microbiology.

Research and training facilities at the OU Biological Station, the Sam Noble Museum, the Oklahoma Biological Survey, and the Stephenson Research and Technology Center enhance the research opportunities for faculty and graduate students.

The SBS takes special pride in its teaching at both the graduate and undergraduate levels. Courses at the undergraduate level provide a broad foundation in the biological sciences and allow students to pursue selected areas of interest in depth through research participation and advanced courses.

Undergraduate degree programs offered in the SBS are also popular options for students interested in a health professions career, and the curricula provide an excellent base of preparation for a wide variety of careers or for postgraduate study.

## Programs for Excellence

### PROGRAMS FOR ACADEMIC EXCELLENCE

We provide hands-on, authentic educational and research experiences that prepare our students for successful careers in science, technology, and medical professions. The SBS is actively involved in the Honors Program, and many undergraduate students carry out independent research projects under the guidance of faculty members with national and international reputations in their fields.

### Student Organizations

The Zoological Society, the Premed Club, the PreVet Club, the Minority Association of Pre-Health Students, Alpha Epsilon Delta, the OU Botanical

Society, and the American Society for Microbiology Student Chapter are sponsored by SBS faculty members and allow students with common interests to take field trips and hear talks about career planning and other important topics. The Biology Aid Program is comprised of undergraduate students who volunteer to tutor other students in introductory biology courses. It is a rewarding experience for both the student volunteers and those with whom they work.

The Biology Graduate Student Organization works with the faculty to organize the weekly seminar program of visiting scholars and other educational enrichment opportunities for both graduate and undergraduate students. Additional weekly seminars in neurobiology, ecology and evolutionary biology, molecular, cell and developmental biology, and microbiology provide venues for graduate students and faculty to discuss research ideas and findings.

All of these clubs meet regularly and provide undergraduate and graduate students with opportunities for socializing, networking, and professional development.

### Research Opportunities

Undergraduate students can participate in research with SBS faculty in a number of ways, such as Independent Study courses and Honors Research courses. Original research is central to our graduate programs, and graduate student research in the department spans the entire range of biological inquiry from molecules to organisms to ecosystems. Graduate students are supported by stipends, and undergraduate research can be performed on a volunteer basis, for degree credit, or, in certain cases, as a paid employee. The School also partners with companies and foundations to provide internship opportunities for our students.

## Special Facilities and Programs

The SBS is housed in five buildings on the OU Norman campus (Richards, Sutton, and George Lynn Cross Halls, the Stephenson Research and Technology Center, and the Physical Sciences Center), which contain faculty and graduate student offices, research and teaching laboratories, multi-user molecular biology core facilities, maintenance shops, stockrooms, graphics and photography workrooms, and computer rooms. Support staff include academic advisors, a media preparation technician, a computer specialist, and a shop supervisor. The SBS also maintains facilities and equipment, including several boats and vehicles, for research in the field. Teaching and research opportunities are provided for students at the following locations.

## BIOLOGICAL STATION AND OTHER RESEARCH UNITS

The University of Oklahoma Biological Station, located on Lake Texoma, an impoundment of the Red River on the Oklahoma-Texas border, is a permanent year-round field station with a resident staff of research scientists that provides year-round facilities for faculty and students. A summer session with approximately ten courses is attended by undergraduate and graduate students from throughout the country.

Students also use the facilities of the Samuel Roberts Noble Microscopy Laboratory, the Sam Noble Oklahoma Museum of Natural History, and the Oklahoma Biological Survey.

## LABORATORY ANIMAL FACILITY

This facility contains breeding colonies of rodents and provides housing for a variety of other small mammals, fish, amphibians, and reptiles.

## CORE MOLECULAR LABORATORY

The department's core molecular laboratory provides all the tools necessary to go from tissues to sequence to analysis.

## TISSUE CULTURE LABORATORY

This lab provides facilities for in vitro culture of vertebrate cells and tissues and for the production of monoclonal antibodies.

## COMPUTER FACILITIES

Computer rooms located in all buildings contain several microcomputers with associated printing and graphics equipment. In addition, numerous computers are located in individual research laboratories. Supercomputing and other special applications computer facilities are available through the OU Supercomputing Center for Education & Research (OSCER).

## AQUATIC RESEARCH FACILITY

The 8-acre Aquatic Research Facility (ARF) on the south research campus supports researchers and student activities with 32 ponds, 4 climate-controlled greenhouses, and a system of outdoor artificial streams.

## ANIMAL BEHAVIOR LABORATORY

A laboratory devoted to animal behavior and ecological studies, this facility provides indoor space and outdoor enclosures for the study of a wide variety of animals.

## KESSLER ATMOSPHERIC AND ECOLOGICAL FIELD STATION

Kessler Atmospheric and Ecological Field Station is a 350-acre tract of mixed grass prairie donated to the University of Oklahoma for research and teaching in environmental studies.

## OLIVER WILDLIFE PRESERVE

This wilderness area of 80 acres, situated just two miles south of the main campus, provides a natural laboratory for studies in ecology, natural history, and behavior.

## Scholarships and Financial Aid

The department has undergraduate scholarships and graduate scholarships available for academically outstanding students.

### M. BLANCHE AND M. FRANCES ADAMS SCHOLARSHIP

Scholarships of \$1,000 to \$3,000 per year for up to three years will be awarded on a competitive basis to undergraduate students majoring in SBS degree programs.

### GEORGE MIKSCH SUTTON SCHOLARSHIPS

Scholarships of \$500 to \$2,000 or more are awarded to undergraduate and graduate students in the field of Ornithology. Selection is based on merit and financial need.

Students are also encouraged to take advantage of the variety of scholarship and financial aid opportunities that are available. For additional information, please visit Dodge Family College of Arts and Sciences Scholarship Opportunities and Financial Aid Services Office.

## Undergraduate Study

### Biology

The biology major program is designed to meet the needs of students who plan to enter graduate school in the biological sciences, to

enter medical, dental, or veterinary college, or to work in specialized paramedical fields, environmental programs, or other careers for which biology would serve as an academic background. The department strongly recommends that each student work closely with his or her advisor on a regular basis since not all courses are offered every semester. Each major or prospective major should work closely with the biology advisory office on a regular basis to plan a program which will meet their career goals. The advisory office can furnish information on courses, curricula and careers available to majors and will facilitate the assignment of a faculty advisor.

- Biology, Bachelor of Science

Biology majors may also work for the standard secondary teaching certificate in science. For information consult an academic advisor in the College of Arts and Sciences office.

## MICROBIOLOGY

Microbiologists work in hospitals, universities, medical schools, government laboratories, and almost every industry, specializing in a wide variety of areas, from agriculture to the space industry. Our microbiology degrees are designed to promote development of the scientific, analytical, and problem-solving skills needed for our students to excel in these careers, as well as providing great preparation for and placement in medical, professional, and graduate schools.

- Microbiology (Standard) Bachelor of Science
- Microbiology: Biotechnology, Bachelor of Science
- Microbiology (Professional), Bachelor of Microbiology

## PLANT BIOLOGY

Plant biologists work in universities, medical facilities, government laboratories, and a variety of industries (e.g., agricultural, chemical, and pharmaceutical). Plant science is a growing area and studying plant biology provides a solid scientific foundation to make you employable in a wide range of fields. Our plant biology degrees are great preparation for careers to address complex societal issues involving population growth, food supply, and environmental problems.

- Plant Biology, Bachelor of Science
- Plant Biology: Biotechnology, Bachelor of Science

## MINORS

- Biology Minor
- Microbiology Minor
- Plant Biology Minor

## Graduate Study

### Biology PROGRAMS OFFERED

- Biology, M.S.
- Biology: Bioinformatics, M.S.
- Biology, Ph.D.
- Biology: Bioinformatics, Ph.D.
- Microbiology, M. S.
- Microbiology: Bioinformatics, M.S.
- Microbiology, Ph.D.
- Plant Biology, M.S.
- Plant Biology: Bioinformatics, M.S.
- Plant Biology, Ph.D.

- Cellular & Behavioral Neurobiology - Biology, Ph.D.
- Ecology & Evolutionary Biology - Biology, Ph.D.
- Ecology & Evolutionary Biology - Botany and Microbiology, Ph.D.

### Graduate Certificate

- Microscopic Imaging and Technology, Graduate Certificate

### Areas of Specialization

The graduate programs have internationally-recognized strengths in ecology/systematics, animal behavior, neurosciences, physiology, genetics/cell biology, and anaerobic microbiology. In addition to the core area M.S. and Ph.D. programs, many SBS faculty participate in two other Ph.D. programs on campus: Ecology and Evolutionary Biology and Cellular and Behavioral Neurobiology. Detailed information on all SBS graduate programs may be obtained from the Director of Graduate Studies or by contacting sbs@ou.edu.

Work leading to the Ph.D. degree is offered in most areas of research specialization. The Ph.D. programs require a satisfactory demonstration of knowledge in their research area. This proficiency will be determined by the dissertation advisory committee. The satisfactory completion and successful defense of original research as described in a dissertation is also required. Each student will, in consultation with the chairperson, select a dissertation advisory committee. A student must complete the general requirements of the Graduate College, appropriate research skills.

Each student will be assigned a specific dissertation committee whose functions are to aid in designing the degree program, provide advice on the dissertation research and conduct the oral dissertation defense examination.

### Courses

#### **BIOL 1003 Contemporary Issues in Biology 3 Credit Hours**

An introduction to biology, focusing on the scientific background needed to understand selected issues related to cells, genetics and inheritance, evolution and ecology. Not open to students with credit for BIOL 1005, BIOL 1013, BIOL 1114, BIOL 1124, BIOL 1134, or PBIO 1114. Cannot be used for major credit in Biology, Microbiology, or Plant Biology. (F, Sp) [II-NS].

#### **BIOL 1005 Concepts in Biology 5 Credit Hours**

Prerequisite: None, but high school or college chemistry is recommended. An introduction to the life sciences, focusing on the structure and function of organisms and their relationship to the environment. Fulfills general education laboratory science requirement. Not open to students with credit for BIOL 1003 or BIOL 1134, or PBIO 1114, BIOL 1114 or BIOL 1124. Cannot be used for major credit in Biology, Plant Biology, or Microbiology. Field trips. (F, Sp) [II-NSL].

#### **BIOL 1013 Introduction to Biology 3 Credit Hours**

Introductory survey of the fundamental concepts that underlie biological phenomena from the cellular to the ecosystem level. Not open to students with credit for BIOL 1003, BIOL 1005, BIOL 1114, BIOL 1124, or BIOL 1134. Cannot be used for major credit in Biology, Plant Biology or Microbiology. (F, Sp) [II-NS].

#### **BIOL 1114 Introductory Zoology 4 Credit Hours**

Major biological principles and concepts as illustrated in the structure, function and evolution of animals. Emphasis is on self-regulatory mechanisms, especially in the vertebrates, and their adaptive significance. (F, Sp, Su) [II-NS].

#### **BIOL 1121 Introductory Zoology Lab 1 Credit Hour**

Prerequisite: previous completion or concurrent enrollment in 1114. Laboratory study of structure and development of organ systems. Experiments on physiological process of selected vertebrates and invertebrates. (F, Sp, Su) [II-NSL].

#### **BIOL 1124 Intro Biol: Molecule/Cell/Phys 4 Credit Hours**

Major principles and concepts are presented in the function and physiology of animals, plants, fungi and microbes. Emphasis is on biological chemistry, cell structure and function, cellular energetics, molecular genetics, homeostasis and physiology. Includes biological laboratory experience with emphasis on critical thinking and problem solving. (F, Sp, Su) [II-NSL].

#### **BIOL 1134 Introductory Biology: Evolution, Ecology and Diversity 4 Credit Hours**

Prerequisite: Life science majors only. Major biological principles and concepts as illustrated in a survey of the diversity, behavior, and ecological functions of animals, plants, fungi, and microbes. Emphasis is on evolution, ecology, and diversity. Will include biological laboratory experience with emphasis on problem solving. Will include training in scientific procedures, including laboratory technical skills, writing skills, and introduction to statistical analysis. (Sp) [II-NSL].

#### **BIOL 1203 The Age of Dinosaurs 3 Credit Hours**

(Crosslisted with GEOL 1203) Introduction to basic principles and theories in biology (evolution, systematics, vertebrate morphology and relationships) and geology (geologic time, earth history, plate tectonics, sedimentation and stratigraphy), focusing on the evolutionary history of Dinosauria. May not be counted for major coursework in Biology or Geology. (F) [II-NS].

#### **BIOL 2124 Human Physiology 4 Credit Hours**

Prerequisite: BIOL 1114 and BIOL 1121 with a grade of C or better, or BIOL 1124 with a grade of C or better; a course in chemistry with a grade of C or better. May not be applied for biology major credit. Open only to majors in nursing, physical therapy, health and exercise science, and selected fields. Function of vertebrate organ systems in homeostasis. Circulation, digestion, endocrine and nervous control, metabolism, muscle action and respiration, with emphasis on humans. Laboratory. (F, Sp, Su)

#### **BIOL 2234 Introduction to Human Anatomy 4 Credit Hours**

Prerequisite: BIOL 1114 and BIOL 1121 with a grade of C or better, or BIOL 1124 with a grade of C or better, sophomore standing. (Cannot be enrolled concurrently with BIOL 2255). Open only to majors in health and exercise science, physical therapy, nursing and selected fields. An introduction to the gross morphology of the human body. The course will use a lab/lecture format with extensive use of models, videos, and computer-assisted instruction as well as prosected cadavers. Not for Biology major credit. (F)

#### **BIOL 2255 Human Anatomy 5 Credit Hours**

Prerequisite: BIOL 1114 and BIOL 1121 with a grade of C or better, or BIOL 1124 with a grade of C or better, sophomore standing. (Cannot be enrolled concurrently with BIOL 2234). Open only to majors in health and exercise science, physical therapy, nursing and selected fields. See [http://biology.ou.edu/human\\_anatomy-physiology.htm](http://biology.ou.edu/human_anatomy-physiology.htm) for complete list. The development and gross morphology of the human body and its systems. Laboratory dissection of human cadavers. Not for biology major credit. Laboratory (F, Sp)

- BIOL 2404 Ecology/Environmental Quality 4 Credit Hours**  
(Crosslisted with PBIO 2404) Prerequisite: sophomore standing. Study of ecological principles and their applications to human systems, study of population, air pollution, water pollution, energy issues, etc. Laboratory exercises focus on learning scientific methods of measurement of environmental quality factors. Laboratory (Sp) [II-NSL].
- BIOL 2913 Intro to Quantitative Biology 3 Credit Hours**  
Prerequisite: 1114 and 1121, or 1124, or Biology 1134, Mathematics 1523 or 1643 or higher, or permission of instructor. The connections between basic mathematics and how biological data are organized, tested, and interpreted. Includes review of probability theory, introduction to parametric and non-parametric biostatistics, fundamentals of experimental design, and sketches of how optimality theory can be used to generate biological questions. (Sp even-numbered years)
- BIOL 2970 Special Topics 3 Credit Hours**  
0 to 3 hours. Prerequisite: BIOL 1134 and BIOL 1124; or BIOL 1134 and BIOL 1114 and BIOL 1121; or BIOL 1124, BIOL 1134, or BIOL 1114 and BIOL 1121, and either Plant Biology 1114 or Chemistry 1315; or permission of instructor; May be repeated with change of content, maximum credit nine hours. Seminar or special topics course for content not currently offered in regularly scheduled courses. May include library and/or laboratory research, and field projects. (Irreg.)
- BIOL 3013 Evolution 3 Credit Hours**  
Prerequisite: BIOL 1124 and BIOL 1134. Processes of evolution including natural selection and non-selective forces. Phylogenetics and the history of life. The nature and origin of species. Factors contributing to divergence of genes, populations, species, and higher taxa such as genetics, ecology, geography, and behavior. (F, Sp)
- BIOL 3063 Veterinary Entomology 3 Credit Hours**  
Prerequisite: BIOL 1124, or BIOL 1114 and BIOL 1121; and BIOL 1134. The study of insects and their near relatives, such as ticks, as they relate to the causation of economic loss and transmission of disease organisms in livestock and companion animals. Insect biology, disease transmission, and methods of control will be stressed in lecture. Laboratory emphasizes 1) collection, preservation, and pathogens, and 2) methods used to control/evaluate insecticides and acaricides. Laboratory.
- BIOL 3073 Medical Entomology 3 Credit Hours**  
Prerequisite: 1114 and 1121, or Biology 1134. Medical entomology investigates the relationship of insects and other arthropods to the health of humans, domestic animals, and wildlife. Laboratory. (Sp)
- BIOL 3083 Animal Behavior 3 Credit Hours**  
(Crosslisted with PSY 3083) Prerequisite: 2013 or permission of instructor. Animal behavior from an evolutionary perspective. The effects of natural selections on mechanisms underlying behavior and on diversity of behavior among and within species. (F, Sp)
- BIOL 3101 Principles of Physiology Lab 1 Credit Hour**  
Prerequisite: BIOL 3103 or concurrent enrollment. Provides students with an introduction to methods and procedures used in physiological research. Topics include data acquisition, analysis and basic statistics, effects of temperature on living systems, nervous system functions, muscle mechanics and physiology, and studies of metabolic rates. In addition to hands-on lab experience, library projects and research papers are used to introduce students to methods of scientific communication. (Sp)
- BIOL 3103 Principles of Physiology 3 Credit Hours**  
Prerequisite: ZOO/BIOL 1124, or ZOO/BIOL 1114 and ZOO/BIOL 1121; and Biology 1134, or permission of instructor. One semester of physics and organic chemistry strongly recommended. Introduction to basic concepts of physiology; relation of functions of organisms to physical and chemical principles, and to the environment; discussion of experimental design, constituents of tissues, energy, growth, homeostasis, cellular and organ functions. (F, Sp)
- BIOL 3113 Cell Biology 3 Credit Hours**  
(Crosslisted with PBIO and MBIO 3113) Prerequisite: 1114, or 1124, or BIOL 1134, or PBIO 1114, and CHEM 3053. Introduction to the cell as a unit of life. A chemical and physical comparison of prokaryotic and eucaryotic cells to include a discussion of cell metabolism, types of metabolic regulation, and an analysis of ultrastructure. Emphasis will be placed on the dynamic changes in metabolism and ultrastructure which occur during the life of a cell. (F, Sp)
- BIOL 3122 Cell Biology Laboratory 2 Credit Hours**  
Prerequisite: BIOL 1124; Prerequisite or Concurrent Enrollment: BIOL 3113. This laboratory course introduces fundamental concepts of cellular biology through hands-on experience. The emphasis is to promote development of skills in formulating hypotheses, experimental design, data analysis and interpretation, and the ability to engage in ethical research, scientific writing, and communication. (F)
- BIOL 3201 Animal Development Lab 1 Credit Hour**  
Prerequisite: 3203 or concurrent enrollment. Laboratory study of the development and embryology of a variety of animals. Developmental concepts and mechanisms will be illustrated through the use of prepared materials and hands-on experiments. Laboratory (F, Sp)
- BIOL 3203 Animal Development 3 Credit Hours**  
Prerequisite: BIOL 1124, or BIOL 1114 and BIOL 1121; and BIOL 3333; and BIOL 1134. Study of animal development from gamete formation through organogenesis and postembryonic phases in different animal models. Concepts and mechanisms at the tissue, cellular and molecular levels will supplement descriptive analyses of development. (Sp)
- BIOL 3214 Comparative Vertebrate Anatomy 4 Credit Hours**  
Prerequisite: BIOL 1114 and BIOL 1121; or BIOL 1124; or BIOL 1134; or equivalent. A study of the anatomy and evolutionary development of vertebrate organ systems. Representative vertebrates are studied in laboratory. Laboratory (F)
- BIOL 3333 Genetics 3 Credit Hours**  
(Crosslisted with PBIO 3333) Prerequisite: BIOL 1124, or BIOL 1114 and BIOL 1121; BIOL 1134 recommended. Principles of inheritance at gene, chromosome, and population levels; nature of the genetic material and its involvement in the determination of structure and function. (F, Sp)
- BIOL 3342 Genetics Laboratory 2 Credit Hours**  
(Crosslisted with PBIO 3342) Prerequisite: 3333 or concurrent enrollment, or equivalent. The demonstrations, crosses and experiments are designed to illustrate various genetic phenomena, including Mendelian laws, recombination, mutation, natural and artificial selection, and interaction of genotype with environment. The primary organism studied is *Drosophila*, with some use of corn, *Neurospora*, and others. Laboratory (F)
- BIOL 3403 Principles of Ecology 3 Credit Hours**  
Prerequisite: BIOL 1114 and BIOL 1121, or BIOL 1134, or PBIO 1114. Patterns of environments and biological communities; the processes maintaining these patterns. Field trips. Some overnight trips. Laboratory (F, Sp)

- BIOL 3440 Mentored Research Experience 3 Credit Hours**  
0 to 3 hours. Prerequisite: ENGL 1113 or equivalent, and permission of instructor; May be repeated, maximum credit 12 hours. For the inquisitive student to apply the scholarly processes of the discipline to a research or creative project under the mentorship of a faculty member. Student and instructor should complete an Undergraduate Research & Creative Projects (URCP) Mentoring Agreement and file it with the URCP office. Not for honors credit. (F, Sp, Su)
- BIOL 3463 Water and Ecological Sustainability 3 Credit Hours**  
(Crosslisted with ENST 3463) Prerequisite: junior standing and English 1213 or Expository Writing 1213, BIOL 1114 or BIOL 1124 or BIOL 1134, or permission of instructor. Objective of the course is to allow students to examine and discuss important historical and current issues relating to the interactions between socio-economic use of water resources and ecosystem biodiversity, function, and sustainability. (F) [II-NS].
- BIOL 3563 Biological Conservation 3 Credit Hours**  
Prerequisite: BIOL 1114 and BIOL 1121, or BIOL 1134, or PBIO 1114. Active learning format course for exploring ecological, legal, and societal issues affecting biodiversity at local, regional, and global scales. Offered Fall of even-numbered years. (Irreg.)
- BIOL 3833 Introduction to Neurobiology 3 Credit Hours**  
Prerequisite: BIOL 1124. Introduction to cellular and behavioral neurobiology. Topics covered will include cellular neurobiology, neurophysiology, neuroanatomy, sensory processing, movement, and neurobiology of behavior. (Sp)
- BIOL 3960 Honors Reading (HONORS) 1-3 Credit Hours**  
1 to 3 hours. Prerequisite: admission to Honors Program and departmental permission; May be repeated, maximum credit six hours. Will consist of topics designated by the instructor. The content will emphasize work not presented in other courses. (F, Sp, Su)
- BIOL 3970 Honors Seminar 1-3 Credit Hours**  
1 to 3 hours. Prerequisite: admission to Honors Program; May be repeated, maximum credit six hours. Discussion of recent and current research trends and significant developments in zoology. (Irreg.)
- BIOL 3980 Honors Research (HONORS) 1-3 Credit Hours**  
1 to 3 hours. Prerequisite: Departmental permission and admission to Honors Program; May be repeated, maximum credit six hours. Will provide an opportunity for the gifted Honors candidate to work at a special project under the guidance of a professor in the student's field. Laboratory (F, Sp, Su)
- BIOL 3990 Independent Study 1-3 Credit Hours**  
1 to 3 hours. Prerequisite: one course in general area to be studied and permission of instructor and department; May be repeated, maximum credit six hours. Contracted independent study for topic not currently offered in regularly scheduled courses. Independent study may include library and/or laboratory research and field projects. (F, Sp, Su)
- BIOL 4003 Arthropod Vector Surveillance and Management 3 Credit Hours**  
Prerequisite: BIOL 1124 or BIOL 1134. Immerse yourself in a medical-veterinary field experience. Collect, preserve, and identify arthropod pests and vectors of pathogens that cause disease in humans and animals. Determine the risk associated with arthropod pests and vector borne diseases and develop an integrated pest (vector) management program to reduce that risk. Laboratory. (Sp)
- BIOL 4023 Field Mammalogy 3 Credit Hours**  
(Slashlisted with BIOL 5023) Prerequisite: two college science courses that include a laboratory, one of which should be in biological sciences or permission of UOBS Director; Course taught at Biological Station, students must apply for enrollment into course. Study of mammals with emphasis on principle of mammalian ecology, conservation, biodiversity, techniques of field study, and methods of collection and preservation. Topics include characteristics of mammals, classification, natural history, ecology, biodiversity, conservation, and techniques in field study. Emphasis is given to mammals of southern Oklahoma and northern Texas. Laboratory. No student may earn credit for both 4023 and 5023. (Su)
- BIOL G4034 Mammalogy 4 Credit Hours**  
Prerequisite: BIOL 1124 and BIOL 1134. Classification, distribution, and natural history of mammals with emphasis on Oklahoma species. Mammals are collected and prepared for scientific collections. Field trips. Some overnight camping. Laboratory. Offered Fall even-numbered years. (Irreg.)
- BIOL G4044 Ornithology 4 Credit Hours**  
Prerequisite: BIOL 1124, or BIOL 1114 and 1121; and BIOL 1134. Biology of birds. Identification of birds in North America with emphasis on Oklahoma; relationships, natural history and behavior of birds. Field trips. Laboratory. Offered Sp odd-numbered years. (Irreg.)
- BIOL 4053 Forensic Entomology 3 Credit Hours**  
Prerequisite: BIOL 1124, or BIOL 1114 and BIOL 1121; and BIOL 1134. Lecture will explore the use of insects in forensic entomology and its impact on death scene investigation, neglect or abuse; contamination of food products and other marketable goods and subsequent litigation. Lab will be centered on a "death scene investigation". Students will collect data from a pig carcass to determine factors that affect the rate of decomposition. Laboratory.
- BIOL 4063 Field Herpetology 3 Credit Hours**  
(Slashlisted with BIOL 5063) Prerequisite: two college science courses that include a laboratory, one of which should be in biological sciences or permission of UOBS Director. Overview of methods, techniques, and standards for the collection, management, and analysis of herpetological field data for various applications. Includes collection of amphibians and reptiles, and diagnostic (morphological, ecological, and behavioral) characteristics of species. Students design and complete individual projects that address current issues in biology and conservation in herpetology. Laboratory. No student may earn credit for both 4063 and 5063. (Su)
- BIOL G4073 General Entomology 3 Credit Hours**  
Prerequisite: Sophomore standing, and BIOL 1114 and BIOL 1121, or BIOL 1134, or PBIO 1114, or BIOL 1005, or permission of instructor. Introduction to the world of insects. Morphological and physiological adaptations; taxonomy, life histories, and methods of collection. Field trips. Laboratory (F)
- BIOL G4083 Herpetology 3 Credit Hours**  
Prerequisite: 2013 and Biology 1134 or permission of instructor. An introduction to the study of amphibians and reptiles. Taxonomy, ecology, behavior and life histories of amphibians and reptiles, with emphasis on local forms. Field trips. Laboratory. Offered Fall of odd-numbered years. (Irreg.)

- BIOL 4113 Cellular Pathology 3 Credit Hours**  
(Slashlisted with BIOL 5113) Prerequisite: 3113 or permission of instructor. The course focus is on the molecular and cellular bases of disease and alterations in cellular processes that lead to the development of various pathological conditions. Topics include symptoms of cellular disease, pathology of organelles, cell injury, cell death, immunopathology, neoplasia and genetic disorders. No student may earn credit for both 4113 and 5113. (F)
- BIOL 4153 Endocrinology 3 Credit Hours**  
(Slashlisted with BIOL 5153) Prerequisite: BIOL 3103; BIOL 3113 also strongly recommended. Endocrinology covers the structure and function of endocrine glands and the mechanisms of hormone action. Coverage of the endocrine glands includes biosynthesis of hormones, control and secretion of hormones, physiological, morphological, and behavioral actions of hormones, as well as a review of common endocrine disorders and clinical conditions. No student may earn credit for both 4153 and 5153. (Sp)
- BIOL 4204 Vertebrate Paleobiology 4 Credit Hours**  
(Crosslisted with GEOL 4204) Prerequisite: BIOL 1114 and 1121, or 1124 or 1134; BIOL 3214; or permission of instructor. Systematics, relationships, zoogeography and evolutionary morphology of the major groups of vertebrates. Field trips. Laboratory. (Sp)
- BIOL 4233 Neurobiology of Disease 3 Credit Hours**  
(Slashlisted with BIOL 5233) Prerequisite: BIOL 4833 (preferred), or BIOL 3113 and BIOL 3333, or BIOL 2124 or BIOL 3103; or permission of the instructor. Cellular and molecular mechanisms underlying both normal neuronal function and neuronal disorders. Includes a review of basic concepts in neuroscience through traditional lectures, and reading and discussion of original research articles. Students are required to give oral presentations, write critiques and term papers, and present research posters. No student may earn credit for both 4233 and 5233. (F)
- BIOL G4244 Animal Histology 4 Credit Hours**  
0 to 4 hours. Prerequisite: BIOL 3103 and BIOL 3113, or permission of instructor. Structure and function of animal tissues with emphasis on the cellular basis of tissue and organ function. Laboratory emphasizes the identification of cells and tissues with the use of the light microscope. Laboratory (Sp)
- BIOL 4353 Molecular Tech-Field Biology 3 Credit Hours**  
(Slashlisted with BIOL 5353) Prerequisite: 1114 and 1121, or 1124 and permission of instructor; 3333 or 3403 recommended. Selected protocols and data interpretation using molecular techniques to study protein and DNA variation in natural populations and the application of molecular techniques to research problems in ecology, systematics, animal behavior, conservation biology, and related areas. Graduate students enrolled in 5353 will have additional project expectations and written work. Taught at the OU Biological Station. Field trips. Laboratory No student may earn credit for both 4353 and 5353. (Su)
- BIOL 4361 Experimental Genetics and Cell Biology Lab 1 Credit Hour**  
Prerequisite: BIOL 3333 or BIOL 3113. Students will be introduced to experimental design and techniques including types of microscopy such as SEM and TEM, cell and tissue culture, DNA isolation, protein and DNA electrophoresis, PCR, and introductory bioinformatics. Offered Sp of odd numbered years. (Irreg.)
- BIOL 4423 Stream Ecology 3 Credit Hours**  
Prerequisite: BIOL 1124, or BIOL 1114 and BIOL 1121; and BIOL 1134; junior or senior standing, or permission of instructor. A combined lecture/laboratory course that focuses on the physical, chemical, and biological features of stream ecosystems, including current theories explaining species interactions and stream function. Course requirements/evaluation including a midterm and final examination, individual research papers and presentations, participation in group laboratory and field experiments, and reading and discussing the primary literature. Field trips. Laboratory. Offered Fa of odd-numbered years. (Irreg.)
- BIOL G4463 Lake Ecology 3 Credit Hours**  
Prerequisite: BIOL 3403, or permission of instructor. An introduction to the biology, chemistry, physics, and geology of freshwater environments, with emphasis on ecology. (Sp)
- BIOL G4493 Ichthyology 3 Credit Hours**  
Prerequisite: BIOL 1124, or BIOL 1114 and BIOL 1121; and BIOL 1134. Taxonomy, morphology, ecology and distribution of fishes, with emphasis on those of the region. Field trips. Some overnight trips. Laboratory. (Sp)
- BIOL 4523 Biogeography and Macroecology 3 Credit Hours**  
(Slashlisted with BIOL 5523) Prerequisite: BIOL 3013: Evolution, or permission of instructor. This course will explore the causes and consequences of the geographic distribution of life on Earth. We will discuss the processes which shape individual species distributions, why some regions host more species than others, and how the evolution of biodiversity is tied to the history and geography of Earth itself. No student may earn credit for both 4523 and 5523. (F)
- BIOL 4553 Wetlands Ecology 3 Credit Hours**  
(Slashlisted with BIOL 5553) Prerequisite: Two college science courses that include a laboratory, one of which should be in biological sciences or permission of UOBS Director. Comprehensive field-based examination of wetland science and management. Biological, physical, chemical, and hydrological aspects of wetland ecosystem structure and function are explored through visits to several field sites. Major wetland types and resources are examined and the biogeochemical and ecological diversity of wetland waters, soils, vegetation, and fauna is investigated. Laboratory. No student may earn credit for both 4553 and 5553. (Su)
- BIOL 4573 Conservation Genetics 3 Credit Hours**  
Prerequisite: 3333 or permission of the instructor. This lecture/discussion course will examine the use of population genetic/ecological genetic principles in the study and management of populations of threatened and/or endangered species. No student may earn credit for both 4573 and 5573. (Sp)
- BIOL 4633 Ecology and Evolution of Infectious Diseases 3 Credit Hours**  
(Slashlisted with BIOL 5633) Prerequisite: Junior standing, and a course on foundations of ecology and evolution is strongly recommended. Basic biological principles in how parasites are transmitted in natural populations, coevolution of hosts and parasites, and how novel parasites emerge and impact their host populations, including zoonotic parasites. No student may earn credit for both 4633 and 5633. (Sp)
- BIOL G4653 Parasitology 3 Credit Hours**  
Prerequisite: BIOL 1124, or BIOL 1114 and BIOL 1121; and BIOL 1134. Parasitology is an introduction to the biological relationships known as parasitism. Although there are many different types of parasites, this course will focus on primarily protozoan and helminthes parasites that cause disease in humans and domestic animals. Field trips. Laboratory. (Sp)

- BIOL 4663 Advanced Limnology 3 Credit Hours**  
(Slashlisted with BIOL 5663) Prerequisite: BIOL 4423 or BIOL 5423, or BIOL 4463, or permission of instructor; May be repeated with change of content, maximum credit 6 hours. Detailed study of fundamental or contemporary topics within limnology, such as biogeochemistry, nutrient cycling, ecological stoichiometry, biodiversity, and predatory-prey and food-web dynamics in aquatic communities. No student may earn credit for both 4663 and 5663. (Sp)
- BIOL 4753 Molecular Evolution and Phylogenetics 3 Credit Hours**  
(Slashlisted with BIOL 5753) Prerequisite: BIOL 2013 or BIOL 3333 or permission of instructor. Theory and practice of inferring evolutionary history from molecular and morphological data. Applications of the phylogenetic approach in systematics, comparative biology, molecular evolution, and genomics will be covered. (F even-numbered years) No student may earn credit for both 4753 and 5753.
- BIOL 4833 Neurobiology 3 Credit Hours**  
(Slashlisted with BIOL 5833) Prerequisite: permission of instructor. Advanced examination of cellular and behavioral neurobiology. Topics covered will include membrane biophysics, cellular neurobiology, neurophysiology, neuroanatomy, sensory processing, movement, and neurobiology of behavior. No student may earn credit for both 4833 and 5833. (F)
- BIOL 4843 Molecular Biology 3 Credit Hours**  
(Slashlisted with BIOL 5843; Crosslisted with PBIO and MBIO 4843) Prerequisite: BIOL 1114, or BIOL 1124, or BIOL 1134, or Plant Biology 1114, or Microbiology 3813 and Microbiology 3812, and one course in organic chemistry. Introduction to the characteristics and biological functions of nucleic acids and proteins in living cells with emphasis on nucleic acid replication, transcription, translation and regulation; also emphasis on the molecular aspects of microbial genetics transformation, transduction and conjugation; and emphasis on molecular immunology and genetic engineering/recombinant DNA technology. No student may earn credit for both 4843 and 5843. (F, Sp)
- BIOL 4863 Neural Control of Movement 3 Credit Hours**  
(Slashlisted with BIOL 5863) Prerequisite: BIOL 3103, or BIOL 3113, or BIOL 3833, or BIOL 4833, or BIOL 5833, or permission of instructor. Introduction to neural control of movement through reading and discussion of key original research articles from the 19th century to the present. Students lead discussions and write essays addressing a general question, utilizing data from the articles. Topics include localization of function, sensory vs. central contributions, roles of single neurons, effects of neuromodulators, and motor learning. No student may earn credit for both 4863 and 5863. (Sp)
- BIOL 4871 Current Topics in Neurobiology 1 Credit Hour**  
(Slashlisted with BIOL 5871) Prerequisite: BIOL 3833 or permission of instructor; May be repeated with change of content, maximum credit three hours. A seminar course designed to develop a student's abilities to interpret and critically evaluate research in cellular and behavioral neurobiology. Involves both public seminars and journal club style discussions of contemporary literature. No student may earn credit for both 4871 and 5871. (F, Sp)
- BIOL 4873 Diversity of Biological Sex Characteristics 3 Credit Hours**  
(Slashlisted with BIOL 5873) Prerequisite: BIOL 1124 and BIOL 1134. This course explores the diverse biological sex characteristics of nonhuman animals and people. We examine the evolution of sexual reproduction, sex-determining mechanisms, and hermaphroditic, parthenogenetic, intersex, and multiple-gender animal species, followed by the biology of intersex and transgender people. Finally, we discuss human infant genital surgeries and participation in athletic competitions. No student may earn credit for both 4873 and 5873. (F)
- BIOL 4893 Behavioral Neurobiology 3 Credit Hours**  
(Slashlisted with BIOL 5893) Prerequisite: BIOL 3103, or BIOL 3113, or BIOL 3833, or BIOL 4833, or BIOL 5833, or permission of instructor. Examines neurobiological mechanisms of natural animal behaviors (i.e. neuroethology), utilizing textbook and lectures as well as in-depth reading, discussion, and student presentation of original research articles. No student may earn credit for both 4893 and 5893. (F)
- BIOL G4913 Quantitative Biology 3 Credit Hours**  
Prerequisite: BIOL 1124, or BIOL 1114 and BIOL 1121; and BIOL 1134; Permission of instructor required. Techniques for complex data analysis and experimental design. (F)
- BIOL 4943 Multivariate Analysis 3 Credit Hours**  
(Slashlisted with BIOL 5943) Prerequisite: BIOL 4913 or permission of instructor. An introduction to the concepts and underpinnings of multivariate statistics used commonly in the life sciences. It includes sections on regression, central tendency, data reduction, cluster analyses, and ordination and treats both parametric and non-parametric approaches. No student may earn credit for both 4943 and 5943. (Sp)
- BIOL 4953 BioWriting 3 Credit Hours**  
(Slashlisted with BIOL 5953; Crosslisted with MBIO and PBIO 4953) Prerequisite: permission of instructor. This course provides students engaged in research with the information and skills needed to effectively communicate as professional biologists. Students will learn to report the results of their own research in the format of a journal article, conference-style presentation, and poster. No student may earn credit for both 4953 and 5953. (Irreg.)
- BIOL 4960 Directed Readings 1-4 Credit Hours**  
1 to 4 hours. Prerequisite: good standing in University; permission of instructor and dean; May be repeated, maximum credit four hours. Designed for upper-division students who need opportunity to study a specific problem in greater depth than formal course content permits. (Irreg.)
- BIOL 4961 Undergraduate Seminar 1 Credit Hour**  
Prerequisite: Senior standing in Zoology/Biology or permission of department; May be repeated, maximum credit two hours. Survey of current research programs in environmental biology, cell biology, physiology, animal behavior and other fields presented in weekly public seminars by visiting and local experts in biology. (F, Sp)
- BIOL 4970 Special Topics in Biology 3 Credit Hours**  
0 to 3 hours. Prerequisite: permission of instructor and department; May be repeated with change of content, maximum credit nine hours. Seminar or special topic course; may include laboratory or field work. No student may earn credit for 4970 and 5970 on the same topic. (F, Sp, Su)
- BIOL 4981 Current Topics in Disease Ecology 1 Credit Hour**  
(Slashlisted with BIOL 5981) Prerequisite: Junior standing. This seminar course will involve discussion of recent empirical and theoretical literature in the field of disease ecology and evolution. No student may earn credit for both 4981 and 5981. (F, Sp)

- BIOL 4983 Senior Seminar** **3 Credit Hours**  
Prerequisite: BIOL major with senior standing, or permission. An interdisciplinary approach will be used to synthesize ideas from the major fields of zoology. Readings and discussion will focus on contemporary social, ethical and economic issues. (F, Sp) [V].
- BIOL 4990 Independent Study** **1-3 Credit Hours**  
1 to 3 hours. Prerequisite: three courses in general area to be studied and permission of instructor and department; May be repeated, maximum credit six hours. Contracted independent study for topic not currently offered in regularly scheduled courses. Independent study may include library and/or laboratory research and field projects. (F, Sp, Su)
- BIOL 5023 Field Mammalogy** **3 Credit Hours**  
(Slashlisted with BIOL 4023) Prerequisite: graduate standing and two college science courses that include a laboratory, one of which should be in biological sciences or permission of UOBS Director. Study of mammals with emphasis on principle of mammalian ecology, conservation, biodiversity, techniques of field study, and methods of collection and preservation. Topics include characteristics of mammals, classification, natural history, ecology, biodiversity, conservation, and techniques in field study. Emphasis is given to mammals of southern Oklahoma and northern Texas. No student may earn credit for both 4023 and 5023. Laboratory. (Su)
- BIOL 5063 Field Herpetology** **3 Credit Hours**  
(Slashlisted with BIOL 4063) Prerequisite: graduate standing and two college science courses that include a laboratory, one of which should be in biological sciences or permission of UOBS Director. Overview of methods, techniques, and standards for the collection, management, and analysis of herpetological field data for various applications. Includes collection of amphibians and reptiles, and diagnostic (morphological, ecological, and behavioral) characteristics of species. Students design and complete individual projects that address current issues in biology and conservation in herpetology. No student may earn credit for both 4063 and 5063. Laboratory. (Su)
- BIOL 5113 Cellular Pathology** **3 Credit Hours**  
(Slashlisted with BIOL 4113) Prerequisite: Graduate standing and BIOL 3113 or permission of instructor. The course focus is on the molecular and cellular bases of disease and alterations in cellular process that lead to the development of various pathological conditions. Topics include symptoms of cellular disease, pathology of organelles, cell injury, cell death, immunopathology, neoplasia and genetic disorders. No student may earn credit for both 4113 and 5113. (F)
- BIOL 5153 Endocrinology** **3 Credit Hours**  
(Slashlisted with BIOL 4153) Prerequisite: Graduate standing and BIOL 3103; BIOL 3113 also strongly recommended. Endocrinology covers the structure and function of endocrine glands and the mechanisms of hormone action. Coverage of the endocrine glands includes biosynthesis of hormones, control and secretion of hormones, physiological, morphological, and behavioral actions of hormones, as well as a review of common endocrine disorders and clinical conditions. No student may earn credit for both 4153 and 5153. (Sp)
- BIOL 5233 Neurobiology of Disease** **3 Credit Hours**  
(Slashlisted with BIOL 4233) Prerequisite: BIOL 4833 (preferred), or BIOL 3113 and BIOL 3333, or BIOL 2124 or BIOL 3103; or permission of the instructor. Cellular and molecular mechanisms underlying both normal neuronal function and neuronal disorders. Includes a review of basic concepts in neuroscience through traditional lectures, and reading and discussion of original research articles. Students are required to give oral presentations, write critiques and term papers, and present research posters. No student may earn credit for both 4233 and 5233. (F)
- BIOL 5353 Molecular Tech-Field Biology** **3 Credit Hours**  
(Slashlisted with BIOL 4353) Prerequisite: Graduate standing and permission of instructor. Selected protocols and data interpretation using molecular techniques to study protein and DNA variation in natural populations and the application of molecular techniques to research problems in ecology, systematics, animal behavior, conservation biology, and related areas. Graduate students enrolled in 5353 will have additional project expectations and written work. Taught at the OU Biological Station. Field trips. Laboratory No student may earn credit for both 4353 and 5353. (Su)
- BIOL 5364 Transmissn Electron Microscopy** **4 Credit Hours**  
(Crosslisted with P BIO and M BIO 5364) Prerequisite: Graduate standing and permission of instructor. Introduction to the theory of transmission electron microscopy and practical instruction in specimen preparation, ultramicrotomy, instrument operation, photography and quantitative methods. Laboratory. (F)
- BIOL 5374 Scanning Electron Microscopy** **4 Credit Hours**  
(Crosslisted with P BIO and M BIO 5374) Prerequisite: basic chemistry; basic physics; demonstrated need; graduate standing and permission of instructor. Principles of scanning electron microscopy are combined with training in the operation of the SEM and ancillary equipment. Students will be certified in the operation of all equipment. Sample preparation on a variety of samples and darkroom procedures will be performed. Independent project with oral report and poster required. Laboratory (Irreg.)
- BIOL 5394 Advanced Light Microscopy** **4 Credit Hours**  
(Crosslisted with M BIO and P BIO 5394) Prerequisite: permission of instructor and graduate standing. Focuses on theory and techniques in light microscopy covering principles including confocal laser scanning microscopy, multiple photon imaging, FLIM/FCS, FRET, fluorescence microscopy, phase contrast, DIC, 3D rendering, and other advanced optical technologies. Also includes a lab section where students will learn to use advanced epifluorescence and confocal microscopes. (F)
- BIOL 5403 Population Ecology** **3 Credit Hours**  
Prerequisite: graduate standing. History, demography, environmental factors, density-dependent factors, genetics and population ecology, theories of population and community organization (ideas of Elton, Williams, Preston, MacArthur, Smith, Hairston, and Slodobodkin). No laboratory. Offered Sp of even-numbered years. (Irreg.)
- BIOL 5413 Community Ecology** **3 Credit Hours**  
Prerequisite: Graduate standing, BIOL 3403 and MATH 1743 or 1823, or permission. Theoretical and empirical study of the structure and organization of natural communities. Topics include competition, predation, disturbance, abiotic gradients, species equilibria.
- BIOL 5423 Stream Ecology** **3 Credit Hours**  
Prerequisite: graduate standing or permission of instructor. A combined lecture/laboratory course that focuses on the physical, chemical, and biological features of stream ecosystems, including current theories explaining species interactions and stream function. Course requirements/evaluation including a midterm and final examination, individual research papers and presentations, participation in group laboratory and field experiments, and reading and discussing the primary literature. Field trips. Laboratory. Offered Fa of odd-numbered years. (Irreg.)



- BIOL 5453 Advanced Ecology/Evol Biology 3 Credit Hours**  
(Crosslisted with P BIO 5453) Prerequisite: Graduate standing and BIOL 3403. Required for students in the ecology and evolutionary biology doctoral program. An introduction to current research opportunities and research programs in ecology and evolutionary biology at the University of Oklahoma. Specific topics and lecturers will vary from week to week to give students a broad overview of ongoing research projects. (F)
- BIOL 5471 Seminar in Ecology & Evolutionary Biology 1 Credit Hour**  
(Crosslisted with P BIO and M BIO 5471) Prerequisite: graduate standing; May be repeated, maximum credit 2 hours. Two semesters of enrollment are required for students in the ecology and evolutionary biology doctoral program. An intensive, student-based seminar in which students present both proposals and ongoing progress reports on doctoral level research projects in ecology and evolutionary biology. (F, Sp)
- BIOL 5523 Biogeography and Macroecology 3 Credit Hours**  
(Slashlisted with BIOL 4523) Prerequisite: Graduate standing and BIOL 3013, or Permission of Instructor. This course will explore the causes and consequences of the geographic distribution of life on Earth. We will discuss the processes which shape individual species distributions, why some regions host more species than others, and how the evolution of biodiversity is tied to the history and geography of Earth itself. No student may earn credit for both 4523 and 5523. (F)
- BIOL 5553 Wetlands Ecology 3 Credit Hours**  
(Slashlisted with BIOL 4553) Prerequisite: graduate standing and two college science courses that include a laboratory, one of which should be in biological sciences or permission of UOBS Director. Comprehensive field-based examination of wetland science and management. Biological, physical, chemical, and hydrological aspects of wetland ecosystem structure and function are explored through visits to several field sites. Major wetland types and resources are examined and the biogeochemical and ecological diversity of wetland waters, soils, vegetation, and fauna is investigated. No student may earn credit for both 4553 and 5553. Laboratory. (Su)
- BIOL 5573 Conservation Genetics 3 Credit Hours**  
Prerequisite: Graduate standing and BIOL 3333 or permission of the instructor. This lecture/discussion course will examine the use of population genetic/ecological genetic principles in the study and management of populations of threatened and/or endangered species. (Sp)
- BIOL 5633 Ecology and Evolution of Infectious Diseases 3 Credit Hours**  
(Slashlisted with BIOL 4633) Prerequisite: Graduate standing; a course on foundations of ecology and evolution is strongly recommended. Basic biological principles in how parasites are transmitted in natural populations, coevolution of hosts and parasites, and how novel parasites emerge and impact their host populations, including zoonotic parasites. No student may earn credit for both 4633 and 5633. (Sp)
- BIOL 5663 Advanced Limnology 3 Credit Hours**  
(Slashlisted with BIOL 5663) Prerequisite: 4423 or 5423, or 4463 and 4471, or permission of instructor; May be repeated with change of content, maximum credit 6 hours. Detailed study of fundamental or contemporary topics within limnology, such as biogeochemistry, nutrient cycling, ecological stoichiometry, biodiversity, and predator-prey and food-web dynamics in aquatic communities. No student may earn credit for both 4663 and 5663. (Sp)
- BIOL 5753 Molecular Evolution and Phylogenetics 3 Credit Hours**  
(Slashlisted with BIOL 4753) Prerequisite: BIOL 2013 or BIOL 3333 or permission of instructor and graduate standing. Theory and practice of inferring evolutionary history from molecular and morphological data. Applications of the phylogenetic approach in systematics, comparative biology, molecular evolution, and genomics will be covered. Offered Fall of even-numbered years. No student may earn credit for both 4753 and 5753. (Irreg.)
- BIOL 5833 Neurobiology 3 Credit Hours**  
(Slashlisted with BIOL 4833) Prerequisite: graduate standing or permission of instructor. Advanced examination of cellular and behavioral neurobiology. Topics covered will include membrane biophysics, cellular neurobiology, neurophysiology, neuroanatomy, sensory processing, movement, and neurobiology of behavior. No student may earn credit for both 4833 and 5833. (F)
- BIOL 5843 Molecular Biology 3 Credit Hours**  
(Crosslisted with P BIO and M BIO 5843; Slashlisted with BIOL 4843) Prerequisite: graduate standing or permission of instructor. Introduction to the characteristics and biological functions of nucleic acids and proteins in living cells with emphasis on nucleic acid replication, transcription, translation and regulation; also emphasis on the molecular aspects of microbial genetics transformation, transduction and conjugation; and emphasis on molecular immunology and genetic engineering/recombinant DNA technology. No student may earn credit for both 4843 and 5843. (F, Sp)
- BIOL 5863 Neural Control of Movement 3 Credit Hours**  
(Slashlisted with BIOL 4863) Prerequisite: Graduate standing and BIOL 3103 or BIOL 3113 or BIOL 4833/5833, or permission of instructor. Introduction to neural control of movement through reading and discussion of key original research articles from the 19th century to the present. Students lead discussions and write essays addressing a general question, utilizing data from the articles. Topics include localization of function, sensory vs. central contributions, roles of single neurons, effects of neuromodulators, and motor learning. No student may earn credit for both 4863 and 5863. (Sp)
- BIOL 5871 Current Topics in Neurobiology 1 Credit Hour**  
(Slashlisted with BIOL 4871) Prerequisite: Graduate standing and permission of the instructor; May be repeated, maximum credit three hours. A seminar course designed to develop a student's abilities to interpret and critically evaluate research in cellular and behavioral neurobiology. Involves both public seminars and journal club style discussions of contemporary literature. No student may earn credit for both 4871 and 5871 concurrently. No student may earn credit for both 4871 and 5871. (F, Sp)
- BIOL 5873 Diversity of Biological Sex Characteristics 3 Credit Hours**  
(Slashlisted with BIOL 4873) Prerequisite: Graduate standing. This course explores the diverse biological sex characteristics of nonhuman animals and people. We examine the evolution of sexual reproduction, sex-determining mechanisms, and hermaphroditic, parthenogenetic, intersex, and multiple-gender animal species, followed by the biology of intersex and transgender people. Finally, we discuss human infant genital surgeries and participation in athletic competitions. No student may earn credit for both 4873 and 5873. (F)

- BIOL 5893 Behavioral Neurobiology** **3 Credit Hours**  
(Slashlisted with BIOL 4893) Prerequisite: Graduate standing and BIOL 3103 or BIOL 3113, or BIOL 4833/5833 or permission of instructor. Examines neurobiological mechanisms of natural animal behaviors (i.e., neuroethology), utilizing textbook and lectures as well as in-depth reading, discussion, and student presentation of original research articles. No student may earn credit for both 4893 and 5893. (F)
- BIOL 5923 Programming in R for Biology** **3 Credit Hours**  
Prerequisite: graduate standing or permission of instructor. R is a data analysis and graphics platform that has become increasingly popular in the sciences because of its power and versatility. This course provides an introduction to programming using R for applications in the biological sciences, with an emphasis on implementation. (F)
- BIOL 5943 Multivariate Analysis** **3 Credit Hours**  
(Slashlisted with BIOL 4943) Prerequisite: Graduate standing and BIOL 4913 or permission of instructor. Introduces the concepts and underpinnings of multivariate statistics used commonly in the life sciences. The following topics will be included: regression, central tendency, data reduction, cluster analyses, and ordination and treats both parametric and non-parametric approaches. No student may earn credit for both 4943 and 5943. (Sp)
- BIOL 5953 BioWriting** **3 Credit Hours**  
(Slashlisted with BIOL 4953; Crosslisted with MBIO and PBIOL 5953) Prerequisite: Graduate standing and permission of instructor. This course provides students engaged in research with the information and skills needed to effectively communicate as professional biologists. Students will learn to report the results of their own research in the format of a journal article, conference-style presentation, and poster. Graduate students have additional assignments beyond those completed by undergraduates. No student may earn credit for both 4953 and 5953. (Irreg.)
- BIOL 5960 Directed Readings** **1-3 Credit Hours**  
1 to 3 hours. Prerequisite: graduate standing and permission of department; May be repeated, maximum credit twelve hours. Directed readings and/or literature reviews under the direction of a faculty member. (F, Sp, Su)
- BIOL 5970 Special Topics in Biology** **3 Credit Hours**  
0 to 3 hours. Prerequisite: Graduate standing and permission of instructor; May be repeated with change of topic, maximum credit 12 hours. Special topics course; may include laboratory or field work. No student may earn credit for 4970 and 5970 on the same topic. (F, Sp, Su)
- BIOL 5980 Research for Master's Thesis** **2-9 Credit Hours**  
2 to 9 hours. Prerequisite: Graduate standing. Variable enrollment, two to nine hours; maximum credit applicable toward degree, six hours. Laboratory (F, Sp, Su)
- BIOL 5981 Current Topics in Disease Ecology** **1 Credit Hour**  
(Slashlisted with BIOL 4981) Prerequisite: Graduate standing; May be repeated, maximum credit 9 hours. This seminar course will involve discussion of recent empirical and theoretical literature in the field of disease ecology and evolution. No student may earn credit for both 4981 and 5981. (F, Sp)
- BIOL 5990 Independent Study** **1-6 Credit Hours**  
1 to 6 hours. Prerequisite: Graduate standing and permission. May be repeated in different fields; maximum credit 12 hours. Directed readings. Written report required. No laboratory. (F, Sp, Su)
- BIOL 6960 Directed Readings** **1-3 Credit Hours**  
1 to 3 hours. Prerequisite: graduate standing or permission of instructor; May be repeated, maximum credit six hours. Directed readings and/or literature review under the direction of a faculty member. (Irreg.)
- BIOL 6970 Seminar** **1-4 Credit Hours**  
1 to 4 hours. Prerequisite: graduate standing and permission of instructor; May be repeated, maximum credit 12 hours; no more than six hours may be in any one field. No laboratory. (F, Sp, Su)
- BIOL 6980 Research for Doctoral Dissertation** **2-16 Credit Hours**  
2 to 16 hours. Prerequisites: Graduate standing and permission of instructor; may be repeated. Directed research culminating in the completion of the doctoral dissertation. (F, Sp, Su)
- BIOL 6990 Independent Study** **1-3 Credit Hours**  
1 to 3 hours. Prerequisite: Graduate standing and permission of instructor; May be repeated, maximum credit nine hours. Contracted independent study for a topic not currently offered in regularly scheduled courses. Independent study may include library and/or laboratory research and field projects. (Irreg.)
- MBIO 2124 Cornerstone Research Experience** **4 Credit Hours**  
Prerequisite: permission of instructor. Hands-on course targeted toward freshmen and sophomores; therefore there are no prerequisite courses required. The goal is to provide students with an authentic laboratory research experience building and experimentally testing hypotheses, collection and processing of data, and oral and written presentation of research results. The skills learned in this course will be beneficial during and beyond an undergraduate career. (F, Sp) [II-NS].
- MBIO 2815 Introduction to Microbiology** **5 Credit Hours**  
Prerequisite: one course in college chemistry. Introduction to microorganisms as biological entities. Survey of the roles of microorganisms in the ecosystem. Application of microorganisms to industrial and environmental problems. Discussion of microorganisms as causes of human disease and response of hosts to microbial invasion. This course does not count for major credit in Microbiology or Botany. Laboratory (F, Sp, Su) [II-NSL].
- MBIO 2970 Special Topics/Seminar** **1-3 Credit Hours**  
1 to 3 hours. Prerequisite: Permission of instructor; May be repeated, maximum credit nine hours. Special topics or seminar course for content not currently offered in regularly scheduled courses. May include library and/or laboratory research and field projects. (Irreg.)
- MBIO 3001 Microbiology: the Discipline and Degree** **1 Credit Hour**  
Prerequisite: Biology 1114, Biology 1124 or Biology 1134. Introduce students to their discipline, degree and faculty. Allows students microbiology credit prior to MBIOL 3813, which has a prerequisite of Chemistry 3053. By the end of the course students will have an introduction to use of the literature of microbiology and writing in scientific English, as well as familiarity with the discipline, progress towards degree completion and their faculty. (Sp)
- MBIO 3111 Undergraduate Professional Development** **1 Credit Hour**  
Prerequisite: Permission of instructor. The Professional Development course is designed to assist our microbiology students in achieving their career goals by enhancing their ability to communicate their accomplishments effectively. Students will learn about the career opportunities in microbiology, how to prepare resumes and/or graduate and professional school applications, how to communicate effectively in an interview, and how to build a professional network. (Sp)

- MBIO 3113 Cell Biology 3 Credit Hours**  
(Crosslisted with BOT and BIOL 3113) Prerequisite: Botany 1114, or Biology 1134, or Biology 1114 and 1121, or Biology 1124; and Chemistry 3053. Introduction to the cell as a unit of life. A chemical and physical comparison of prokaryotic and eukaryotic cells to include a discussion of cell metabolism, types of metabolic regulation and an analysis of ultrastructure. Emphasis will be placed on the dynamic changes in metabolism and ultrastructure which occur during the life of a cell. (F, Sp)
- MBIO 3440 Mentored Research Experience 3 Credit Hours**  
0 to 3 hours. Prerequisite: ENGL 1113 or equivalent, and permission of instructor; May be repeated, maximum credit 12 hours. For the inquisitive student to apply the scholarly processes of the discipline to a research or creative project under the mentorship of a faculty member. Student and instructor should complete an Undergraduate Research & Creative Projects (URCP) Mentoring Agreement and file it with the URCP office. Not for honors credit. (F, Sp, Su)
- MBIO 3673 Practical Bioinformatics 3 Credit Hours**  
(Crosslisted with PBIO 3673) Prerequisite: MBIO 2815, or MBIO 3813, or PBIO 1114, or BIOL 1005, or BIOL 1114, or equivalent introductory biology course, and junior standing, or instructor permission. Study of the use of computers to analyze and interpret various types of biological data. Topics covered will include accessing genomics databases, aligning DNA and protein sequences, searching genomic databases for similar sequences, analyzing protein structure, and building molecular phylogenies. Classes will emphasize group work and in-class computer exercises in a highly interactive environment. (Sp)
- MBIO 3812 Fundamentals of Microbiology Laboratory 2 Credit Hours**  
Prerequisite: credit or concurrent enrollment in 3813. Fundamental microbiological methods: aseptic technique, culture methods, microscopy, metabolic and physiological tests, bacterial isolation and identification, environmental microbiology. Laboratory (F, Sp, Su)
- MBIO 3813 Fundamentals of Microbiology 3 Credit Hours**  
Prerequisite: BIOL 1005 or BIOL 1114 or BIOL 1124 or BIOL 1134 or PBIO 1114; and CHEM 1315 and CHEM 1415, or CHEM 1335 and CHEM 1435. Cell structure and phylogeny of bacteria, archaea, and eukaryotic microorganisms; growth, metabolism and ecological roles; symbiotic relationships; gene expression, genetic exchange, genomics. (F, Sp, Su)
- MBIO 3960 Honors Reading 1-3 Credit Hours**  
1 to 3 hours. Prerequisite: admission to Honors Program; May be repeated, maximum credit six hours. Consists of topics designated by the instructor in keeping with the student's major program. The topics will cover materials not usually presented in the regular courses. (F, Sp, Su)
- MBIO 3970 Honors Seminar 1-3 Credit Hours**  
1 to 3 hours. Prerequisite: admission to Honors Program; May be repeated, maximum credit six hours. Projects covered will vary. Deals with concepts not usually presented in regular coursework. (F, Sp, Su)
- MBIO 3980 Honors Research 1-3 Credit Hours**  
1 to 3 hours. Prerequisite: admission to Honors Program and departmental permission; May be repeated, maximum credit six hours. (F, Sp, Su)
- MBIO 3990 Independent Study 1-3 Credit Hours**  
1 to 3 hours. Prerequisite: one course in general area to be studied and permission of instructor and department; May be repeated, maximum credit six hours. Contracted independent study for topic not currently offered in regularly scheduled courses. Independent study may include library and/or laboratory research and field projects. (F, Sp, Su)
- MBIO 4313 Biotechnology Applications 3 Credit Hours**  
(Crosslisted with PBIO 4313) Prerequisite: PBIO/BIOL 3113, or PBIO/BIOL 3333, or PBIO/BIOL/MBIO 4843, or PBIO/MBIO 4873, or CHEM 3653, or permission of instructor. For students who possess a working knowledge of molecular biology. Focus on developing familiarity with methods used in biotechnology to address societal challenges. Students will put into practice central methods of biotechnology, gaining practical skills for use in future careers in laboratory science, particularly methods relevant to pharmaceutical production, agricultural improvement, bio-fuel production, and medical and forensic diagnostics, among others. (Sp)
- MBIO 4630 MBIO Internship 1-6 Credit Hours**  
1 to 6 hours. (Crosslisted with PBIO 4630) Prerequisite: MBIO major; must have completed at least 30 hours; permission of instructor. This course is a planned hands-on work experience that will provide students with the opportunity to earn college credit while engaging in a valuable learning opportunity within the field of microbiology. Through an internship, students can explore microbiology-related career paths prior to graduation and apply the knowledge obtained from their MBIO coursework. (F, Sp, Su)
- MBIO 4673 Microbiomes: Health & Disease 3 Credit Hours**  
(Slashlisted with MBIO 5673) Prerequisite: Senior standing, MBIO 3812 and 3813, and CHEM 3013 or 3053, or permission of instructor. Introduces students to the modern-day characterization of microbiomes, from initial sequence information to the living organisms that make up these complex communities. Students will become familiar with the role microbiomes play in health and disease processes in addition to their role in personalized medicine. No student may earn credit for both 4673 and 5673. (Irreg.)
- MBIO 4693 Environmental Sampling Methods 3 Credit Hours**  
(Slashlisted with MBIO 5693; Crosslisted with METR and PBIO 4693) Prerequisite: diverse STEM background; permission of instructor; senior standing. The course gives students from diverse STEM backgrounds experience and knowledge of environmental sampling techniques, analysis of data generated, and interpretation of results in a scientific field outside their primary area of study. The multi-disciplinary structure helps students develop an understanding of different sampling techniques based on assumptions and perspectives on the environment at different spatial scales. No student may earn credit for both 4693 and 5693. (Sp)
- MBIO 4703 Basic Virology 3 Credit Hours**  
Prerequisite: MBIO 3813, and either CHEM 3653 or MBIO/PBIO/BIOL 4843, or permission of instructor. Introduction to the principles of viruses that infect animals, plants and bacteria. Topics will include viral structural and taxonomy, virus replication and disease pathogenesis, methods of viral detection and diagnosis, host resistance to viral infections, viruses and cancer and the used of viruses in gene therapy and vaccine applications. (Sp)
- MBIO 4733 Microbial Genetics 3 Credit Hours**  
(Slashlisted with MBIO 5733) Prerequisite: MBIO/PBIO/BIOL 4843, or permission of instructor. Microbial genetics underlies important topics such as antibiotic resistance, genetic engineering, drug development, and many biotechnological advances. Explores the interesting world of microbial genetics by discussing molecular genetic methods and related aspects of bacterial and archaeal biology. Examples will include both traditional and recently developed microbial model systems. No student may earn credit for both 4733 and 5733. (Sp)

- MBIO 4743 Case Studies in Medical Microbiology 3 Credit Hours**  
Prerequisite: MBIO 3813; MBIO 4823 or concurrent enrollment; or instructor permission. Provides in-depth knowledge of infectious diseases utilizing an inquiry-based format. Case studies will be discussed in the context of patient symptoms as well as molecular- and culture-based test results. Case studies from standard textbooks and clinical microbiology journals will be utilized. Students will gain experience in identifying causative agents of numerous infections. Ideal course for pre-dental, pre-medical and pre-pharmacy students. (Irreg.)
- MBIO 4783 Introduction to Python Programming for Data Analytics 3 Credit Hours**  
(Slashlisted with MBIO 5783; Crosslisted with PBIO 4783) Prerequisite: Senior standing. This course will introduce students, who have no prior programming experience, to Python programming. It will cover data analysis and visualization methods in Python. Real-world examples will be used to teach general concepts in data analytics and practical coding skills in Python. No student may earn credit for both 4783 and 5783. (F)
- MBIO 4810 Special Topics 3 Credit Hours**  
0 to 3 hours. (Slashlisted with MBIO 5810) Prerequisite: two courses in Microbiology and permission of instructor; May be repeated with change of content, maximum credit three hours per semester, nine hours total. Topics will include newly developing areas of the discipline. Taught at an upper-division level based on previous course background. No student may earn credit for both 4810 and 5810. (Irreg.)
- MBIO 4813 Pathogenic Microbiology Laboratory 3 Credit Hours**  
Prerequisite: MBIO 3812 and MBIO 3813, or equivalent. This course will focus primarily on bacterial species that cause disease in humans. Emphasis will be placed on the use of selective/differential media for pathogen isolation; the key diagnostic features of pathogenic bacteria and the application of rapid technologies for pathogen identification. Scientific papers will also be used to highlight the virulence properties of various pathogens. (Sp)
- MBIO 4823 Pathogenic Microbiology and Infectious Disease 3 Credit Hours**  
Prerequisite: MBIO 3812 and MBIO 3813. Introduces the basic methods for pathogenic microbiology and infectious disease epidemiology. Topics covered include definitions and nomenclature, outbreak investigations, disease surveillance, case-studies, laboratory diagnosis, immunology, molecular epidemiology, dynamics of transmission, and vaccine effectiveness. Emerging pathogens, their effects on society and the health care services will also be addressed. (F)
- MBIO 4833 Basic Immunology 3 Credit Hours**  
Prerequisite: one semester of organic chemistry, and an introductory biology course, plus one of the following: 3813 and 3812, Zoology 2124, 3113, 3204, 3333 or biochemistry or graduate standing and permission. Fundamentals of immunochemistry, cellular immunology, immunogenetics and clinical immunology. (Sp)
- MBIO 4843 Molecular Biology 3 Credit Hours**  
(Slashlisted with MBIO 5843; Crosslisted with PBIO and BIOL 4843) Prerequisite: MBIO 3812 and MBIO 3813, or Plant Biology 1114, or Biology 1114, or Biology 1124, or Biology 1134, and one course in organic chemistry. Introduction to the characteristics and biological functions of nucleic acids and proteins in living cells with emphasis on nucleic acid replication, transcription, translation and regulation; also emphasis on the molecular aspects of microbial genetics transformation, transduction and conjugation; and emphasis on molecular immunology and genetic engineering/recombinant DNA technology. No student may earn credit for both 4843 and 5843. (F, Sp)
- MBIO 4853 Physiology of Microorganisms 3 Credit Hours**  
Prerequisite: MBIO 3813, MBIO 3812 and a course in organic chemistry, or graduate standing. Diversity, metabolism, energetics and physiology of microorganisms. (Sp)
- MBIO 4864 Geomicrobiology 4 Credit Hours**  
(Slashlisted with MBIO 5864) Prerequisite: 3813 or permission of instructor. Life below the earth's surface. Bacterial degradation of pollutants. Petroleum microbiology. Role of microorganisms in geochemical cycling of carbon, sulfur, and metals. No student may earn credit for both 4864 and 5864. (F) [II-NSL].
- MBIO 4873 Microbial Physiology and Molecular Biology Laboratory 3 Credit Hours**  
Prerequisite: MBIO 3812 and MBIO 3813. Current techniques to explore molecular aspects of gene expression and regulation. Experiments include: plasmid and phage propagation, nucleic acid purification, DNA and protein manipulation, and gene analysis. (F, Sp) [II-NSL].
- MBIO 4883 Water Microbiology Laboratory 3 Credit Hours**  
Prerequisite: MBIO 3812 and MBIO 3813. Focuses on the causes and prevention of waterborne microbial diseases and the use of microorganisms to improve water quality. Topics include: waterborne diseases, detection of waterborne pathogens, epidemiology, indicator organisms, water quality standards, treatment of drinking water and sewage, and groundwater contamination. The laboratory provides training in the standard methods used to detect microbial contamination. (F)
- MBIO 4893 Capstone in Microbiology 3 Credit Hours**  
Prerequisite: three hours of calculus; 3813, 3812 and corequisite or prerequisite 4843. Combines laboratory research experiences, primarily in the areas of microbial diversity, physiology, and genetics, with an introduction to how research in microbiology is carried out. Laboratory (F, Sp) [V].
- MBIO 4903 Topics in Virology 3 Credit Hours**  
(Slashlisted with MBIO 5903) Prerequisite: Chemistry 3653 or MBIO 4843 or permission of instructor. Aspects related to selected RNA viruses, such as HIV/AIDS and polio virus, will be studied and discussed. Topics will include the molecular structure of RNA viruses, the mechanisms of viral assembly and replication, viral disease pathogenesis, host responses to viral infections, vaccine development, anti-viral and RNA interference (RNAi) therapeutics. No student may earn credit for both 4903 and 5903. (F)
- MBIO 4950 Senior Thesis - Capstone 1-6 Credit Hours**  
1 to 6 hours. Prerequisite: MBIO 3813 and permission of instructor; May be repeated for credit; maximum credit six hours. A minimum of six hours is required. This is a capstone course allowing students to carry out individual research projects under a faculty mentor. Students will present research results orally in a poster session, and by writing a senior thesis. Honors research credit may substitute for some or all of the senior thesis credit hours. (F, Sp, Su) [V].
- MBIO 4960 Directed Readings 1-4 Credit Hours**  
1 to 4 hours. Prerequisite: good standing in University; permission of instructor and dean; May be repeated, maximum credit four hours. Designed for upper-division students who need opportunity to study a specific problem in greater depth than formal course content permits. (Irreg.)

- MBIO 4970 Special Topics/Seminar 1-3 Credit Hours**  
1 to 3 hours. Prerequisite: Senior standing or permission of instructor; May be repeated, maximum credit nine hours. Special topics or seminar course for content not currently offered in regularly scheduled courses. May include library and/or laboratory research and field projects. (Irreg.)
- MBIO 4990 Independent Study 1-3 Credit Hours**  
1 to 3 hours. Prerequisite: three courses in general area to be studied and permission of instructor and department; May be repeated, maximum credit six hours. Contracted independent study for topic not currently offered in regularly scheduled courses. Independent study may include library and/or laboratory research and field projects. (F, Sp, Su)
- MBIO 5364 Transmission Electron Microscopy 4 Credit Hours**  
(Crosslisted with PBIO and BIOL 5364) Prerequisite: permission. Introduction to the theory of transmission electron microscopy and practical instruction in specimen preparation, ultramicrotomy, instrument operation, photography and quantitative methods. Laboratory (F)
- MBIO 5374 Scanning Electron Microscopy 4 Credit Hours**  
(Crosslisted with PBIO and BIOL 5374) Prerequisite: basic chemistry; basic physics; demonstrated need; graduate standing and permission of instructor. Principles of scanning electron microscopy combined with training in the operation of the SEM and ancillary equipment. Students will be certified in the operation of all equipment. Sample preparation on a variety of samples and darkroom procedures will be performed. Independent project with oral report and poster required. Laboratory .
- MBIO 5394 Advanced Light Microscopy 4 Credit Hours**  
(Crosslisted with BIOL and PBIO 5394) Prerequisite: permission of instructor and graduate standing; Corequisite: Lab section. Focuses on theory and techniques in light microscopy covering principles including confocal laser scanning microscopy, multiple photon imaging, FLIM/FCS, FRET, fluorescence microscopy, phase contrast, DIC, 3D rendering, and other advanced optical technologies. Also includes a lab section where students will learn to use advanced epifluorescence and confocal microscopes. (F)
- MBIO 5471 Seminar in Ecology & Evolutionary Biology 1 Credit Hour**  
(Crosslisted with PBIO and BIOL 5471) Prerequisite: graduate standing; May be repeated, maximum credit 2 hours. Two semesters of enrollment are required for students in the ecology and evolutionary biology doctoral program. An intensive, student-based seminar in which students present both proposals and ongoing progress reports on doctoral level research projects in ecology and evolutionary biology. (F, Sp)
- MBIO 5620 Investigations in Microbiology 1-6 Credit Hours**  
1 to 6 hours. Prerequisite: 15 hours of microbiology or permission of instructor; May be repeated with change of subject matter, maximum nine hours for a Masters student and twelve hours for a Ph.D. student. Maximum of six hours allowed with one professor, unless approved by Department Chair by petition. Fields of study: environmental microbiology, immunology, industrial microbiology, medical microbiology, medical mycology, microbial ecology, microbial genetics, microbial physiology, ultra-structural morphology, virology and molecular biology. (F, Sp, Su)
- MBIO 5673 Microbiomes: Health & Disease 3 Credit Hours**  
(Slashlisted with MBIO 4673) Prerequisite: Graduate standing; and MBIO 3812 and 3813; and CHEM 3013 or 3053; or permission of instructor. Introduces students to the modern-day characterization of microbiomes, from initial sequence information to the living organisms that make up these complex communities. Students will become familiar with the role microbiomes play in health and disease processes in addition to their role in personalized medicine. No student may earn credit for both 4673 and 5673. (Irreg.)
- MBIO 5693 Environmental Sampling Methods 3 Credit Hours**  
(Slashlisted with MBIO 4693; Crosslisted with METR and PBIO 5693) Prerequisite: Graduate standing and permission of instructor. The course gives students from diverse STEM backgrounds experience and knowledge of environmental sampling techniques, analysis of data generated, and interpretation of results in a scientific field outside their primary area of study. The multi-disciplinary structure helps students develop an understanding of different sampling techniques based on assumptions and perspectives on the environment at different spatial scales. No student may earn credit for both 4693 and 5693. (Sp)
- MBIO 5733 Microbial Genetics 3 Credit Hours**  
(Slashlisted with MBIO 4733) Prerequisite: graduate standing and MBIO/PBIO/BIOL 4843 or 5843, or permission of instructor. Microbial genetics underlies important topics such as antibiotic resistance, genetic engineering, drug development, and many biotechnological advances. Explores the interesting world of microbial genetics by discussing molecular genetic methods and related aspects of bacterial and archaeal biology. Examples will include both traditional and recently developed microbial model systems. No student may earn credit for both 4733 and 5733. (Sp)
- MBIO 5783 Introduction to Python Programming for Data Analytics 3 Credit Hours**  
(Slashlisted with MBIO 4783; Crosslisted with PBIO 5783) Prerequisite: Graduate standing. This course will introduce students, who have no prior programming experience, to Python programming. It will cover data analysis and visualization methods in Python. Real-world examples will be used to teach general concepts in data analytics and practical coding skills in Python. No student may earn credit for both 4783 and 5783. (F)
- MBIO 5810 Special Topics 3 Credit Hours**  
0 to 3 hours. (Slashlisted with MBIO 4810) Prerequisite: two courses in microbiology, graduate standing and permission; May be repeated with change of content, maximum credit three hours per semester, nine hours total. Topics will include newly developing areas of the discipline. Taught at an upper-division level based on previous course background. No student may earn credit for both 4810 and 5810. (Irreg.)
- MBIO 5821 Graduate Professional Development Seminar 1 Credit Hour**  
(Crosslisted with PBIO 5821) Prerequisite: Graduate standing and permission of instructor. This course will cover various topics and involve activities that are targeted at helping graduate students succeed in their first year of study, while also providing an opportunity to build a sense of community with other incoming students. (F)
- MBIO 5843 Molecular Biology 3 Credit Hours**  
(Slashlisted with MBIO 4843; Crosslisted with PBIO and BIOLOGY 5843) Prerequisite: graduate standing or permission of instructor. Introduction to the characteristics and biological functions of nucleic acids and proteins in living cells with emphasis on nucleic acid replication, transcription, translation and regulation; also emphasis on the molecular aspects of microbial genetics transformation, transduction and conjugation; and emphasis on molecular immunology and genetic engineering/recombinant DNA technology. No student may earn credit for both 4843 and 5843. (F, Sp)
- MBIO 5864 Geomicrobiology 4 Credit Hours**  
(Slashlisted with MBIO 4864) Prerequisite: 3813 or permission of instructor. Life below the earth's surface. Bacterial degradation of pollutants. Petroleum microbiology. Role of microorganisms in geochemical cycling of carbon, sulfur, and metals. No student may earn credit for both 4864 and 5864. (F)

- MBIO 5903 Topics in Virology** **3 Credit Hours**  
(Slashlisted with MBIO 4903) Prerequisite: graduate standing and CHEM 3653 or MBIO 4843 or permission of instructor. Aspects related to selected RNA viruses, such HIV/AIDS and polio virus, will be studied and discussed. Topics will include the molecular structure of RNA viruses, the mechanisms of viral assembly and replication, viral disease pathogenesis, host responses to viral infections, vaccine development, anti-viral and RNA interference (RNAi) therapeutics. No student may earn credit for both 4903 and 5903 on the same No student may earn credit for both 4903 and 5903. (F)
- MBIO 5953 BioWriting** **3 Credit Hours**  
(Slashlisted with MBIO 4953; Crosslisted with BIOL and P BIO 5953) Prerequisite: permission of instructor. This course provides students engaged in research with the information and skills needed to effectively communicate as professional biologists. Students will learn to report the results of their own research in the format of a journal article, conference-style presentation, and poster. Graduate students have additional assignments beyond those completed by undergraduates. No student may earn credit for both 4953 and 5953. (Irreg.)
- MBIO 5960 Directed Readings** **1-3 Credit Hours**  
1 to 3 hours. Prerequisite: graduate standing and permission of department. May be repeated; maximum credit twelve hours. Directed readings and/or literature reviews under the direction of a faculty member. (F, Sp, Su)
- MBIO 5970 Special Topics/Seminar** **1-3 Credit Hours**  
1 to 3 hours. Prerequisite: graduate standing or permission of instructor; May be repeated, maximum credit nine hours. Special topics or seminar course for content not currently offered in regularly scheduled courses. May include library and/or laboratory research and field projects. (Irreg.)
- MBIO 5971 Seminar in Microbiology** **1 Credit Hour**  
(Crosslisted with P BIO 5971) Prerequisite: graduate standing, permission of instructor. Required of all graduate students in microbiology. May be repeated; maximum credit two hours for the master's degree, three hours for the doctor's degree. Topics are selected from various areas of microbiology, and each student is called upon for discussion or formal presentations. No laboratory. (F, Sp)
- MBIO 5980 Research for Master's Thesis** **2-9 Credit Hours**  
2 to 9 hours. Variable enrollment, two to nine hours; maximum credit applicable toward degree, six hours. (F, Sp, Su)
- MBIO 5990 Special Studies in Microbiology** **1-3 Credit Hours**  
1 to 3 hours. Prerequisite: Graduate standing, 15 hours of microbiology, permission of instructor; May be repeated, Maximum credit of six hours with one professor, unless approved by Department Chair by petition. The student selects an area in which the student desires to read intensively, selects a staff member who is an authority in that field, and together they plan a program for investigation of the literature. (F, Sp, Su)
- MBIO 6960 Directed Readings** **1-3 Credit Hours**  
1 to 3 hours. Prerequisite: graduate standing or permission of instructor; May be repeated, maximum credit six hours. Directed readings and/or literature review under the direction of a faculty member. (Irreg.)
- MBIO 6970 Special Topics/Seminar** **1-3 Credit Hours**  
1 to 3 hours. Prerequisite: graduate standing or permission of instructor; May be repeated, maximum credit 12 hours. Special topics or seminar course for content not currently offered in regularly scheduled courses. May include library and/or research and field projects. (Irreg.)
- MBIO 6980 Research for Doctoral Dissertation** **2-16 Credit Hours**  
2 to 16 hours. Prerequisite: Graduate standing and permission of instructor; may be repeated. Directed research culminating in the completion of the doctoral dissertation. (F, Sp, Su)
- MBIO 6990 Independent Study** **1-3 Credit Hours**  
1 to 3 hours. Prerequisite: Graduate standing and permission of instructor; May be repeated, maximum credit nine hours. Contracted independent study for a topic not currently offered in regularly scheduled courses. Independent study may include library and/or laboratory research and field projects. (Irreg.)
- P BIO 1114 General Botany** **4 Credit Hours**  
Previous course in chemistry (high school or college) recommended. Fulfills Arts and Sciences' biological science requirement. Basic processes and structures in plants; their relation to factors in the environment; reproduction; heredity, heritable and nonheritable variations in plants and their causes and consequences are studied. Scientific procedures are acquired through application and discussion. Laboratory (F, Sp, Su) [II-NSL].
- P BIO 2404 Ecology & Environmntl Quality** **4 Credit Hours**  
(Crosslisted with BIOL 2404) Prerequisite: sophomore standing. Study of ecological principles and their applications to human systems, study of population, air pollution, water pollution, energy issues, etc. Laboratory exercises focus on learning scientific methods of measurement of environmental quality factors. This course does not count for major credit in Plant Biology. Laboratory. (Sp) [II-NSL].
- P BIO 2503 Plant Care and Cultivation** **3 Credit Hours**  
Prerequisite: P BIO 1114, or Biology 1005, or Biology 1114, or Biology 1134, or any introductory college Biology course. Application of the principles of botany to the cultivation, propagation, and maintenance of plants grown in home environments. Particular attention is given to the effects of light, water, minerals, and soil factors on plant growth; seed and vegetative propagation; pest control; and proper conditions for cultivated plants. (F) [II-NS].
- P BIO 3113 Cell Biology** **3 Credit Hours**  
(Crosslisted with MBIO and BIOL 3113) Prerequisite: 1114, or Biology 1134, or Biology 1114 and 1121, or Biology 1124; and Chemistry 3053. Introduction to the cell as a unit of life. A chemical and physical comparison of prokaryotic and eukaryotic cells to include a discussion of cell metabolism, types of metabolic regulation and an analysis of ultrastructure. Emphasis will be placed on the dynamic changes in metabolism and ultrastructure which occur during the life of a cell. (F, Sp)
- P BIO 3163 Economic Botany** **3 Credit Hours**  
Prerequisite: 1114, or Biology 1134, or Biology 1005, or any introductory biology course. A survey of plants and plant products used in industry, drug plants and drugs, and especially food plants and food adjuncts. Origin of agriculture, domestication and evolution of crop plants, and uses of plants in different cultures are emphasized. (F) [IV-WC].
- P BIO 3333 Genetics** **3 Credit Hours**  
(Crosslisted with BIOL 3333) Prerequisite: eight hours of ZOO/BIOL and/or P BIO and/or MBIO, or five hours of ZOO/BIOL or P BIO or MBIO and permission of instructor. Principles of inheritance at gene, chromosome and population levels; nature of the genetic material and its involvement in the determination of structure and function. No laboratory. (F, Sp)

- PBIO 3342 Genetics Laboratory 2 Credit Hours**  
Prerequisite: 3333 or concurrent enrollment or equivalent. The demonstrations, crosses and experiments are designed to illustrate various genetic phenomena, including Mendelian laws, recombination, mutation, natural and artificial selection and interaction of genotype with environment. The primary organism studied is *Drosophila*, with some use of corn, *Neurospora* and others. Laboratory (F)
- PBIO 3440 Mentored Research Experience 3 Credit Hours**  
0 to 3 hours. Prerequisites: ENGL 1113 or equivalent, and permission of instructor. May be repeated; maximum credit 12 hours. For the inquisitive student to apply the scholarly processes of the discipline to a research or creative project under the mentorship of a faculty member. Student and instructor should complete an Undergraduate Research & Creative Projects (URCP) Mentoring Agreement and file it with the URCP office. Not for honors credit. (F, Sp, Su)
- PBIO 3451 Methods in Plant Ecology 1 Credit Hour**  
Prerequisite: Corequisite: PBIO 3453. Methodology in plant physiological, population, community and ecosystem ecology will be covered. Emphasis will be on actual field or laboratory experience and the applicability of these methods to other areas of ecology. Laboratory. (F)
- PBIO 3453 Principles of Plant Ecology 3 Credit Hours**  
Prerequisite: PBIO 1114 or BIOL 1134. Introduction to physiological, population and community ecology. Emphasis is placed on environmental factors, disturbance and succession and how these factors affect species diversity and landscape patterns. One field trip. (F)
- PBIO 3673 Practical Bioinformatics 3 Credit Hours**  
(Crosslisted with MBI0 3673) Prerequisite: PBIO 1114, or MBI0 2815, or MBI0 3813, or BIOL 1005, or BIOL 1114, or equivalent introductory biology course, and junior standing, or instructor permission. Study of the use of computers to analyze and interpret various types of biological data. Topics covered will include accessing genomics databases, aligning DNA and protein sequences, searching genomic databases for similar sequences, analyzing protein structure, and building molecular phylogenies. Classes will emphasize group work and in-class computer exercises in a highly interactive environment. (Sp)
- PBIO 3960 Honors Reading (HONORS) 1-3 Credit Hours**  
1 to 3 hours. Prerequisite: admission to Honors Program. May be repeated; maximum credit six hours. (F, Sp, Su)
- PBIO 3970 Honors Seminar 1-3 Credit Hours**  
1 to 3 hours. Prerequisite: admission to Honors Program; May be repeated; maximum credit six hours. Subjects covered vary. Deals with concepts not usually treated in regular courses.
- PBIO 3980 Honors Research (HONORS) 1-3 Credit Hours**  
1 to 3 hours. Prerequisite: admission to Honors Program; May be repeated; maximum credit six hours. Provides an opportunity for the gifted Honors candidate to work on a special project in the student's field. (F, Sp, Su)
- PBIO 3990 Independent Study 1-3 Credit Hours**  
1 to 3 hours. Prerequisite: one course in general area to be studied; permission of instructor and department; May be repeated; maximum credit six hours. Contracted independent study for topic not currently offered in regularly scheduled courses. Independent study may include library and/or laboratory research and field projects. (F, Sp, Su)
- PBIO G4114 Principles of Plant Physiology 4 Credit Hours**  
Prerequisite: PBIO 1114 and CHEM 3053 or permission of instructor. Plant Physiology is the study of how plants grow and develop, respond to biotic and abiotic factors in their environments, convert solar energy to chemical energy, and generally how plants go about their business. Modern plant physiology is a fairly all-inclusive discipline and incorporates plant anatomy and morphology, biochemistry, genetics, molecular biology, etc. Laboratory. (F)
- PBIO 4264 Morphology of Vascular Plants 4 Credit Hours**  
Prerequisite: permission of instructor. Structural organization and phylogenetic relationships of vascular land plants are explored using living and extinct plants. Emphasis is given to understanding the origins, unique and common features of plant life histories, organography and morphogenesis. (Irreg.)
- PBIO G4283 Plant Anatomy 3 Credit Hours**  
Prerequisite: seven hours in biology or permission of instructor. The structure and development of the organs of vascular plants as revealed by observations of representative living and prepared specimens. Theories concerning the evolution of organs and internal structure. (Sp odd-numbered years)
- PBIO 4313 Biotechnology Applications 3 Credit Hours**  
(Crosslisted with MBI0 4313) Prerequisite: PBIO/BIOL 3113 or PBIO/BIOL 3333 or PBIO/MBIO/BIOL 4843 or PBIO/MBIO 4873 or Chemistry 3653 or permission of instructor. For students who possess a working knowledge of molecular biology. Focus on developing familiarity with methods used in biotechnology to address societal challenges. Students will put into practice central methods of biotechnology, gaining practical skills for use in future careers in laboratory science, particularly methods relevant to pharmaceutical production, agricultural improvement, bio-fuel production, and medical and forensic diagnostics, among others. (Sp)
- PBIO 4334 Horticulture 4 Credit Hours**  
Prerequisite: PBIO 1114 and BIOL 1134, or permission of the instructor. Application of botanical principles to the cultivation, propagation, and maintenance of plants. Attention is given to the evolutionary history of the plants and their needs in cultivation. Lab activities cover growth and propagation of plants in a greenhouse environment, constructing and testing hypotheses for how plant growth is affected by different conditions, and using R to examine resulting data. Laboratory. (Irreg.)
- PBIO 4483 Physiological Plant Ecology 3 Credit Hours**  
(Slashlisted with PBIO 5483) Prerequisite: PBIO 3453 or PBIO 4115 or permission of instructor. Study of energy budgets, plant water relations, carbon uptake and release, nutrient uptake and availability, and other factors as they affect plant growth, competition and ecosystem-level factors. In-depth analysis of current literature. (F, even-numbered years) No student may earn credit for both 4483 and 5483.
- PBIO 4534 Plant Systematics 4 Credit Hours**  
(Slashlisted with PBIO 5534) Prerequisite: PBIO 1114 and BIOL 1134 or permission of the instructor. Introduction to the evolution and identification of vascular plants with emphasis on the origin and evolution of the Oklahoma flora. Laboratory activities stress identification skills, terminology, field techniques, and family recognition for the flora of Oklahoma. Field trips. Laboratory. No student may earn credit for both 4534 and 5534. (Irreg.)

- PBIO 4630 PBIO Internship 1-6 Credit Hours**  
1 to 6 hours. (Crosslisted with MBIO 4630) Prerequisite: PBIO major; must have completed at least 30 hours; permission of instructor. This course is a planned hands-on work experience that will provide students with the opportunity to earn college credit while engaging in a valuable learning opportunity within the field of plant biology. Through an internship, students can explore plant biology career paths prior to graduation and apply the knowledge obtained from their PBIO coursework. (F, Sp, Su)
- PBIO 4693 Environmental Sampling Methods 3 Credit Hours**  
(Slashlisted with PBIO 5693; Crosslisted with METR and MBIO 4693) Prerequisite: diverse STEM background; permission of instructor; senior standing. The course gives students from diverse STEM backgrounds experience and knowledge of environmental sampling techniques, analysis of data generated, and interpretation of results in a scientific field outside their primary area of study. The multi-disciplinary structure helps students develop an understanding of different sampling techniques based on assumptions and perspectives on the environment at different spatial scales. No student may earn credit for both 4693 and 5693. (Sp)
- PBIO 4733 Environmental Remote Sensing 3 Credit Hours**  
(Slashlisted with PBIO 5733; Crosslisted with GIS 4733) Prerequisite: either a course or hands-on experience in remote sensing, GIS, statistical analysis, computer programming, or permission of the instructor and adviser. Course develops comprehensive knowledge and advanced skills of remote sensing, to apply to the study of the structure, composition, and functions of vegetation, landscapes, and the biosphere. Students will learn hyperspectral data acquisition and analysis; field survey methods; land cover classification from multiple sensors, time series data; and estimation of biophysical and biochemical parameters. Includes image processing software and algorithms. No student may earn credit for both 4733 and 5733. (Sp)
- PBIO 4783 Introduction to Python Programming for Data Analytics 3 Credit Hours**  
(Slashlisted with PBIO 5783; Crosslisted with MBIO 4783) Prerequisite: Senior standing. This course will introduce students, who have no prior programming experience, to Python programming. It will cover data analysis and visualization methods in Python. Real-world examples will be used to teach general concepts in data analytics and practical coding skills in Python. No student may earn credit for both 4783 and 5783. (F)
- PBIO 4810 Special Topics 1-3 Credit Hours**  
1 to 3 hours. (Slashlisted with PBIO 5810) Prerequisite: two courses in botany and permission; May be repeated with change of content; maximum credit three hours per semester, nine hours total. Topics will include newly developing areas of the discipline. Taught at an upper-division level based on previous course background. No student may earn credit for both 4810 and 5810 for the same course content. No student may earn credit for both 4810 and 5810. (Irreg.)
- PBIO 4843 Molecular Biology 3 Credit Hours**  
(Slashlisted with PBIO 5843; Crosslisted with MBIO and BIOL 4843) Prerequisite: MBIO 3812 and MBIO 3813, or Plant Biology 1114, or Biology 1114, or Biology 1124, or Biology 1134, and one course in organic chemistry. Introduction to the characteristics and biological functions of nucleic acids and proteins in living cells with emphasis on nucleic acid replication, transcription, translation and regulation; also emphasis on the molecular aspects of microbial genetics transformation, transduction and conjugation; and emphasis on molecular immunology and genetic engineering/recombinant DNA technology. No student may earn credit for both 4843 and 5843. (F, Sp)
- PBIO 4960 Directed Readings 1-4 Credit Hours**  
1 to 4 hours. Prerequisite: good standing in University; permission of instructor and dean; May be repeated; maximum credit four hours. Designed for upper-division students who need opportunity to study a specific problem in greater depth than formal course content permits. (Irreg.)
- PBIO 4970 Special Topics/Seminar 1-3 Credit Hours**  
1 to 3 hours. Prerequisite: Senior standing or permission of instructor; May be repeated; maximum credit nine hours. Special topics or seminar course for content not currently offered in regularly scheduled courses. May include library and/or laboratory research and field projects. (Irreg.)
- PBIO 4983 Senior Capstone: Plant Biol 3 Credit Hours**  
Prerequisite: Majors only, 12 hours of botany and senior standing. Interdisciplinary approach to synthesize ideas from the major areas of botany. Readings, research and discussions on the important issues in botany at the present and into the next century. A major written assignment required. [V].
- PBIO 4990 Independent Study 1-3 Credit Hours**  
1 to 3 hours. Prerequisite: three courses in general area to be studied, permission of instructor and department; May be repeated; maximum credit six hours. Contracted independent study for topic not currently offered in regularly scheduled courses. Independent study may include library and/or laboratory research and field projects. (F, Sp, Su)
- PBIO 5364 Transmis Electron Microscopy 4 Credit Hours**  
(Crosslisted with MBIO and ZOO 5364) Prerequisite: permission. Introduction to the theory of transmission electron microscopy and practical instruction in specimen preparation, ultramicrotomy, instrument operation, photography and quantitative methods. Laboratory (F)
- PBIO 5374 Scanning Electron Microscopy 4 Credit Hours**  
(Crosslisted with MBIO and ZOO 5374) Prerequisite: basic chemistry; basic physics; demonstrated need; graduate standing and permission of instructor. Principles of scanning electron microscopy combined with training in the operation of the SEM and ancillary equipment. Students will be certified in the operation of all equipment. Sample preparation on a variety of samples and darkroom procedures will be performed. Independent project with oral report and poster required. Laboratory.
- PBIO 5394 Advanced Light Microscopy 4 Credit Hours**  
(Slashlisted with PBIO 4394; Crosslisted with BIOL and MBIO 5394) Prerequisite: permission of instructor and graduate standing; Corequisite: Lab section. Focuses on theory and techniques in light microscopy covering principles including confocal laser scanning microscopy, multiple photon imaging, FLIM/FCS, FRET, fluorescence microscopy, phase contrast, DIC, 3D rendering, and other advanced optical technologies. Also includes a lab section where students will learn to use advanced epifluorescence and confocal microscopes. No student may earn credit for both 4394 and 5394. (F)
- PBIO 5453 Advanced Ecology/Evolut Biol 3 Credit Hours**  
(Crosslisted with BIOL 5453) Prerequisite: Graduate standing, general ecology. Required for students in the ecology and evolutionary biology doctoral program. An introduction to current research opportunities and research programs in ecology and evolutionary biology at the University of Oklahoma. Specific topics and lecturers will vary from week to week to give students a broad overview of ongoing research projects. (F)



- PBIO 5471 Seminar in Ecology & Evolutionary Biology 1 Credit Hour**  
(Crosslisted with MBIO and BIOL 5471) Prerequisite: graduate standing; May be repeated, maximum credit 2 hours. Two semesters of enrollment are required for students in the ecology and evolutionary biology doctoral program. An intensive, student-based seminar in which students present both proposals and ongoing progress reports on doctoral level research projects in ecology and evolutionary biology. (F, Sp)
- PBIO 5483 Physiological Plant Ecology 3 Credit Hours**  
(Slashlisted with PBIO 4483) Prerequisite: graduate standing and PBIO 3453 or PBIO 4115 or permission of instructor. Study of energy budgets, plant water relations, carbon uptake and release, nutrient uptake and availability, and other factors as they affect plant growth, competition and other ecosystem-level factors. In-depth analysis of current literature. No student may earn credit for both 4483 and 5483. (F, even-numbered years)
- PBIO 5534 Plant Systematics 4 Credit Hours**  
(Slashlisted with PBIO 4534) Prerequisite: Graduate standing. Introduction to the evolution and identification of vascular plants with emphasis on the origin and evolution of the Oklahoma flora. Laboratory activities stress identification skills, terminology, field techniques, and family recognition for the flora of Oklahoma. Field trips. Laboratory. No student may earn credit for both 4534 and 5534. (Irreg.)
- PBIO 5620 Investigations in Botany 1-6 Credit Hours**  
1 to 6 hours. Prerequisite: 15 hours of BOT/PBIO and permission of instructor; May be repeated, maximum of nine hours for a masters student and twelve hours for Ph.D. student. Only six hours allowed with one professor, unless approved by Department Chair by petition. Fields: Ecology, morphology, physiology, systematics, mycology, anatomy, electron microscopy, plant molecular biology. (F, Sp, Su)
- PBIO 5693 Environmental Sampling Methods 3 Credit Hours**  
(Slashlisted with PBIO 4693; Crosslisted with MBIO and METR 5693) Prerequisite: Graduate standing and permission of instructor. The course gives students from diverse STEM backgrounds experience and knowledge of environmental sampling techniques, analysis of data generated, and interpretation of results in a scientific field outside their primary area of study. The multi-disciplinary structure helps students develop an understanding of different sampling techniques based on assumptions and perspectives on the environment at different spatial scales. No student may earn credit for both 4693 and 5693. (Sp)
- PBIO 5733 Environmental Remote Sensing 3 Credit Hours**  
(Slashlisted with PBIO 4733; Crosslisted with GIS 5733) Prerequisite: Graduate standing, and either a course or hands-on experience in remote sensing, GIS, statistical analysis, computer programming, or permission of the instructor and adviser. Course develops comprehensive knowledge and advanced skills of remote sensing, to apply to the study of the structure, composition, and functions of vegetation, landscapes, and the biosphere. Students will learn hyperspectral data acquisition and analysis; field survey methods; land cover classification from multiple sensors, time series data; and estimation of biophysical and biochemical parameters. Includes image processing software and algorithms. No student may earn credit for both 4733 and 5733. (Sp)
- PBIO 5783 Introduction to Python Programming for Data Analytics 3 Credit Hours**  
(Slashlisted with PBIO 4783; Crosslisted with MBIO 5783) Prerequisite: Graduate standing. This course will introduce students, who have no prior programming experience, to Python programming. It will cover data analysis and visualization methods in Python. Real-world examples will be used to teach general concepts in data analytics and practical coding skills in Python. No student may earn credit for both 4783 and 5783. (F)
- PBIO 5810 Special Topics 1-3 Credit Hours**  
1 to 3 hours. (Slashlisted with PBIO 4810) Prerequisite: two courses in plant biology, graduate standing, and permission of instructor; May be repeated with change of content, maximum credit three hours per semester, nine hours total. 1 to 3 hours. Topics will include newly developing areas of the discipline. Taught at the graduate level based on previous course background. No student may earn credit for both 4810 and 5810 for the same content. No student may earn credit for both 4810 and 5810. (Irreg.)
- PBIO 5821 Graduate Professional Development Seminar 1 Credit Hour**  
(Crosslisted with MBIO 5821) Prerequisite: Graduate standing and permission of instructor. This course will cover various topics and involve activities that are targeted at helping graduate students succeed in their first year of study, while also providing an opportunity to build a sense of community with other incoming students. (F)
- PBIO 5843 Molecular Biology 3 Credit Hours**  
(Slashlisted with PBIO 4843; Crosslisted with MBIO and BIOL 5843) Prerequisite: graduate standing or permission of instructor. Introduction to the characteristics and biological functions of nucleic acids and proteins in living cells with emphasis on nucleic acid replication, transcription, translation and regulation; also emphasis on the molecular aspects of microbial genetics – transformation, transduction and conjugation; and emphasis on molecular immunology and genetic engineering/recombinant DNA technology. No student may earn credit for both 4843 and 5843. (F, Sp)
- PBIO 5953 BioWriting 3 Credit Hours**  
(Slashlisted with PBIO 4953; Crosslisted with BIOL and MBIO 5953) Prerequisite: permission of instructor. This course provides students engaged in research with the information and skills needed to effectively communicate as professional biologists. Students will learn to report the results of their own research in the format of a journal article, conference-style presentation, and poster. Graduate students have additional assignments beyond those completed by undergraduates. No student may earn credit for both 4953 and 5953. (Irreg.)
- PBIO 5960 Directed Readings 1-3 Credit Hours**  
1 to 3 hours. Prerequisite: graduate standing and permission of department; May be repeated, maximum credit twelve hours. Directed readings and/or literature reviews under the direction of a faculty member. (F, Sp, Su)
- PBIO 5970 Special Topics/Seminar 1-3 Credit Hours**  
1 to 3 hours. Prerequisite: Graduate standing or permission of instructor; May be repeated, maximum credit nine hours. Special topics or seminar course for content not currently offered in regularly scheduled courses. May include library and/or laboratory research and field projects. (Irreg.)
- PBIO 5971 Seminar in Botany 1 Credit Hour**  
(Crosslisted with MBIO 5971) Prerequisite: graduate standing, majors only, and permission of instructor. Required of all graduate students in botany. May be repeated; maximum credit two hours for the master's degree, three hours for the doctor's degree. Selected topics in botany. Each student is called upon for discussion or formal presentations. No laboratory. (F, Sp)
- PBIO 5980 Research for Master's Thesis 2-9 Credit Hours**  
2 to 9 hours. Prerequisite: Graduate standing. Variable enrollment, two to nine hours; maximum credit applicable toward degree, six hours. Preparation of an original research paper in one of the fields of botany. (F, Sp, Su)

**PBIO 5990 Special Studies in Botany 1-3 Credit Hours**

1 to 3 hours. Prerequisite: Graduate standing, 15 hours of BOT/PBIO and permission of instructor; May be repeated, maximum credit 12 hours, with a limit of six hours with one professor unless approved by Department Chair by petition. The student selects an area in which the student desires to read intensively, then selects a staff member who is an authority in that field and together they plan a program for investigation of the literature. (F, Sp, Su)

**PBIO 6960 Directed Readings 1-3 Credit Hours**

1 to 3 hours. Prerequisite: graduate standing or permission of instructor; May be repeated, maximum credit six hours. Directed readings and/or literature review under the direction of a faculty member. (Irreg.)

**PBIO 6970 Special Topics/Seminar 1-3 Credit Hours**

1 to 3 hours. Prerequisite: graduate standing or permission of instructor; May be repeated, maximum credit 12 hours. Special topics or seminar course for content not currently offered in regularly scheduled courses. May include library and/or research and field projects. (Irreg.)

**PBIO 6980 Research for Doctoral Dissertation 2-16 Credit Hours**

2 to 16 hours. Prerequisite: Graduate standing and permission of instructor; may be repeated. Preparation of a research paper consisting of a notable contribution to knowledge in one of the fields of botany. (F, Sp, Su)

**PBIO 6990 Independent Study 1-3 Credit Hours**

1 to 3 hours. Prerequisite: Graduate standing and permission of instructor; May be repeated, maximum credit nine hours. Contracted independent study for a topic not currently offered in regularly scheduled courses. Independent study may include library and/or laboratory research and field projects. (Irreg.)

Last Name	First/Middle Name	Middle init.	OU Service start	Title(s), date(s) appointed	Degrees Earned, Schools, Dates Completed
Becker	Daniel	J	2021	ASSISTANT PROFESSOR OF BIOLOGY, 2021	Ph.D., University of Georgia, 2017; Bard College, 2010
Bentz	Alexandra		2021	ASSISTANT PROFESSOR OF BIOLOGY, 2021	Ph.D., University of Georgia, 2017; M.S., Appalachian State University, 2012; B.A., Appalachian State University, 2010
Bergey	Elizabeth	A	2000	ASSOCIATE HERITAGE ZOOLOGIST OF OKLAHOMA BIOLOGICAL SURVEY, 2006; PROFESSOR OF BIOLOGY, 2017	Ph.D., University of California-Berkeley, 1992; M.S., Colorado State University, 1981, B.S., University of Oklahoma 1977
Berkowitz	Robert	A	1997	PROFESSOR OF BIOLOGY, 2010; PRESIDENT'S ASSOCIATES PRESIDENTIAL PROFESSOR, 2015	Ph.D., Washington University, 1993; A.B., University of Chicago, 1984

Bridge	Eli	S	2012	ADJUNCT ASSISTANT PROFESSOR OF BIOLOGY, 2012; CHAIR, INSTITUTIONAL ANIMAL CARE AND USE COMMITTEE, 2016; ASSOCIATE PROFESSOR OF OKLAHOMA BIOLOGICAL SURVEY, 2017	Ph.D., University of Minnesota, 2004; B.A., Westminster College, 1997
Bright	Eric	G		INSTRUCTOR OF BIOLOGY	Ph.D., University of Oklahoma, 2015
Broughton	Richard	E	2000	PROFESSOR OF BIOLOGY, 2014; PROFESSOR OF BIOLOGICAL SURVEY, 2014	Ph.D., Arizona State University, 1995; M.S., University of California-Chico; B.S., University of California-Chico, 1987
De Leon	Kara	B	2019	ASSISTANT PROFESSOR OF MICROBIOLOGY, 2019	Ph.D., Montana State University, 2013; B.S., Northwest Nazarene University, 2006
Dunn	Anne	K	2007	ASSOCIATE PROFESSOR OF MICROBIOLOGY AND PLANT BIOLOGY, 2013	Ph.D., University of Wisconsin, 2002; B.S., Iowa State University, 1996
Eberle	Jess	R		INSTRUCTOR IN BIOLOGY	M.S., University of Oklahoma, 2015
Everman	Elizabeth		2017	ASSISTANT PROFESSOR OF BIOLOGY, 2017	Ph.D., Kansas State University, 2017
Fornelli	Luca		2019	ASSISTANT PROFESSOR OF BIOLOGY, 2019	Ph.D., Ecole Polytechnique Federale de Lausanne, Switzerland, 2014
Gibson	J.	Phil		PROFESSOR OF BIOLOGY; PROFESSOR OF BOTANY AND MICROBIOLOGY	Ph.D., University of Colorado, 1995; M.S., University of Georgia, 1990; B.S., Oklahoma State University, 1988
Gordon	Cynthia	L	2003	DIRECTOR, HUMAN ANATOMY PROGRAMS, 2010; ASSOCIATE PROFESSOR OF BIOLOGY, 2011	Ph.D., University of Oklahoma, 2003; M.S., Murray State University, 1998; B.S., Ohio State University, 1989
Hewes	Randall	S	2001	PROFESSOR OF BIOLOGY, 2015; ADJUNCT PROFESSOR OF CELL BIOLOGY, COLLEGE OF MEDICINE, 2015	Ph.D., University of Washington, 1993; B.S., Carleton College, 1988
Hung	Keng-Lou James		2021	ASSISTANT PROFESSOR OF BIOLOGY, 2021	Ph.D., University of California-San Diego, 2017; B.A., Dartmouth College, 2010
Ibberson	Carolyn		2021	ASSISTANT PROFESSOR OF MICROBIOLOGY, 2021	Ph.D., University of Iowa, 2015; B.S., University of Wisconsin-Madison, 2010

Karr	Elizabeth	A	2007	ASSOCIATE PROFESSOR OF MICROBIOLOGY AND PLANT BIOLOGY, 2014	Ph.D., Southern Illinois University, 2003; B.S., Murray State University, 1999	FAMILY FOUNDATION PRESIDENTIAL PROFESSOR, 2018
Kaspari	Michael	E	1995	PRESIDENT'S ASSOCIATES PRESIDENTIAL PROFESSOR, 2008; GEORGE LYNN CROSS RESEARCH PROFESSOR OF BIOLOGY, 2013	Ph.D., University of Arizona, 1992; M.S., University of Nebraska, 1985; B.S., University of Nebraska, 1983	
Kelly	Jeffrey	F	2002	PROFESSOR OF BIOLOGY, 2014; PROFESSOR OF OKLAHOMA BIOLOGICAL SURVEY, 2014; CORIX ENDOWED CHAIR IN WATER AND SUSTAINABILITY, 2018; DIRECTOR, CORIX PLAINS INSTITUTE, 2018	Ph.D., Colorado State University, 1996; M.S., Oklahoma State University, 1991; B.S., University of Maine, 1987	
Ketchum	Heather	R	2005	ASSOCIATE PROFESSOR OF BIOLOGY, 2012; ADJUNCT ASSOCIATE PROFESSOR OF LIBERAL STUDIES, 2012; PRESIDENTIAL TEACHING FELLOW OF HONORS, 2018	Ph.D., Texas A&M University, 2002; M.S., California Polytechnic, 1996; B.S., University of California-Riverside, 1993	
Klawinski	Paul		2022	DISTINGUISHED LECTURER, DEPARTMENT OF BIOLOGY, 2022		
Lanier	Hayley		2017	ASSISTANT PROFESSOR OF BIOLOGY, 2017; ASSISTANT CURATOR OF SAM NOBLE OKLAHOMA MUSEUM OF NATURAL HISTORY, 2017	Ph.D., University of Alaska, 2010; B.S., University of Kansas, 2004	
Lawson	Paul	A	2005	PROFESSOR OF MICROBIOLOGY AND PLANT BIOLOGY, 2013	Ph.D., University of London, 1993; B.S., University of London, 1984	
Lee	Eric	M		ASSISTANT PROFESSOR OF BIOLOGY, 2014	Ph.D., University of Oklahoma, 2014	
Lemon	Christian	H	2013	ASSOCIATE PROFESSOR OF BIOLOGY, 2016	Ph.D., Binghamton University, 2001; M.A., Binghamton University, 1998; B.S., University of Oklahoma, 1994	
Markham	Michael	R	2011	ROBERT G. AND BETTY GALE CASE-HOOPER PROFESSOR IN BIOLOGY, 2011; ASSOCIATE PROFESSOR OF BIOLOGY, 2015; SAM K. VIERSEN	Ph.D., University of New Mexico, 1994; B.A., University of New Mexico, 1990	
Marske	Katharine		2017	ASSISTANT PROFESSOR OF BIOLOGY, 2017		Ph.D., University of Auckland, 2010; M.S., Montana State University, 2004; B.S., Luther College, 2001
Martin	Wendy	M		LECTURER, 2016		Ph.D., University of Oklahoma, 2016; M.A., University of Oklahoma, 2011; M.S. Univ of Oklahoma, 1997, B.S. Southwestern Oklahoma State University, 1991
Masly	John	P	2010	ASSOCIATE PROFESSOR OF BIOLOGY, 2016		Ph.D., University of Rochester, 2007; M.S., University of Rochester, 2001; B.S., Pennsylvania State University, 1998
McCarthy	Heather	R	2011	ASSOCIATE PROFESSOR OF MICROBIOLOGY AND PLANT BIOLOGY, 2017		Ph.D., Duke University, 2007; B.S., Oregon State University, 2000
McCaughey	David	W	2006	ASSOCIATE PROFESSOR OF BIOLOGY, 2012		Ph.D., University of Texas, 1997; B.S., University of North Carolina, 1990
Meysick	Karen		2009	ASSISTANT PROFESSOR OF MICROBIOLOGY AND PLANT BIOLOGY, 2017		Ph.D., University of Ottawa, 1996; M.S., University of Ottawa, 1990; B.S., University of Windsor, 1987
Moore	Abigail	J	2016	CURATOR, BEBB HERBARIUM, 2016; ASSISTANT PROFESSOR OF OKLAHOMA BIOLOGICAL SURVEY, 2016; ASSISTANT PROFESSOR OF MICROBIOLOGY AND PLANT BIOLOGY, 2016		Ph.D., University of California-Berkeley, 2010; B.S., University of Utah, 2004
Padash Barmchi	Mojgan		2018	ASSISTANT PROFESSOR OF BIOLOGY, 2018		Ph.D., Lund University, 2006
Pan	Chongle		2018	ASSOCIATE PROFESSOR OF MICROBIOLOGY AND PLANT BIOLOGY AND COMPUTER SCIENCE, 2018		Ph.D., University of Tennessee, 2006; B.S., East China Normal University, 2001
Qin	Wei		2021	ASSISTANT PROFESSOR OF MICROBIOLOGY AND PLANT BIOLOGY, 2021		Ph.D., University of Washington; B.S., Beijing Normal University
Ross	Jeremy	D	2017	ASSISTANT PROFESSOR OF THE OKLAHOMA BIOLOGICAL SURVEY, 2017		Ph.D., Bowling Green State University, 2011; B.S., Brandon University, 2002

Rowe	Ashlee	A	2018	ASSISTANT PROFESSOR OF BIOLOGY, 2018	Ph.D., North Carolina State University, 2004	Thompson	James	N	1975	SAMUEL ROBERTS NOBLE PRESIDENTIAL PROFESSOR, 1996; DAVID ROSS BOYD PROFESSOR OF BIOLOGY, 2001	Ph.D., University of Cambridge, 1973; B.A., University of Oklahoma, 1968
Rowe	Matt			PROFESSOR OF BIOLOGY	Ph.D., University of California-Davis, 1984; M.S., University of California-Davis, 1979; BS in Psychology, University of California at Davis, 1976	Uno	Gordon	E	1979	DAVID ROSS BOYD PROFESSOR OF MICROBIOLOGY AND PLANT BIOLOGY, 2001	Ph.D., University of California-Berkeley, 1979; B.A., University of Colorado, 1983
Safiejko-Mroczka	Barbara		1989	ASSOCIATE PROFESSOR OF BIOLOGY, 2009	Ph.D., Technical University of Dgansk, 1987; M.S., Warsaw University, 1974; B.S., Warsaw University, 1974	Vaughn	Caryn	C	1994	PRESIDENT'S ASSOCIATES PRESIDENTIAL PROFESSOR, 2005; PROFESSOR OF OKLAHOMA BIOLOGICAL SURVEY, 2007; PROFESSOR OF BIOLOGY, 2007; GEORGE LYNN CROSS RESEARCH PROFESSOR OF OKLAHOMA BIOLOGICAL SURVEY, 2016	Ph.D., University of Oklahoma, 1984; M.S., University of Oklahoma, 1979; B.S., University of Oklahoma, 1977
Savage-Ashlock	Kristen	N	2014	LECTURER, 2014	Ph.D., University of Oklahoma, 2009; B.S., University of Oklahoma, 2003	Vitiello	Seasson Phillips		2021	LECTURER, 2021	Ph.D., University of Rochester, 2008, B.S., Nazareth College, 1999
Schlupp	Ingo	B	2005	PROFESSOR OF BIOLOGY, 2011; BRIAN E. AND SANDRA O'BRIEN PRESIDENTIAL PROFESSOR, 2012	Ph.D., Hamburg University, 1995; Diploma Biology, Hamburg University, 1991	Weider	Lawrence	J	1999	PROFESSOR OF BIOLOGY, 2005	Ph.D., University of Illinois, 1984; B.S., St. Bonaventure University, 1978
Schroeder	Susan	J	2010	ASSOCIATE PROFESSOR OF MICROBIOLOGY AND PLANT BIOLOGY; ASSOCIATE PROFESSOR OF CHEMISTRY AND BIOCHEMISTRY	Ph.D., University of Rochester, 2002; B.S., University of Rochester, 1995	Wellborn	Gary	A	1996	PROFESSOR OF BIOLOGY, 2015	Ph.D., University of Michigan, 1993; M.S., University of Texas, 1987; B.S., University of Texas, 1984
Shaw	Tarren	J		LECTURER, 2013	Ph.D., Oklahoma State University, 2009	Willis	Katie	L	2017	LECTURER, 2017	Ph.D., University of Maryland, 2014; B.S., University of Oklahoma, 2008
Siler	Cameron	D	2013	ASSOCIATE PROFESSOR OF BIOLOGY, 2018; ASSOCIATE CURATOR, HERPETOLOGY, SAM NOBLE OKLAHOMA MUSEUM OF NATURAL HISTORY, 2018	Ph.D., University of Kansas, 2011; B.S., University of Texas, 2004	Woodruff	Gavin		2020	ASSISTANT PROFESSOR OF BIOLOGY, 2020	Ph.D., University of Maryland, 2013; B.S., Georgia State University, 2007
Souza	Lara	A	2012	ASSOCIATE PROFESSOR OF MICROBIOLOGY AND PLANT BIOLOGY, 2018; ASSOCIATE PROFESSOR OF OKLAHOMA BIOLOGICAL SURVEY, 2018; DISTINGUISHED FACULTY FELLOW, OFFICE OF THE VICE PRESIDENT FOR RESEARCH, 2016	Ph.D., University of Tennessee, 2008; M.S., Appalachian State University, 2003; B.S., Appalachian State University, 1999	Xiao	Xiangming		2008	PROFESSOR OF MICROBIOLOGY AND PLANT BIOLOGY, 2008; DIRECTOR, CENTER FOR EARTH OBSERVATION AND MODELING, 2020; ADJUNCT PROFESSOR OF BIOLOGY, 2011; GEORGE LYNN CROSS RESEARCH PROFESSOR OF MICROBIOLOGY AND PLANT BIOLOGY, 2018	Ph.D., Colorado State University, 1994; M.S., University of Science & Technology, 1987; B.S., Xiamen University, 1982
Stein	Laura			ASSISTANT PROFESSOR OF BIOLOGY	Ph.D. University of Illinois: Urbana-Champaign, 2015; B.S., University of Arizona, 2009						

Zhou	Jizhong	2005	PRESIDENT'S ASSOCIATES PRESIDENTIAL PROFESSOR, 2005; DIRECTOR, INSTITUTE OF ENVIRONMENTAL GENOMICS, 2005; GEORGE LYNN CROSS RESEARCH PROFESSOR OF MICROBIOLOGY AND PLANT BIOLOGY, 2014	Ph.D., Washington State University, 1993; M.S., Hunan Agricultural University, 1984; B.S., Hunan Agricultural University, 1981
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