

# INTEGRATIVE BIOLOGY

The Department of Integrative Biology offers BS degree programs in biology, physiology and zoology.

The undergraduate degree in biology is appropriate for students wanting to obtain a broad background in the life sciences. Students complete coursework in animal, plant and microbial biology, genetics, ecology, physiology and evolution. This degree meets the requirements for admission to graduate and professional schools and also prepares students for a broad range of biology-related employment opportunities. Students who choose this degree can also select options in allied health, environmental biology, pre-medical sciences or secondary teacher certification.

The undergraduate degree in physiology offers specialized coursework as preparation for graduate school or a medically-related professional school. The bachelor's degree in physiology requires courses in biology, genetics, microbiology, comparative anatomy, biochemistry, physics and chemistry. The mammalian physiology lecture and lab sequence provides a unique capstone experience. Students may also choose to pursue an option in pre-medical sciences.

The curriculum in zoology is designed to provide a thorough background in the biology of animals and prepares students for graduate school and many applied and professional careers. The zoology degree requires courses in ecology, evolution, genetics, and vertebrate and invertebrate zoology. Students participate in unique research experiences and/or internships and develop a good foundation in the related fields of chemistry, physics and mathematics. Options with the zoology degree include ecology and conservation biology, pre-medical sciences and pre-veterinary science.

## Courses

### BIOL 1114 Introductory Biology (LN)

**Description:** Introduction to the integration between structure and function among all levels of biological organization. Application of principles of evolution, genetics, physiology and ecology to understanding the integrated and interdependent nature of living systems through discussions emphasizing the process of science. Current issues and local research and observation and investigation in both lecture and lab. Recommended for non-science and science majors. Course previously offered as BISC 1114.

**Credit hours:** 4

**Contact hours:** Lecture: 3 Lab: 3

**Levels:** Undergraduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Integrative Biology

**General Education and other Course Attributes:** Scientific Investigation, Natural Sciences

### BIOL 1604 Animal Biology

**Prerequisites:** BIOL 1114.

**Description:** Morphology, physiology, ecology, life histories and importance of representatives of major groups to humans. Evolution of systems and mechanisms which have allowed animals to survive and adapt to diverse habitats. Previously offered as ZOO 1604.

**Credit hours:** 4

**Contact hours:** Lecture: 3 Lab: 2

**Levels:** Undergraduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Integrative Biology

### BIOL 2890 Honors Experience in Integrative Biology

**Prerequisites:** Honors Program participation and concurrent enrollment in a designated BIOL course.

**Description:** A supplemental Honors experience in Integrative Biology to partner concurrently with designated BIOL course(s). This course adds a different intellectual dimension to the designated course(s).

**Credit hours:** 1

**Contact hours:** Lecture: 1

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**General Education and other Course Attributes:** Honors Credit

### BIOL 3023 General Genetics

**Prerequisites:** BOT 1404, or BIOL 1604, or equivalent.

**Description:** Inheritance in plants, animals, and microorganisms; molecular and classical aspects. Previously offered as BIOL 3024 and BISC 3024.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

### BIOL 3034 General Ecology

**Prerequisites:** BIOL 1114 or equivalent and (BOT 1404 or BIOL 1604 or equivalent) and (MATH 1513 or MATH 1613 or MATH 1715 or MATH 2144).

**Description:** An overview of the study of organisms interacting with each other and their environment at individual, population, community, and ecosystem levels of organization. Includes human interaction with ecological systems.

**Credit hours:** 4

**Contact hours:** Lecture: 3 Lab: 3

**Levels:** Graduate, Undergraduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Integrative Biology

**BIOL 3053 Freshwater: Concepts, Threats and Management (N)**

**Description:** Freshwater is a critical, non-substitutable resource. Do we have enough? How are we going to manage it? This course will introduce non-biology majors to the concepts, threats, and policy relevant to freshwaters using information published in the popular science press. Issues directly relevant to Oklahoma, and the U.S. will be discussed. Debates modeled using the legal system of policy formulation will promote critical thought and communication skills in an exciting real-world milieu. ZOO and PHSL majors may count as elective hours only. Previously offered as ZOO 3023.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**General Education and other Course Attributes:** Natural Sciences

**BIOL 3104 Invertebrate Zoology**

**Prerequisites:** BIOL 1604.

**Description:** Morphology, physiology, reproduction and ecology of major invertebrate groups. Previously offered as ZOO 3104.

**Credit hours:** 4

**Contact hours:** Lecture: 3 Lab: 3

**Levels:** Undergraduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Integrative Biology

**BIOL 3113 Human Evolution (N)**

**Prerequisites:** BIOL 1114 or equivalent strongly recommended.

**Description:** Overview of how evolution shapes human biology. Topics include evolutionary mechanisms, human genetic variation and health, primate diversity, the fossil record, and the origins, dispersal, and behavior of anatomically modern humans. ZOO and PHSL majors may count as elective hours only. Previously offered as ZOO 3113.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**General Education and other Course Attributes:** Natural Sciences

**BIOL 3114 Vertebrate Morphology**

**Prerequisites:** BIOL 1604.

**Description:** Comparative morphology of representative vertebrates with emphasis on phylogeny and ontogeny and consideration of histology and function. Previously offered as ZOO 3114.

**Credit hours:** 4

**Contact hours:** Lecture: 3 Lab: 3

**Levels:** Undergraduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Integrative Biology

**BIOL 3123 Human Heredity (N)**

**Description:** The impact of genetics on human endeavor. No degree credit for students with prior credit in BIOL 3023. ZOO and PHSL majors may count as elective hours only. Previously offered as ZOO 3123.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**General Education and other Course Attributes:** Natural Sciences

**BIOL 3153 Animal Behavior**

**Prerequisites:** Junior standing.

**Description:** Survey of theory and application in basic and applied animal behavior. Interdisciplinary analysis of animal behavior in the field, captive settings and laboratories. Previously offered as ZOO 3153.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 3163 Environmental Biology**

**Prerequisites:** Introductory Biology and one course in General Chemistry.

**Description:** Overview of how organisms are influenced by the environment in which they live and how anthropogenic activities impact their environment. Topics include impacts of disturbing energy and material cycles, toxicological disease, and infectious disease. Previously offered as ZOO 3163.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 3204 Physiology**

**Prerequisites:** "C" or better in both BIOL 1114 and (CHEM 1215 or CHEM 1314 or CHEM 1414).

**Description:** Anatomy and function of the human body. Human and domestic animal physiology considered in laboratories. Previously offered as ZOO 3204.

**Credit hours:** 4

**Contact hours:** Lecture: 3 Lab: 2

**Levels:** Undergraduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Integrative Biology

**BIOL 3214 Human Anatomy**

**Prerequisites:** "C" or better in either BIOL 1604 or BIOL 3204.

**Description:** Gross anatomy of the human body and its systems with a minor emphasis on histology. Laboratory based on human models and comparisons with dissections of nonhuman mammals. Previously offered as ZOO 3214.

**Credit hours:** 4

**Contact hours:** Lecture: 3 Lab: 3

**Levels:** Undergraduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Integrative Biology

**BIOL 3233 Human Reproduction**

**Prerequisites:** BIOL 1114 or consent of instructor.

**Description:** Overview of human reproduction, including conception, pregnancy, childbirth, sexual maturation, and parental investment in offspring. Draws from multiple fields such as genetics, anatomy and physiology, developmental biology and evolutionary theory. Previously offered as ZOO 3233.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 3513 Principles of Conservation Biology**

**Prerequisites:** Sophomore standing and (BIOL 1114 and BIOL 1604).

**Description:** A scientific foundation of conservation biology through the study of the importance of conservation in society, the role of conservation policy, protected areas, and planning, and the future of conservation biology. Topics covered include Ecology, Evolution, and Genetics. Previously offered as ZOO 3513.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 3604 Biological Principles for Teachers**

**Prerequisites:** BIOL 1114 and BIOL 3204 and CHEM 1314.

**Description:** Capstone course in biology for potential science teachers. Review of biological phenomena and principles as related to the curriculum. Course previously offered as BISC 3604.

**Credit hours:** 4

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 3700 Readings and Special Studies in Integrative Biology**

**Prerequisites:** BIOL 1604 and consent of instructor.

**Description:** Discussion of selected readings. Previously offered as ZOO 3700. Offered for variable credit, 1-3 credit hours, maximum of 6 credit hours.

**Credit hours:** 1-3

**Contact hours:** Other: 1

**Levels:** Undergraduate

**Schedule types:** Discussion

**Department/School:** Integrative Biology

**BIOL 3890 Advanced Honors Experience in Integrative Biology**

**Prerequisites:** Honors Program participation and concurrent enrollment in a designated BIOL course.

**Description:** A supplemental Honors experience in Integrative Biology to partner concurrently with designated upper-division BIOL course(s). This course adds a different intellectual dimension to the designated course(s).

**Credit hours:** 1

**Contact hours:** Lecture: 1

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**General Education and other Course Attributes:** Honors Credit

**BIOL 3933 Research Methods**

**Prerequisites:** BIOL 1114 and (MATH 1613 or MATH 2144) and (STAT 2013 or STAT 4013).

**Description:** Students perform independent inquiries and learn to combine skills from mathematics and science to solve research problems. Students will design experiments, collect and analyze data, formulate hypotheses, justify conclusions, create mathematical models, read and evaluate the research literature, and write and present research reports. No credit for students with degree credit in MATH 3933.

**Credit hours:** 3

**Contact hours:** Lecture: 2 Lab: 2

**Levels:** Undergraduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Integrative Biology

**BIOL 4024 Histology**

**Prerequisites:** BIOL 3114, BIOL 3204, or BIOL 3214.

**Description:** The study of cellular composition and functional components of tissues. With an emphasis in vertebrates, the course is a survey of the microanatomy and function of tissues such as epithelial, connective, muscular, and nervous. May not be used for degree credit with BIOL 5024.

**Credit hours:** 4

**Contact hours:** Lecture: 3 Lab: 2

**Levels:** Undergraduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Integrative Biology

**BIOL 4104 General Parasitology**

**Prerequisites:** BIOL 1604.

**Description:** Fundamentals of parasitism with emphasis on: life cycles, disease conditions, epidemiology, diagnosis, treatment, historical significance, terminology, taxonomy, and parasitological techniques. Previously offered as ZOO 4104.

**Credit hours:** 4

**Contact hours:** Lecture: 3 Lab: 3

**Levels:** Graduate, Undergraduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Integrative Biology

**BIOL 4113 Conservation Genetics**

**Prerequisites:** (BIOL 3023 or equivalent) and MATH 1513.

**Description:** Principles of population genetics as they pertain to issues in conservation biology. Evolutionary relationships, hybridization, natural selection, factors affecting small populations, gene flow, captive populations, and metapopulations. No credit for students with credit in BIOL 5113. Previously offered as ZOO 4113.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 4133 Evolution**

**Prerequisites:** BIOL 3023.

**Description:** Development of the evolutionary concept; speciation evolutionary mechanisms and phylogenetic concepts. May not be used for degree credit with BIOL 5033. Previously offered as ZOO 4133.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 4134 Embryology**

**Prerequisites:** BIOL 1604 and CHEM 1515.

**Description:** Biochemical basis of development with emphasis on gene regulation. Comparative development of sea urchin, frog, chick and pig. Experiments using frog and mouse, including the molecular level. Previously offered as ZOO 4134.

**Credit hours:** 4

**Contact hours:** Lecture: 3 Lab: 2

**Levels:** Graduate, Undergraduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Integrative Biology

**BIOL 4174 Mammalogy**

**Prerequisites:** "C" or better in BIOL 1604 and (BIOL 3034 or NREM 3013).

**Description:** Taxonomy, identification, evolution, zoogeography, life history traits, and techniques of study of wild mammals. Weekend field trips required. May not be used for degree credit with BIOL 5174. Previously offered as ZOO 4174.

**Credit hours:** 4

**Contact hours:** Lecture: 3 Lab: 3

**Levels:** Undergraduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Integrative Biology

**BIOL 4184 Herpetology**

**Prerequisites:** BIOL or ZOO 1604.

**Description:** The biology of amphibians and reptiles with an emphasis on evolutionary relationships and comparative morphology, physiology, ecology, and natural history; laboratory emphasis on Oklahoma species. Offered spring semester of even-numbered years. Weekend field trips required. May not be used for degree credit with BIOL 5184.

**Credit hours:** 4

**Contact hours:** Lecture: 3 Lab: 2

**Levels:** Undergraduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Integrative Biology

**BIOL 4215 Mammalian Physiology**

**Prerequisites:** "C" or better in both BIOL 3204 and (CHEM 3015 or CHEM 3053).

**Description:** Descriptive and functional analysis of the mammalian nervous, cardiovascular, musculoskeletal, respiratory, renal, endocrine, and digestive organ systems. For majors in human and animal sciences, particularly pre-medical, pre-dental, and pre-veterinary tracks. May not be used for degree credit with BIOL 5215. Previously offered as ZOO 4215.

**Credit hours:** 5

**Contact hours:** Lecture: 5

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 4223 Mammalian Physiology Laboratory**

**Prerequisites:** "C" or better in BIOL 4215.

**Description:** Laboratory experiments that illustrate functions of organs, organ systems or mechanisms of whole body physiological control. Previously offered as ZOO 4223.

**Credit hours:** 3

**Contact hours:** Lecture: 1 Lab: 4

**Levels:** Graduate, Undergraduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Integrative Biology

**BIOL 4253 Pharmacology**

**Prerequisites:** "C" or better in either BIOL 3204 or BIOL 4215; Biochemistry strongly suggested.

**Description:** Major drug classes based on their predominant use or principal activity in the body; basis for drug action; and modification of drugs and their action by physiological processes. May not be used for degree credit with BIOL 5253. Previously offered as ZOO 4243 and BIOL 4243.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 4273 Environmental Physiology**

**Prerequisites:** BIOL 3204 or BIOL 4215.

**Description:** The study of animal adaptation and responses to natural environments. Topics include marine, shoreline, freshwater, and terrestrial habitats as well as anthropogenic problems specific to these habitats. No credit for students with credit in BIOL 5273. Previously offered as ZOO 4273.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 4283 Endocrinology**

**Prerequisites:** "C" or better in (BIOL 3204 or BIOL 4215) and credit in (CHEM 3015 or CHEM 3053 or consent of instructor).

**Description:** Examination of the hormonal control and regulation of physiological processes in vertebrates. Function of the hypothalamus, pituitary, adrenal, thyroid, pancreas, ovary and testes. No credit for students with credit in BIOL 5283. Previously offered as ZOO 4283.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 4293 Behavioral Neuroendocrinology**

**Prerequisites:** BIOL 3204 or BIOL 4215.

**Description:** Examination of the influences of nervous and endocrine systems on behavior, and vice-versa, in vertebrates, including humans. Historical roots and current techniques relating to topics, including male and female reproductive behavior patterns, sex differences in behavior and neuroendocrine causation. No credit for students with credit in BIOL 5293. Previously offered as ZOO 4293.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 4303 Organismal Ecotoxicology**

**Prerequisites:** BIOL 1114 or equivalent and (CHEM 1215 or CHEM 1314) and junior standing.

**Description:** Comparative study of the major groups of environmental contaminants (e.g. heavy metals, PCB's, insecticides) and an introduction to the basic theories, principles and techniques associated with the study of contaminant fate and effects on organisms. No credit for students with credit in BIOL 5303. Same course as BIOL 5303 and ITOX 5303. Previously offered as ZOO 4303.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 4363 Principles of Toxicology****Prerequisites:** BIOL 3204 and (CHEM 1215 or CHEM 1314).**Description:** Basic concepts in toxicology such as chemical partitioning, dose response, toxicokinetics, toxicodynamics, and bioavailability. It will focus on the molecular and cellular mechanisms of toxicity of a few representative natural and man-made compounds. Case studies used to understand real-life scenarios. No credit for students with credit in BIOL 5363.**Credit hours:** 3**Contact hours:** Lecture: 3**Levels:** Undergraduate**Schedule types:** Lecture**Department/School:** Integrative Biology**BIOL 4413 Biology of Fishes****Prerequisites:** BIOL 1604.**Description:** Ecology and evolution of fishes with particular emphasis on physiology, morphology, behavior, and taxonomy; laboratory emphasis on Oklahoma species. Weekend field trips required. Previously offered as ZOO 4413.**Credit hours:** 3**Contact hours:** Lecture: 2 Lab: 2**Levels:** Graduate, Undergraduate**Schedule types:** Lab, Lecture, Combined lecture and lab**Department/School:** Integrative Biology**BIOL 4434 Limnology****Prerequisites:** BIOL 3034 or (NREM 3012 and NREM 3013).**Description:** This course provides an overview of the physical, chemical, and biological characteristics of inland habitats including lakes, reservoirs, streams, and wetlands. Field trips required. May not be used for degree credit with BIOL 5434. Previously offered as ZOO 4434.**Credit hours:** 4**Contact hours:** Lecture: 3 Lab: 3**Levels:** Undergraduate**Schedule types:** Lab, Lecture, Combined lecture and lab**Department/School:** Integrative Biology**BIOL 4464 Ornithology****Prerequisites:** BIOL 1604.**Description:** Classification, evolution, distribution, identification, life histories, and morphological, ecological, and behavioral adaptations of birds. Two weekend field trips required. Same course as NREM 4464. May not be used for degree credit with BIOL 5464 or NREM 5464. Previously offered as ZOO 4464.**Credit hours:** 4**Contact hours:** Lecture: 3 Lab: 3**Levels:** Undergraduate**Schedule types:** Lab, Lecture, Combined lecture and lab**Department/School:** Integrative Biology**BIOL 4524 Biological Laboratory Instrumentation****Prerequisites:** CHEM 1515 and P BIO 1404 or MICR 2123 or BIOL 1604 or equivalents or consent of instructor.**Description:** Lecture and laboratory course in biological instrumentation use, theory, experimental design, maintenance, and troubleshooting. Topics include liquid handling systems, pH/ISE meters, electrophoresis, spectrophotometers, centrifuges, chromatography, thermocyclers, and DNA sequencers. No credit for students with credit in BIOL 5524, MICR 5524, P BIO 5524. Same course as P BIO 4524 and MICR 4524.**Credit hours:** 4**Contact hours:** Lecture: 2 Lab: 4**Levels:** Undergraduate**Schedule types:** Lab, Lecture, Combined lecture and lab**Department/School:** Integrative Biology**BIOL 4700 Undergraduate Research Problems****Prerequisites:** Consent of instructor.**Description:** Participation in faculty research or execution of a problem formulated by the student. Project will include the communication of research results in written and/or oral form. Previously offered as ZOO 4700.**Credit hours:** 1-4**Contact hours:** Other: 1**Levels:** Undergraduate**Schedule types:** Independent Study**Department/School:** Integrative Biology**BIOL 4710 Internships in Integrative Biology****Prerequisites:** Consent of instructor.**Description:** Student participation in a research project during an internship in a Life Sciences related professional work setting. Graded on a pass-fail basis. Previously offered as ZOO 4710.**Credit hours:** 1-3**Contact hours:** Other: 1**Levels:** Undergraduate**Schedule types:** Independent Study**Department/School:** Integrative Biology**BIOL 4750 Honors Study in Integrative Biology****Prerequisites:** Honors Program participation.**Description:** Individual study in the development of biological concepts. Extensive reading, literature search and special experimentation. An individual problems course for the gifted student. Previously offered as ZOO 4750.**Credit hours:** 1-5**Contact hours:** Other: 1**Levels:** Undergraduate**Schedule types:** Independent Study**Department/School:** Integrative Biology**General Education and other Course Attributes:** Honors Credit**BIOL 5000 Research for Master's Thesis****Description:** Independent research for the MS Thesis under the supervision of graduate faculty member. Previously offered as ZOO 5000. Offered for variable credit, 1-3 credit hours, maximum of 6 credit hours.**Credit hours:** 1-6**Contact hours:** Other: 1**Levels:** Graduate**Schedule types:** Independent Study**Department/School:** Integrative Biology

**BIOL 5003 Graduate Orientation and Academic Development**

**Prerequisites:** Admission to Integrative Biology graduate program or instructor approval.

**Description:** Prepare first year Integrative Biology graduate students for success. We address departmental expectations and standards by providing: an introduction to departmental expertise and capabilities, exposure to available tools and resources, a forum for research conceptualization and formulation, instruction on finding and securing funding, guidance on how to convert questions into grant proposals, and a milieu for preparation, submission and peer review of external grant/fellowships. Previously offered as ZOOL 5003.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 5010 Graduate Seminar**

**Description:** Discussion of selected topics. Previously offered as ZOOL 5010. Offered for variable credit, 1-3 credit hours, maximum of 10 credit hours.

**Credit hours:** 1-3

**Contact hours:** Other: 1

**Levels:** Graduate

**Schedule types:** Independent Study

**Department/School:** Integrative Biology

**BIOL 5011 Current, Historical, and Integrative Principles in Integrative Biology**

**Prerequisites:** Admission to Integrative Biology graduate program or instructor approval.

**Description:** This course will furnish fundamental concepts in ecology, evolution, and environmental stress for first-year graduate students in Integrative Biology (and related departments). More importantly, this course is organized as modules that bring together various elements from the three broadly defined, and fundamentally related disciplines (i.e., ecology, evolution, and environmental stress), that our department views as our core strengths. Previously offered as ZOOL 5011.

**Credit hours:** 1

**Contact hours:** Lecture: 1

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 5020 Special Problems**

**Prerequisites:** Graduate standing and consent of instructor.

**Description:** Discussions of selected readings and topics. Previously offered as ZOOL 5020.

**Credit hours:** 1-4

**Contact hours:** Other: 1

**Levels:** Graduate

**Schedule types:** Independent Study

**Department/School:** Integrative Biology

**BIOL 5024 Histology**

**Prerequisites:** Consent of Instructor.

**Description:** The study of cellular composition and functional components of tissues. With an emphasis in vertebrates, the course is a survey of the microanatomy and function of tissues such as epithelial, connective, muscular, and nervous. May not be used for degree credit with BIOL 4024.

**Credit hours:** 4

**Contact hours:** Lecture: 3 Lab: 2

**Levels:** Graduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Integrative Biology

**BIOL 5030 Teaching Integrative Biology**

**Prerequisites:** Consent of instructor.

**Description:** Supervised teaching in the department. Attendance at seminar on problems involved in teaching Integrative Biology in college. Previously offered as ZOOL 5030. Offered for variable credit, 1-3 credit hours, maximum of 4 credit hours.

**Credit hours:** 1-3

**Contact hours:** Other: 1

**Levels:** Graduate, Undergraduate

**Schedule types:** Independent Study

**Department/School:** Integrative Biology

**BIOL 5033 Evolution**

**Description:** Development of the evolutionary concept; speciation evolutionary mechanisms and phylogenetic concepts. May not be used for degree credit with BIOL 4133.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 5100 Current Topics in Biology for Teachers**

**Prerequisites:** Approval of instructor.

**Description:** Acquaints the primary or secondary teacher with recent advances in biology. May include lecture, laboratory or field work. Offered for variable credit, 1-4 credit hours, maximum of 4 credit hours.

**Credit hours:** 1-4

**Contact hours:** Lecture: 1

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 5113 Conservation Genetics**

**Prerequisites:** Course in genetics strongly recommended.

**Description:** Principles of population genetics as they pertain to issues in conservation biology. Evolutionary relationships, hybridization, natural selection, factors affecting small populations, gene flow, captive populations, and META populations. No credit for students with credit in BIOL 4113. Previously offered as ZOOL 5113.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 5123 Behavioral Ecology**

**Prerequisites:** Course in ecology strongly recommended.

**Description:** Analysis and description of the behavior of animals in their natural environment, especially in terms of natural selection and adaptation. A synthesis of ethology, population genetics, sociobiology, and evolutionary theory. Largely descriptive and generalized with limited emphasis on mathematical theory. Previously offered as ZOO 5123.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 5133 Evolutionary Ecology**

**Prerequisites:** BIOL 3034.

**Description:** This course is intended to inform students about the traditional breadth of evolutionary ecology, and its impacts on contemporary ecological and evolutionary theories. Study will include both broad historical precedent and the far-reaching importance of current research in evolutionary ecology. This course will develop skills in written and oral communication and critical/synthetic thought. Previously offered as ZOO 5133. May not be used for degree credit with ZOO 5133.

**Credit hours:** 3

**Contact hours:** Lecture: 2 Other: 1

**Levels:** Graduate

**Schedule types:** Discussion, Combined lecture & discussion, Lecture

**Department/School:** Integrative Biology

**BIOL 5174 Mammalogy**

**Prerequisites:** College level ecology or Natural History course.

**Description:** Taxonomy, identification, evolution, zoogeography, life history traits, and techniques of study of wild mammals. Weekend field trips required. May not be used for degree credit with BIOL 4174.

**Credit hours:** 4

**Contact hours:** Lecture: 3 Lab: 3

**Levels:** Graduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Integrative Biology

**BIOL 5184 Advanced Herpetology**

**Description:** The biology of amphibians and reptiles with an emphasis on evolutionary relationships and comparative morphology, physiology, ecology, and natural history; laboratory emphasis on Oklahoma species. Offered spring semester of even-numbered years. Weekend field trips required. May not be used for degree credit with BIOL 4184.

**Credit hours:** 4

**Contact hours:** Lecture: 3 Lab: 2

**Levels:** Graduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Integrative Biology

**BIOL 5215 Mammalian Physiology**

**Description:** Descriptive and functional analysis of the mammalian nervous, cardiovascular, musculoskeletal, respiratory, renal, endocrine and digestive organ systems. For majors in human and animal sciences, particular pre-medical, pre-dental, and pre-veterinary tracks. May not be used for degree credit with BIOL 4215.

**Credit hours:** 5

**Contact hours:** Lecture: 5

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 5243 Ecological Immunology**

**Description:** The causes and consequences of variation in immunity studied within the context of evolution and ecology. A combination of lectures and student-led presentations intended for graduate students and advanced undergraduates. Previously offered as ZOO 5243.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 5253 Pharmacology**

**Prerequisites:** Upper division Physiology and Organic Chemistry.

**Description:** Major drug classes based on their predominant use or principal activity in the body; basis for drug action; and modification of drugs and their action by physiological processes. May not be used for degree credit with BIOL 4243 or BIOL 4253.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 5273 Environmental Physiology**

**Prerequisites:** BIOL 3204 or BIOL 4215 or equivalent.

**Description:** The study of animal adaptation and responses to natural freshwater, and terrestrial habitats as well as anthropogenic problems specific to these habitats. No credit for students with credit in BIOL 4273. Previously offered as ZOO 5273.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 5283 Endocrinology**

**Prerequisites:** A course in physiology and chemistry or consent of instructor.

**Description:** Examination of the hormonal control and regulation of physiological processes in vertebrates. Function of the hypothalamus, pituitary, adrenal, thyroid, pancreas, ovary and testes. No credit for students with credit in BIOL 4283. Previously offered as ZOO 5283.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 5293 Behavioral Neuroendocrinology**

**Prerequisites:** BIOL 3204 or BIOL 4215.

**Description:** Examination of the influences of nervous and endocrine systems on behavior and vice-versa, in vertebrates including humans. Historical roots and current techniques relating to topics, including male and female reproductive behavior patterns, sex differences in behavior and neuroendocrine causation. No credit for students with credit in BIOL 4293. Previously offered as ZOO 5293.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 5303 Organismal Ecotoxicology**

**Description:** Comparative study of the major groups of environmental contaminants (e.g. heavy metals, PCB's, insecticides) and an introduction to the basic theories, principles and techniques associated with the study of contaminant fate and effects on organisms. No credit for students with credit in BIOL 4303. Same course as ITOX 5303. Previously offered as ZOO 5303.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 5343 Population and Community Ecotoxicology**

**Prerequisites:** Course in ecology strongly recommended.

**Description:** Examines the exposure of animals to environmental contaminants and resulting effects at the individual through community level. The dynamic nature of exposure to contaminants will be of particular interest in this course. For example, how do the natural history traits of a species either protect it from exposure, or enhance its potential for exposure to contaminants? Topics will range from the historical perspectives to ecotoxicology to study design and risk assessment. Same course as ITOX 5343. Previously offered as ZOO 5343.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 5363 Principles of Toxicology**

**Prerequisites:** Course in chemistry and physiology strongly recommended.

**Description:** Basic concepts in toxicology such as chemical partitioning, dose response, toxicokinetics, toxicodynamics, and bioavailability. It will focus on the molecular and cellular mechanisms of toxicity of a few representative natural and man-made compounds. Case studies used to understand real-life scenarios. No credit for students with credit in BIOL 4363.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 5403 Advanced Wetland Ecology**

**Prerequisites:** A course in aquatic ecology or wetland management recommended.

**Description:** Principles and theory of wetland ecology with a focus on wetland processes, function, and services. Topics include wetland geomorphology, biogeochemistry and hydrology of wetlands, wetland functions and services, wetland development, wetland restoration, water issues, wetland policy, philosophy of wetland management, and educating society about wetlands. Same course as NREM 5403. Previously offered as ZOO 5403.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 5423 Techniques in Environmental Toxicology**

**Prerequisites:** Organic chemistry or instructor consent.

**Description:** Practical understanding of modern techniques used to quantify exposure and effects of environmental toxicants. Laboratory topics include gas chromatography, HPLC, atomic absorption spectroscopy, immunoassay, and toxicity testing. Same course as ITOX 5423. Previously offered as ZOO 5423.

**Credit hours:** 3

**Contact hours:** Lecture: 1 Lab: 4

**Levels:** Graduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Integrative Biology

**BIOL 5434 Limnology**

**Prerequisites:** College level ecology course.

**Description:** This course provides an overview of the physical, chemical, and biological characteristics of inland habitats including lakes, reservoirs, streams, and wetlands. Field trips required. May not be used for degree credit with BIOL 4434.

**Credit hours:** 4

**Contact hours:** Lecture: 3 Lab: 3

**Levels:** Graduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Integrative Biology

**BIOL 5464 Ornithology**

**Description:** Classification, evolution, distribution, identification, life histories, and morphological, ecological, and behavioral adaptations of birds. Two weekend field trips required. May not be used for degree credit with BIOL 4464, NREM 4464. Previously offered as NREM 5564.

**Credit hours:** 4

**Contact hours:** Lecture: 3 Lab: 3

**Levels:** Graduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Integrative Biology

**BIOL 5503 Spatial Ecology and Analysis**

**Prerequisites:** Course in ecology strongly recommended.

**Description:** Theory, methods, and models for identifying and quantifying spatial patterns and processes, with a focus on implications for ecological relationships. Previously offered as ZOO 5503.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 5523 Population Ecology**

**Prerequisites:** BIOL 3034 and MATH 1513.

**Description:** Theory and principles of predicting and analyzing population abundance and dynamics. Life history theory, foraging theory, habitat selection, population genetics, and species interactions. Previously offered as ZOO 5523.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology



**BIOL 5524 Biological Laboratory Instrumentation**

**Prerequisites:** CHEM 1515 and PBIO 1404 or MICR 2123 or BIOL 1604 or equivalents or consent of instructor.

**Description:** Lecture and laboratory course in biological instrumentation use, theory, experimental design, maintenance, and troubleshooting. Topics include liquid handling systems, pH/ISE meters, electrophoresis, spectrophotometers, centrifuges, chromatography, thermocyclers, and DNA sequencers. May not be used for degree credit in BIOL 4524, MICR 4524, PBIO 4524. Same course as PBIO 5524 and MICR 5524. Additional flat fee of \$50.00 applies.

**Credit hours:** 4

**Contact hours:** Lecture: 2 Lab: 4

**Levels:** Graduate

**Schedule types:** Lab, Lecture, Combined lecture and lab

**Department/School:** Integrative Biology

**BIOL 5623 Ecological Data and Alternative Hypothesis**

**Prerequisites:** Course in statistics strongly recommended.

**Description:** Emphasizes statistical analyses that start with a set of plausible alternative hypotheses and use likelihoods to quantify the relative support the hypotheses receive from empirical data. Instruction will be done with lectures, computer lab exercises, and in-class presentations. Previously offered as ZOO 5623.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 5633 Ecological and Behavioral Modeling**

**Prerequisites:** Course in ecology strongly recommended.

**Description:** This course will provide a general overview of modeling approaches for studying a variety of ecological and environmental problems. It will provide students with a toolbox of techniques, and discuss how they can be used to address questions and generate testable predictions. The course will emphasize modeling individual behavior and population dynamics. Previously offered as ZOO 5633.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 5643 Ecological Niche Modeling and Species Distributions**

**Prerequisites:** Course in ecology strongly recommended.

**Description:** Ecological niche modeling theory and practice. Generation of niche models and distribution predictions to address questions on species' ecology, conservation, biogeography, and phylogeography. Familiarization with ESRI ArcGIS software, as well as environmental GIS data sources. Previously offered as ZOO 5643.

**Credit hours:** 3

**Contact hours:** Lecture: 3

**Levels:** Graduate

**Schedule types:** Lecture

**Department/School:** Integrative Biology

**BIOL 6000 Research for PhD Dissertation**

**Description:** Independent research for the PhD dissertation under the supervision of a graduate faculty member. Previously offered as ZOO 6000. Offered for variable credit, 1-15 credit hours, maximum of 60 credit hours.

**Credit hours:** 1-15

**Contact hours:** Other: 1

**Levels:** Graduate

**Schedule types:** Independent Study

**Department/School:** Integrative Biology

## Undergraduate Programs

- Biology, BS (<http://catalog.okstate.edu/arts-sciences/integrative-biology/biological-science-bs>)
- Biology: Allied Health, BS (<http://catalog.okstate.edu/arts-sciences/integrative-biology/biological-science-pre-healthcare-bs>)
- Biology: Environmental Biology, BS (<http://catalog.okstate.edu/arts-sciences/integrative-biology/biological-science-environmental-biology-bs>)
- Biology: Pre-Medical Sciences, BS (<http://catalog.okstate.edu/arts-sciences/integrative-biology/pre-medical-sciences-bs>)
- Biology: Secondary Teacher Certification, BS (<http://catalog.okstate.edu/arts-sciences/integrative-biology/biological-science-secondary-teacher-certification-bs>)
- Physiology, BS (<http://catalog.okstate.edu/arts-sciences/integrative-biology/physiology-bs>)
- Physiology: Pre-Medical Sciences, BS (<http://catalog.okstate.edu/arts-sciences/integrative-biology/physiology-pre-medical-sciences-bs>)
- Zoology, BS (<http://catalog.okstate.edu/arts-sciences/integrative-biology/zoology-bs>)
- Zoology: Ecology and Conservation Biology, BS (<http://catalog.okstate.edu/arts-sciences/integrative-biology/zoology-ecology-conservation-biology-bs>)
- Zoology: Pre-Medical Sciences, BS (<http://catalog.okstate.edu/arts-sciences/integrative-biology/zoology-pre-medical-sciences-bs>)
- Zoology: Pre-Veterinary Sciences, BS (<http://catalog.okstate.edu/arts-sciences/integrative-biology/zoology-pre-veterinary-sciences-bs>)
- Biological Science (BIOL), Minor (<http://catalog.okstate.edu/arts-sciences/integrative-biology/biological-science-minor>)
- Zoology (ZOO), Minor (<http://catalog.okstate.edu/arts-sciences/integrative-biology/zoology-minor>)

## Graduate Programs Programs of Study

Programs of study leading to MS and PhD degrees are offered in Integrative Biology. The department emphasizes Ecology and Evolutionary Biology and Environmental Stress. Among faculty research interests are behavioral and evolutionary ecology, conservation biology, cytogenetics, ecotoxicology, ecosystem services, ecological immunology, behavioral endocrinology and neuroendocrinology, theoretical ecology, invertebrate ecology, ichthyology, herpetology, ornithology, mammalogy, parasitology, landscape ecology, molecular systematics, population ecology, aquatic and wetland ecology, and science education. The department includes the Ecotoxicology and Water Quality Research Laboratory and the Oklahoma State University Collection of Vertebrates.

## Prerequisites

Applicants must have completed a baccalaureate degree including 40 semester hours in biology and related areas and have completed the Graduate Record Examination.

**Assistant Professors:** Polly Campbell, PhD; Matteo Minghetti, PhD; Dan Moen, PhD; Shawn Wilder, PhD

**Teaching Assistant Professors:** Uriel Buitrago-Suarez, PhD; Jason Bruck, PhD; Elisa Cabrera-Guzman, PhD

## The Master of Science Degree

Students must prepare a research proposal and complete either a thesis or a report. For the thesis option, 30 credit hours are required; for the report option, 32 credit hours.

## The Doctor of Philosophy Degree

Students must prepare a research proposal, pass written and oral comprehensive examinations, and complete a dissertation based on original research worthy of publication. Most students enter the program already with an MS degree and their plan of study must include 60 credit hours. Exceptional students can enter the program directly following the BS; their plan of study must include 90 credit hours.

## Financial Aid

The department employs more than 35 graduate teaching assistants (TA). Faculty members also award research assistantships (RA) based on ongoing grants and contracts. Out-of-state students on RA or TA support are assessed in-state tuition only. However, in-state and out-of-state students on RA or TA support also receive full or partial waivers of in-state tuition.

## Research Facilities

The Department of Integrative Biology occupies a six-floor building with offices, classrooms, laboratories and animal rooms. A broad range of instrumentation is available for both teaching and research. The department maintains laboratories in wildlife toxicology, genetic toxicology, conservation genetics, geographic information systems and remote sensing, and water quality. Specialized equipment within the department includes atomic absorption spectrophotometers, ultraviolet and visible spectrophotometers, ion chromatographs, high pressure liquid chromatograph, liquid scintillation counter, ultracentrifuges, gas chromatograph, ion specific electrodes, forage fiber analyzer, bright field and epifluorescent microscopes and photomicrography systems, cryostats, laminar flow hoods, tissue culture equipment, PCR thermocyclers, ultracold freezers, horizontal starch, agarose, and polyacrylamide gel apparatus, automated DNA sequencer and computer labs. Available for use in field studies is the university-owned Lake Carl Blackwell area. The Department of Integrative Biology also houses the OSU Collection of Vertebrates which includes over 25,000 lots of fish, 14,000 reptiles and amphibians, 3,000 birds, and 13,000 mammals. For more information visit our website: [integrativebiology.okstate.edu](http://integrativebiology.okstate.edu) (<http://integrativebiology.okstate.edu>).

## Faculty

Matthew Lovern, PhD—Associate Professor and Interim Head

**Regents Professors:** Anthony Echelle, PhD (emeritus); Stanley Fox, PhD (emeritus); Scott McMurry, PhD; Loren Smith, PhD; Ron Van DenBussche, PhD

**Professors:** Kristen Baum, PhD; Bret S. Danilowicz, PhD; Donald French, PhD; Karen McBee, PhD

**Associate Professors:** Jason Belden, PhD; Matthew Bolek, PhD; Andrew Dzialowski, PhD; Jennifer Grindstaff, PhD; Meredith Hamilton, PhD; Punidan Jeyasingh, PhD; Barney Luttbeg, PhD; Jennifer Shaw, PhD; Mary Towner, PhD;