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[www.bio.txstate.edu](http://www.bio.txstate.edu) (<http://www.bio.txstate.edu>)

Biology is the study of living systems and how they function. Because the biological sciences have had and continue to have profound impact on questions of concern to human society - longevity, environmental quality, biotechnology - knowledge of the biological sciences is an important aspect of higher education. The mission of the Department of Biology is to advance the life sciences through research and to educate and prepare the next generations of scientists, educators, professionals, and scientifically literate citizens. Students select one of four majors: Aquatic Biology, Biology, Microbiology, or Wildlife Biology.

Biology majors take a minimum of eleven courses that include the core curriculum of functional biology, organismal biology, genetics, a biological diversity course, a physiology course, ecology, and evolution. Additional required courses in chemistry, mathematics, and physics provide the broad scientific background that is foundational to biological sciences. At the sophomore level and above, a variety of courses in cellular, molecular, computational and organismal biology assure a student can attain a broad education in the biological sciences as well as a level of specialization in its subdisciplines. A minor outside the Biology Department is required for all areas of study except for the Wildlife Biology program.

## Teacher Certification

Students may earn the Life Science (Texas Grades 7-12) certification through a double major with a B.S. major in Biology and a B.S. major in Education. Initial or additional certification may also be acquired as a post-baccalaureate or graduate student. Students interested in certification are strongly encouraged to see the Science Education program advisor in the Department of Biology early in their undergraduate program or certification process.

## Bachelor of Science (B.S.)

- Major in Aquatic Biology (<http://mycatalog.txstate.edu/undergraduate/science-engineering/biology/aquatic-bs/>)
- Major in Biology (<http://mycatalog.txstate.edu/undergraduate/science-engineering/biology/biology-bs/>)
- Major in Biology (Secondary Education; Teacher Certification in Life Science, Grades Seven through Twelve, with Double Major in B.S. Education) (<http://mycatalog.txstate.edu/undergraduate/science-engineering/biology/biology-teacher-certification-life-sciences-grades-7-12-bs/>)
- Major in Microbiology and Molecular Genetics (<http://mycatalog.txstate.edu/undergraduate/science-engineering/biology/microbiology-molecular-genetics-bs/>)
- Major in Wildlife Biology (<http://mycatalog.txstate.edu/undergraduate/science-engineering/biology/wildlife-certification-biologist-bs/>)

## Minors

- Biology (<http://mycatalog.txstate.edu/undergraduate/science-engineering/biology/biology-minor/>)
- Second Teaching Field in Life Science (7-12)

**Subjects in this department include: BIO (p. 1), GS (p. 14)**

## Courses in Biology (BIO)

### BIO 1130. Functional Biology Laboratory.

Fundamental techniques and instruments used in cellular biological research will be taught while emphasizing safety, measurements, and scientific methods. Students will design and implement controlled experiments, identify independent and dependent variables, analyze data, draw conclusions, and communicate results with appropriate tables and graphs in oral presentations and written papers.

**1 Credit Hour. 0 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**TCCN:** BIOL 1106

### BIO 1131. Organismal Biology Laboratory.

This course introduces the students to the basics of experimental design, scientific method and inquiry, use of statistical analyses and writing research papers. Topics covered include Mendelian and population genetics, natural selection, population ecology, phylogeny, and behavioral ecology.

**1 Credit Hour. 0 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**TCCN:** BIOL 1107

### BIO 1320. Modern Biology I, Molecules, Cells, and Physiology.

Provides students with basic scientific and biological principles. Current problems in biology and the ethics of science are presented with perspectives of public policy from a scientific viewpoint. This course is not recommended for majors in the natural sciences, including biology.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Life & Phys Sciences Core 030|Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**TCCN:** BIOL 1308

### BIO 1321. Ecology, Evolution and Society.

This course provides the non-science major an overview of the ecological and evolutionary principles that govern relationships between living organisms, including humans, and their environment. Special attention is given to environmental issues of current concern, such as overpopulation, climate change, pollution, resource depletion, and conservation biology.

**3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.**

**Course Attribute(s):** Life & Phys Sciences Core 030|Dif Tui- Science & Engineering|Multicultural Perspective

**Grade Mode:** Standard Letter

**TCCN:** BIOL 1309

**BIO 1330. Functional Biology.**

This course provides the students with a strong foundation in cellular and molecular biology. Topics include biochemistry, energy metabolism, molecular bases of gene regulation and protein functions, cell division and control, and cell signaling. This course is required for all biology majors and is not recommended for non-science majors. Prerequisite: College Readiness in English Language Arts and Reading (ELAR) according to the TSI regulations.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Life & Phys Sciences Core 030|Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**TCCN:** BIOL 1306

**BIO 1331. Organismal Biology.**

This course provides science majors with a foundation in organismal biology, Mendelian and population genetics, evolution and ecology. Topic include: patterns of inheritance, genetics, evolution, speciation, phylogenetics, and behavioral population, community, and ecosystem ecology. This course is required for all biology majors and is not recommended for non-science majors. Prerequisite: College Readiness in English Language Arts and Reading (ELAR) according to the TSI regulations and College Readiness in Mathematics according to the TSI regulations.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Life & Phys Sciences Core 030|Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**TCCN:** BIOL 1307

**BIO 2400. Microbiology.**

Principles of microbiology, morphology, anatomy, physiology and taxonomy of representative groups of non-pathogenic organisms. Laboratory methods stress studies of pure cultures, the use of laboratory apparatus in quantitative determinations and the detection and identification of microbial populations in the environment. Prerequisites: BIO 1130 and BIO 1131 and BIO 1330 and BIO 1331 and CHEM 1341 all with grades of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**TCCN:** BIOL 2421

**BIO 2410. Intermediate General Botany.**

An introduction to the biology of plants and plant-like organisms, emphasizing their role in ecosystem processes, relationships between structure and function, and the evolutionary relationships among the major plant groups. Prerequisites: BIO 1130 and BIO 1131 and BIO 1330 and BIO 1331 all with grades of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**BIO 2411. Intermediate Zoology.**

Provides biology majors a strong foundation in animal biology at the organismal level. The format will include details of animal form and function as well as concepts relating to classification, phylogeny, evolution, and ecology. Topics will include natural history, biogeography, adaptations to local environments, shared characters, and behavior. All material is presented in an accepted phylogenetic sequence. Prerequisites: BIO 1130 and BIO 1131 and BIO 1330 and BIO 1331 all with grades of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**BIO 2430. Human Physiology and Anatomy.**

A course on human physiology covering the various organ systems. Principles of molecular biology, cell and tissue structure, anatomy and relationship of structure and function are stressed. May not be credited toward a Biology major or minor.

**4 Credit Hours. 3 Lecture Contact Hours. 4 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**TCCN:** BIOL 2404

**BIO 2440. Principles of Microbiology.**

The Basic Principles of microbiology, morphology, physiology, immunology and the relationship of microorganisms to diseases. This course is designed primarily to meet the requirements for students in allied health sciences and other programs requiring only one semester of microbiology. This course may not be credited toward a biology major or minor. Prerequisites: BIO 1330 and CHEM 1341 both with grades of "D" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**TCCN:** BIOL 2420

**BIO 2450. Genetics.**

An introduction to basic principles of Genetics by studies of Mendelian, molecular, quantitative and population genetics. Topics include: classical transmission genetics, and gene mapping, DNA replication and repair, transcription, translation, control of gene expression, genetic engineering techniques, Hardy-Weinberg equilibrium, evolutionary change via natural selection, and genetic drift. Prerequisites: BIO 1130 and BIO 1131 and BIO 1330 and BIO 1331 and CHEM 1141 and CHEM 1142 and CHEM 1341 and CHEM 1342 all with grades of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**TCCN:** BIOL 2416

**BIO 2451. Human Anatomy and Physiology I.**

Part I of a two semester course on the structure and function of the human body. Designed specifically to prepare students for nursing and other health professions. Prerequisites: BIO 1330 and CHEM 1341 both with grades of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**TCCN:** BIOL 2401

**BIO 2452. Human Anatomy and Physiology II.**

This course is the second part of a two semester course on the structure and function of the human body designed specifically to prepare students for nursing and other health professions. Prerequisites: BIO 1330 and BIO 2451 and CHEM 1341 all with grades of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**TCCN:** BIOL 2402

**BIO 3200. Genetic Engineering Technology.**

This course introduces the technologies used for genetic engineering with an emphasis on the CRISPR-Cas system. Students will examine various applications in medicine, agriculture, and biotechnology and evaluate the potential benefits and problems, including the underlying technological, ethical and safety concerns. Students will gain hands-on experience tagging genes in the model nematode worm, *Caenorhabditis elegans*. Prerequisite: BIO 2450 with a grade of "C" or better.

**2 Credit Hours. 1 Lecture Contact Hour. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 3210. Biology Pedagogy and Learning.**

This course provides an introduction to pedagogical ideas relevant to the teaching and learning of biology for biology learning assistants. Students will learn key education theories and methods from STEM education research and cognitive science. Students will evaluate the processes of teaching and learning and examine structures and practices that facilitate and/or inhibit student learning. Students will apply what they've learned to the teaching of biology as they collaborate with biology faculty as learning assistants for an undergraduate biology course and complete a final project. Prerequisite: Department approval.

**2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 3300. Cell and Molecular Biology.**

Fundamentals of structure and function of prokaryotic and eukaryotic cells. This course includes cell and organelle structure, basic biochemistry, principles of thermodynamics and energy transformation, nucleic acid and protein synthesis, enzyme kinetics, cell motility and cell signaling. Prerequisites: BIO 2450 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 3301. Biology of Sex and Reproduction.**

This course focuses on animals, especially vertebrates, and covers topics such as the evolution of sexual reproduction, genetic variation, sex differentiation during development, reproductive anatomy and physiology, reproductive endocrinology, gestation, disease transmission, and reproductive technologies. Prerequisite: BIO 2450 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 3308. Global Ecology.**

An interdisciplinary introduction to the science of global environmental change. Emphasis will be placed on understanding principles of earth system science, the scientific basis underlying the major components of global environmental change, the linkages between these components, and the central role of humanity in contributing to the observed changes. (WI) Prerequisites: BIO 1130 and BIO 1131 and BIO 1330 and BIO 1331 all with grades of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 3341. Aquatic Toxicology.**

This course examines the basic concepts of aquatic toxicology, including uptake mechanisms, interactions, and elimination of different toxicants. Students will understand how toxic substances impact freshwater and marine organisms and identify potential health impacts to humans. Topics to be discussed include nutrients, metals, oil, pesticides, radionuclides, plastics, and emerging contaminants. Prerequisites: BIO 1331 and CHEM 1341 both with grades of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 3371. Marine Resources.**

This course examines the exploitation and fragility of the marine environment and the economic importance of marine resources. Topics to be examined include ocean ownership, overfishing, aquaculture, shark finning, whaling, ocean mining, marine transportation, tourism, pollution, harvesting energy from the ocean, and the importance of creating marine reserves. Prerequisite: BIO 1331 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 3376. Introduction to Biotechnology.**

This course is an introduction to biotechnology. It provides an insight into how biotechnological applications can solve scientific and societal problems for the benefit of humankind. Prerequisite: BIO 1330 and BIO 1331 both with grades of "D" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 3406. Economic Botany.**

An introduction to the utilization of plants by humans and their economic and ecological significance. Laboratories will stress plant features beneficial to economic and societal needs. Prerequisite: BIO 2450 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**BIO 3421. Vertebrate Physiology.**

The study of the physiology of vertebrate organ systems, including the nervous system, musculoskeletal system, endocrine system, cardiovascular system, respiratory system, digestive system, reproductive system and urinary system. Mammalian systems will be emphasized. Prerequisite: BIO 2450 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**BIO 3425. Human Anatomy.**

This course introduces students to the anatomy of the human body. Aspects of both gross and micro anatomy of tissues, organs, and systems will be covered with an emphasis on hands-on laboratory exploration. This course is designed for students interested in a variety of health professions. Prerequisite: BIO 1330 and BIO 1130 and BIO 1331 and BIO 1131 and CHEM 1341 and CHEM 1141 and CHEM 1342 and CHEM 1142 all with grades of "C" or better.

**4 Credit Hours. 2 Lecture Contact Hours. 4 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 3426. Human Physiology.**

This course focuses on human physiology and covers topics such as the nervous system, muscular system, endocrine system, cardiovascular system, respiratory system, digestive system, exocrine system, and reproductive system. Prerequisite: BIO 2450 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 3430. Mycology.**

A study of the fungal kingdom including slime molds and lichens. Laboratory studies will emphasize taxonomy, morphology and culture techniques. Prerequisites: [BIO 2400 or BIO 2410] and BIO 2450 both with grades of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**BIO 3442. Virology.**

The structure, multiplication and genetics of bacterial, plant, and animal viruses. The role of viruses in human and plant disease. (WI) Prerequisites: BIO 2400 and BIO 2450 both with grades of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 4 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 3460. Aquatic Ecology.**

An introduction to the diversity and ecology of aquatic organisms. Students will learn to use ecological concepts to understand aquatic ecosystems and how they are impacted by human activities. They will also summarize and extract relevant information from scientific papers in aquatic ecology, analyze collected data, and communicate the results effectively. The laboratory sessions will include both lab and field work and at least a one-day field trip. Prerequisite: BIO 4416 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 3461. Plant Taxonomy.**

Principles of identification and classification of plants; nomenclature and characteristics of various plant groups with emphasis on the higher plants. Prerequisite: BIO 2450 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**BIO 3480. Histology.**

A study of the structural and functional relationships between cells and tissues in organs. The laboratory includes the study of prepared slides and of microtechnique. This course is designed to meet the needs of pre-professional students. Prerequisite: BIO 2450 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 4 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**BIO 4126. Immunology Laboratory.**

This laboratory-based course will cover cells of the immune system and basic serological reactions, including bacterial and viral agglutination reactions, precipitation, immunoelectrophoresis, immunofluorescence, and enzyme-linked immunosorbent assays. (WI) Prerequisite: BIO 2400 and BIO 2450 both with grades of "C" or better. Corequisite: BIO 4326 with a grade of "C" or better.

**1 Credit Hour. 0 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 4166. Medical Microbiology Laboratory.**

This laboratory-based course will cover pathogenic bacteria emphasizing identification of selected groups of pathogens and the biological basis for virulence. (WI) Prerequisites: BIO 2400 and BIO 2450 both with grades of "C" or better. Corequisites: BIO 4366.

**1 Credit Hour. 0 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 4176. Microbial Biotechnology Laboratory.**

This laboratory-based course will cover use of microbes for biotechnological applications and is designed to provide practical explorations into fields of biotechnology. Topics include laboratory techniques for recombinant protein purification, fermentation, identification of markers in genetically modified food and bioremediation of pollutants. Prerequisite: BIO 2400 and BIO 2450 both with grades of "C" or better. Corequisite: BIO 4376.

**1 Credit Hour. 0 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 4299. Undergraduate Research.**

Supervised individual research projects in a mentor-student relationship with a biology professor. May be repeated once for credit. Prerequisites: BIO 2450 with a grade of "C" or better and a minimum 3.0 Texas State GPA and instructor approval.

**2 Credit Hours. 0 Lecture Contact Hours. 4 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 4300. Neurobiology.**

This course will give students an overview of neuroscience, particularly the areas of neuroanatomy, neurophysiology, and evolutionary and developmental neurobiology. Prerequisite: BIO 2450 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 4301. Evolution.**

Basic genetic principles applied to natural selection, adaptation, populations, speciation and man's future. Consideration is given to the origin of life, nature of chromosomal variation, evolution of genetic systems and certain other selected topics. Prerequisite: BIO 2450 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 4304. Wildlife and Recreation: Impact, Policy, and Management.**

Students will be introduced to the impact human recreational activities have on wildlife habitats and populations. Management practices to enhance human-wildlife encounters or to minimize detrimental effects on wildlife populations will be presented. Prerequisite: BIO 4416 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 4305. Nature Study.**

This course provides a comprehensive survey of natural events. It includes laboratory and field work emphasizing observation, collection and discovery of relationships. It is creditable only for those seeking elementary or middle school certification and is required for those seeking grade 4-8 Science or Science/Mathematics teaching certification. This course must be taken the semester immediately prior to student teaching.

**3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**BIO 4307. Ecology of Rarity.**

This course will examine the ecology of rarity and its ability to inform public awareness and environmental policy. This course will explore how we define rarity, persistence and viability and address the question, "Is rarity more or less common than might be expected, and is there anything we can or should do about it?" Prerequisite: BIO 4416 with a grade of "D" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 4311. Cancer Biology.**

Cancer Biology provides a foundation for understanding the complex molecular, biochemical, and cellular processes associated with cancer development. Topics include the role of tumor suppressor genes, oncogenes, DNA repair, apoptosis, ECM, cell-cycle control, cell signaling pathways, immune function and cancer-causing viruses. Emerging diagnostics and/or therapeutics will also be discussed. Prerequisite: BIO 2450 with a grade of "C" or better or instructor approval.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter



**BIO 4317. Interpretive Biology Programming and Design.**

In this course, students will explore the methods and principles used by the National Park Service, museums, environmental centers, and state park systems to interest a variety of audiences as well as interpret biology and natural environments effectively. Students will practice skills in both personal and non-personal interpretation by creating science outreach programs, interpretive literature, brochures, path waysides, and other interpretive media. Service-learning is an integral and mandatory part of this course. (WI) Prerequisite: [BIO 2410 or BIO 2411] and BIO 2450 with grades of "D" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 4319. Biological Resources: Conservation and Planning.**

This course is an introduction to the protection and sustainable use of populations, species, habitats, and ecosystems. Course also includes study of the methods used to analyze biodiversity and population regulation. Corequisite: BIO 4416 with a grade of "D" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 4324. Natural History and Conservation of Large Mammals.**

This course will introduce students to advanced details of natural history, research, and conservation of large mammals. Topics considered will include natural history, range and population status (historic and current), importance to and interaction with humans, research design and analysis, and the development of conservation and management plans.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 4326. Immunology.**

This lecture-based course will cover the biology of the immune system and its relationship to disease, emphasizing B and T cell immunity, immune diseases, hypersensitivities, transplantation, and cancer. (WI) Prerequisite: BIO 2400 and BIO 2450 both with grades of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 4327. Issues in Irish Biodiversity and Conservation.**

In this course, students will learn about Irish flora and fauna, ecosystems, conservation strategies in areas of high ecological concern, and public involvement. Emphasis will be placed on case studies and service-learning opportunities. Prerequisite: BIO 1131 and BIO 1331 both with grades of "D" or better and instructor approval. Corequisite: BIO 4328 with a grade of "D" or better.

**3 Credit Hours. 1 Lecture Contact Hour. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 4328. Field Biology of Ireland.**

In this course, students will use multiple techniques to explore biodiversity across multiple ecosystems in Ireland. Prerequisite: BIO 1131 and BIO 1331 both with grades of "D" or better and instructor approval.

Corequisite: BIO 4327 with a grade of "D" or better.

**3 Credit Hours. 0 Lecture Contact Hours. 12 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 4329. Raptor Ecology.**

This course will examine the evolution, taxonomy, ecology, behavior, anatomy, physiology, and conservation of birds of prey of the world with emphasis on diurnal raptors, including those from Texas. Field trips will include at least two overnight visits to significant migration and overwintering areas.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 4331. Human Dimensions of Wildlife and Fisheries Conservation.**

Humans play a role in nearly every aspect of wildlife and fisheries conservation. This course will provide students with principles, concepts, and case studies to understand how the human experience (e.g., culture, politics, economics) influences conservation outcomes. Students will also have an opportunity to integrate human dimensions into local decision-making. Prerequisite: BIO 4416 with a grade of "D" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 4332. Biology in Film and Television: An Analysis of the Biology in Fiction and Non-Fiction Film and TV.**

This course explores how biology is portrayed in popular motion pictures with an emphasis on analyzing biological accuracy, misconceptions perpetuated or portrayed, and investigating the rationale behind motion picture directors' and writers' decisions about how they portray biological content in the final product. Students will watch and discuss a curated list of films and television shows and write an analysis of each film or TV episode. Prerequisite: BIO 1330 and BIO 1130 and BIO 1331 and BIO 1131 with grades of "D" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 4337. Biology and Conservation of Sharks.**

This course examines the biology and conservation of sharks and their relatives (skates, rays, chimaeras, and sawfish). Topics to be examined include evolutionary history, distribution, anatomy and physiology, daily movements and migration, diet, reproduction, relationship with humans, fisheries, conservation, and field methods used in shark research.

Prerequisite: BIO 1331 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 4338. Tropical Ecology and Conservation.**

In this course students will obtain a first-hand knowledge of the ecology, biodiversity, conservation, and culture of tropical ecosystems. This is an immersive and intensive study abroad course combining traditional lecture, field-based instruction, and primary literature-based discussions while observing actual tropical ecosystems. Prerequisite: BIO 1130 and BIO 1131 and BIO 1330 and BIO 1331 all with grades of "C" or better and a minimum 2.5 Overall GPA.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 4343. Fish Physiology.**

This course examines the primary physiological functions in fish, including how fish sense and interact with the environment, maintain their energetic metabolism (respiration, digestion and excretion), reproduce and maintain water balance. Students will learn about the diverse adaptations fish use to cope with environmental and physiological challenges. Prerequisite: BIO 2450 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 4350B. Biological Implications of Water Planning in Texas.**

Current topics in understanding the biological implications of water planning in Texas. This course will be of particular interest to students who have a background in aquatic biology and who intend to stay in Texas post-graduation. May be repeated once with different emphasis.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics

**Grade Mode:** Standard Letter

**BIO 4350D. Watershed Management Frameworks and Applications.**

Introduction to integrated watershed assessment and management tools for identifying programmatic water quality and quantity issues and their root causes and solutions, and their practical application. The scientific and socio-economic elements are considered within the context of planning and developing watershed protection plans and programs.

Prerequisite: Instructor approval.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics

**Grade Mode:** Standard Letter

**BIO 4350E. Techniques in Aquatic Biology.**

This course will provide hands on experience with a suite of physical, chemical, and biological sampling techniques and gear used in applied river studies. Students will be exposed to the fundamentals of data quality objectives, accuracy, precision, detection limits, data visualization, exploratory analysis, univariate and multivariate statistics.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics

**Grade Mode:** Standard Letter

**BIO 4350I. Bird Conservation and Management.**

This course is an introduction to the conservation and management of bird populations in an ecological context. Course covers a variety of species and spatial scales from landscape to ecoregion. Laboratory portion will involve field trips, intensive computer-based labs, and class discussion. Corequisites: BIO 4416 with a grade of "D" or better.

**3 Credit Hours. 2 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics

**Grade Mode:** Standard Letter

**BIO 4350J. Environmental Physiology of Animals.**

This course is a study of how animals respond physiologically to changes in environmental temperature, moisture, salinity, partial pressure of gases, and toxins. Prerequisite: BIO 2450 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics

**Grade Mode:** Standard Letter

**BIO 4350K. Genomics.**

The course is a lecture covering modern genomics, including principles of genome function, the human genome, comparative genomics, genome sequencing, evolution and genomic change, databases and medicine, ethical, legal and social issues. The course also includes discussion of transcriptomics, proteomics, metabolomics, directed evolution, protein design, and systems biology. Prerequisite: BIO 2450 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics

**Grade Mode:** Standard Letter

**BIO 4350M. Wildlife Policy and Law in North America.**

This course provides the student with a historical and cultural context within which wildlife policy and law have developed in North America, particularly in the United States. Federal treaties, statutes, case law, and regulations pertaining to wildlife will be presented. Wildlife law from representative states will be referenced as well. Corequisite: BIO 4423 or BIO 4435 either with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics

**Grade Mode:** Standard Letter

**BIO 4350P. Tropical Ecology and Conservation Lab.**

This laboratory course complements the lecture course, in which students will obtain a first-hand knowledge of the ecology, biodiversity, conservation, and culture of tropical ecosystems. It is an immersive and intensive study abroad course combining traditional lecture and field-based laboratory instruction in tropical ecosystems.

**3 Credit Hours. 0 Lecture Contact Hours. 9 Lab Contact Hours.**

**Co-requisite(s):** BIO 43500

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics

**Grade Mode:** Standard Letter

**BIO 4350Y. Introduction to Laboratory Research Methods.**

This course is for students interested in undergraduate research and introduces the fundamental methods and practices utilized in biological research labs. This hands on course covers keeping a lab notebook, following standard protocols, and collecting/analyzing data. Student will be introduced to current research programs offered in the Biology department. Prerequisite: BIO 1330 and BIO 1331 both with grades of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics

**Grade Mode:** Standard Letter

**BIO 4350Z. Diversity and Cultural Impact of Geoparks.**

Students will explore biological differences in diversity across Geoparks in the United States and Ireland. Additionally, students will study the cultural impact that Geoparks have on the local community and national policy by focusing on differences between science communication strategies and community engagement practices conducted at the parks. Prerequisite: Instructor approval.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics

**Grade Mode:** Standard Letter

**BIO 4351A. Vertebrate Endocrinology.**

This course teaches function and organization of the endocrine system. It describes the major endocrine glands, the synthesis and release of their hormone products, and the interaction with target tissues. Endocrine control of digestion, growth, reproduction, and homeostasis will be compared between mammals and other vertebrate groups. Prerequisite: BIO 2450 and CHEM 2342 both with grades of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics

**Grade Mode:** Standard Letter

**BIO 4351D. Ecology of Temporary Waters.**

Temporary waters (which regularly go dry) are often overlooked. This course explores their diversity, their ecological role and how these systems are impacted by humans. We will also look at the species that rely on temporary waters, their special adaptations, and their populations and community dynamics.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics

**Grade Mode:** Standard Letter

**BIO 4351E. Natural History of America.**

In this field course students will examine the terrestrial and aquatic wildlife of a chosen study area in relation to their conservation and management. Local geology and climate change impacts on wildlife diversity will also be discussed. Prerequisite: BIO 1331 and BIO 1131 both with grades of "C" or better and a minimum 2.5 overall GPA and instructor approval.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics

**Grade Mode:** Standard Letter

**BIO 4351F. Marine Ecology and Conservation.**

In this field course students will examine the ecology, management, and conservation of marine flora and fauna, and the impact of humans on marine life. Prerequisite: BIO 1331 and BIO 1131 both with grades of "C" or better and a minimum 2.5 overall GPA and instructor approval.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics

**Grade Mode:** Standard Letter

**BIO 4351H. Natural History and Conservation of Large Mammals.**

This course will introduce students to advanced details of natural history, research, and conservation of large mammals. Topics considered will include natural history, range and population status (historic and current), importance to and interaction with humans, research design and analysis, and the development of conservation and management plans.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics

**Grade Mode:** Standard Letter



**BIO 4351I. Global Change Biology.**

This course will give an in-depth analysis of the major global changes occurring in present day biological systems. The focus of the course will be on climate change, invasive species, eutrophication, land use change and biodiversity loss. Emphasis will be placed on peer-reviewed literature to better understand how biologists study processes at the global scale. Potential solutions to these global challenges will also be discussed.

Prerequisite: BIO 2450 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics

**Grade Mode:** Standard Letter

**BIO 4351J. Comparative Immunology.**

While most textbooks would present the immune system of animals as a monolith with little variation between species, we are quickly learning that this is not the case. Indeed animal immune systems are immensely diverse. This class will consist of a taxonomic survey of metazoan immune systems, focusing on the evolutionary causes and ecological consequences of this diversity in immune systems across animals.

Prerequisite: BIO 4326 with a grade of "D" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics

**Grade Mode:** Standard Letter

**BIO 4351K. R for Biologists.**

This course broadly introduces biologists to the programming language R for statistical computing. The course will focus on the programming aspects of R using Base-R and tidyverse. This includes fundamentals like accessing the RStudio environment; loading, analyzing, and visualizing data; declaring variables, as well as navigating through and installing new modules. Prerequisite: BIO 2450 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics

**Grade Mode:** Standard Letter

**BIO 4351N. Marine Mammals, Reptiles, and Birds.**

This course is a field course where students will examine the ecology, management, rehabilitation, and conservation of marine mammals, reptiles, and birds. The impact of humans (e.g., pollution, climate change, habitat destruction, transportation, tourism) on their survival and rules and regulations in place to protect them will also be evaluated.

Prerequisite: BIO 1331 and 1131 with a grade of "C" or better and Minimum 2.5 overall GPA and Instructor approval.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Topics

**Grade Mode:** Standard Letter

**BIO 4351P. Ecology and Conservation Abroad.**

The purpose of this course is to provide a first-hand understanding of the natural history, biodiversity, ecology, and conservation of ecosystems that do not occur in the United States. It is an immersive and intensive study abroad course combining traditional lecture and field-based instruction in the field. Corequisite: BIO 4351Q with a grade of "C" or better.

**3 Credit Hours. 20 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics

**Grade Mode:** Standard Letter

**BIO 4351Q. Ecology and Conservation Abroad Lab.**

The purpose of this course is to provide a first-hand understanding of the natural history, biodiversity, ecology, and conservation of ecosystems that do not occur in the United States. It is an immersive and intensive study abroad course combining traditional lecture and field-based instruction in the field. Corequisite: BIO 4351P with a grade of "C" or better.

**3 Credit Hours. 0 Lecture Contact Hours. 20 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics

**Grade Mode:** Standard Letter

**BIO 4360. Molecular Biology.**

This course offers advanced insights into the realm of molecular biology. The curriculum covers a range of subjects such as gene expression (which encompasses the transcription and translation processes in bacteria and other organisms), post-translational protein modifications, chromosomal DNA replication, controls at cell cycle checkpoints, DNA damage and its repair mechanisms, and theories related to cancer and aging. Prerequisite: [BIO 2450 and BIO 2400] or CHEM 3375 or CHEM 4375, with grades of "D" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 4363. History of Medicine.**

This course covers significant concepts, developments, individuals, and events in the history of medicine from antiquity to modern day. Topics include the impact of disease on medical practice, the development of hospitals as sites for care, teaching, and research, how medical science and technology are continuously defined by social, cultural, and political ideas, and the historical roots of several themes in medical ethics. This course will be delivered as an Education Abroad course. (WI) Prerequisite: BIO 2400 or BIO 2440 or BIO 2450 or BIO 2451 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 4364. Explorations in Physiology.**

This course will cover the basic principles of physiological systems and the function of organ systems with an emphasis on humans and other mammals. The focus will be on the interplay between and among multiple organ systems and holistic systems integration. Other topics include the pathophysiology underlying common diseases, drug therapies and treatments, and emerging physiological research. This course will also provide the opportunity for experiential learning gained in diverse cultural settings. Prerequisite: BIO 2400 or BIO 2440 or BIO 2450 or BIO 2451 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 4366. Medical Microbiology.**

This lecture-based course will cover pathogenic bacteria and their relationship to disease, epidemiology and the biological basis for virulence. Students may take only one of BIO 4345, BIO 4350G or BIO 4445 for credit. Prerequisites: BIO 2400 and BIO 2450 both with grades of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 4374. Principles of Zoo Management.**

This course is designed to introduce the principles of captive animal management within conservation and education-based zoos. Zoo management requires a broad understanding of the life history and biological needs of many different species; we will explore the ways modern zoos address these needs and the ways in which future zoos could address them more effectively. Specific topics will include animal husbandry, welfare, nutrition, and behavior as well as environmental enrichment, captive breeding, conservation, zoo regulatory frameworks, ethical concerns, and zoo careers. Prerequisite: BIO 2411 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 4376. Microbial Biotechnology.**

This course provides an overview of how microbes (e.g., bacteria, viruses and yeast) are manipulated to solve practical problems through biotechnology. This course is based on topics of applied microbiology as recommended by American Society of Microbiology. Prerequisite: BIO 2400 and BIO 2450 both with grades of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 4377. Genome Informatics.**

The course will cover basic knowledge on genomics and its bioinformatics tools. Students will learn current topics on genomics and bioinformatics, and will analyze genomic data using statistical software. All the analyses will be performed using a personal and a cluster computer. Prerequisite: BIO 2450 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 4388. Habitat Ecology.**

The course will introduce students to the importance of habitat in understanding a wide range of processes and patterns in Ecology. Course will explore the process of habitat selection, in the context of animal behavior as well as population dynamics. Students will learn methods and techniques of statistically analyzing the habitat associations of species. The central role of habitat in species conservation will also be discussed. Prerequisite: BIO 4416 with "C" or better and instructor approval.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 4400. Plants Important for Wildlife.**

This course explores plant and plant part (specifically gall, fruit, seed, and twig) identification, phylogenetics, co-evolution of plant defenses, economic and ecological impacts of plant uses by wildlife. Prerequisite: BIO 2410 or BIO 2450 either with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 4402. Earth Science I.**

The description and interpretation of earth phenomena considered from the standpoint of meteorology and astroscience. Includes field observations, methods of measurement and interpretation of data related to the physical environment and space technology. May not be counted toward a major or minor in biology. Required for those seeking grade 4-8 Science and Mathematics/Science certification.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**BIO 4403. Earth Science II.**

The description and interpretation of earth phenomena considered from the standpoint of geology and oceanography. Includes field observations, methods of sampling and interpretation of data related to the physical environment. May not be counted toward a major or a minor in biology. Required for those seeking grade 4-8 Science and Mathematics/Science certification.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**BIO 4408. Science Processes and Research.**

Students will analyze scientific research design, design research, interpret data, and communicate results. Stress will be placed on broad-field structure and integration of major science concepts and research-based science pedagogy. This course must be taken the semester prior to student teaching and is required for those seeking 7-12 Life Science or Science teacher certification. This course may not count as one of the four upper-level Biology courses required of general Biology majors, or one of the three upper-level Biology courses required of Biology minors.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**BIO 4410. Field Biology of Plants.**

Ecological relationships and natural history of plants, including historical geology, geography, soils, vegetational regions and surface geology of central Texas. Emphasis is placed on plant-soil-water relationships to develop conservation concepts. Students will make a representative collection of plants. Prerequisite: BIO 2450 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**BIO 4411. Morphology of the Vascular Plants.**

The structure, life-cycles and evolution of fossil and living vascular plants. Emphasis on such topics as the origin of land plants, evolution of the ovule, angiospermy, the flower and fruit. Prerequisites: BIO 2450 and CHEM 1342 both with grades of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**BIO 4412. Plant Anatomy.**

The anatomy of vascular plants stressing descriptive, development and comparative aspects of seed plants and the anatomical adaptations of plants to environmental factors. Prerequisites: BIO 2450 and CHEM 1342 both with grades of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**BIO 4413. Parasitology.**

The biology and biological significance of the common parasites of man and animals. Prerequisites: BIO 2411 and BIO 2450 both with grades of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 4 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**BIO 4415. Ichthyology.**

An introduction to the morphology, taxonomy, natural history and evolution of fishes. Field trips will be made to collect specimens and laboratory periods will be devoted to morphological and systematic analysis. Prerequisites: BIO 2411 and BIO 2450 both with grades of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**BIO 4416. General Ecology.**

The ecological relationships that exist between organisms and those relationships that exist between organism and environment. Laboratory sessions will be devoted to literature review and/or specific ecological problems. This course or BIO 4454 is required of all biology majors. (WI) Prerequisites: BIO 2450 and [BIO 2400 or BIO 2410 or BIO 2411] both with grades of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 4418. Field Ornithology.**

This course is designed to introduce and provide an advanced knowledge of the application of various field, laboratory, and statistical methods and techniques in the study of avian species. The course will include topics related to survey methodology, sampling design, marking/banding, measurement/sample extraction, and aging/sexing of avian species.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**BIO 4420. Natural History of the Vertebrates.**

Environmental relationships and natural history of vertebrates. Emphasis is upon taxonomy, speciation and biotic provinces. The laboratory will include field trips for the study and collection of animals in their natural habitats. Students will assemble a representative collection of animals. (WI) Prerequisites: BIO 2411 and BIO 2450 both with grades of "C" or better and instructor approval.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 4421. Ornithology.**

Introduction to anatomy, behavior, ecology and identification of birds of Texas. Laboratory will emphasize field studies of birds and their habitat requirements. Prerequisites: BIO 2411 and BIO 2450 both with grades of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**BIO 4422. Mammalogy.**

The taxonomy, distribution, ecology, behavior and evolution of mammals with particular emphasis on wild animals of the southwest. Laboratory will emphasize anatomy, identification, preparation of specimens and field exercises in the methods of population analysis. Prerequisites: BIO 2411 and BIO 2450 both with grades of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**BIO 4423. Wildlife Management.**

Applications of the principles of ecology and natural history to the management of wildlife habitats and control of wildlife populations. Laboratory will involve demonstrations and practice exercises with wildlife management techniques and instrumentation and field trips to observe wildlife management projects. (WI) Prerequisites: BIO 2411 and BIO 2450 with grades of "C" or better and BIO 2410 with a grade of "D" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 4425. Biometry.**

Basic principles of statistical methods as applied to biological problems such as sampling techniques, analysis of data, experimental design and population dynamics. Emphasis will be on practical application. Prerequisites: BIO 2450 and [MATH 1315 or MATH 2321 or MATH 2328 or MATH 2417 or MATH 2471] both with grades of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**BIO 4429. Wetland Plant Ecology and Management.**

This course focuses on the biological, physical, chemical, and ecological aspects of major wetland ecosystems. The management and restoration of wetlands will also be discussed. Special attention will be spent on the ecology and identification of wetland plants. Prerequisite: BIO 2410 or BIO 2450 either with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 4431. Bacterial Diversity.**

The overall goal of this research-based course is to isolate, cultivate, characterize, and identify under-explored bacterial lineages from environmental samples. Methods and techniques employed in this course include aseptic techniques, cutting-edge cultivation approaches, maintaining bacterial cultures, gel electrophoresis, DNA isolation, amplification, and sequencing. Prerequisite: BIO 2400 and BIO 2450 both with grades of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 4432. Bacterial Genomics.**

The course offers hands-on training on contemporary approaches, techniques, and bioinformatic tools used to study bacterial genomes. Topics covered include, DNA sequencing, genomic assembling, and annotation, with a strong emphasis in computation biology and genomic data handling/analytics. At the end of this course, students will be familiar with bioinformatics tools used to analyze genes and genomes. Prerequisite: BIO 4431 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 4434. Herpetology.**

A course treating the origin and evolution of amphibians and reptiles; their reproductive and physiological tactics; taxonomy/systematics; and population biology. Emphasis will be placed on North American species and those groups inhabiting Texas. Prerequisites: BIO 2411 and BIO 2450 both with grades of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**BIO 4435. Techniques in Wildlife Management.**

The basic methodology of practical wildlife management. This involves techniques in monitoring and data collection related to population dynamics and habitat parameters of wildlife species. Prerequisites: BIO 2411 and BIO 2450 both with grades of "C" or better and instructor approval.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**BIO 4436. Tropical Biology.**

This course entails an analysis and evaluation of the governing principles of tropical ecosystems, including wildlife ecologies, geological processes, and environmental-cultural interactions. In the laboratories, students will compare ecological relationships that influence tropical biology, discuss peer-reviewed literature and examine tropical flora and fauna during field trips to regional sub-tropical areas. Prerequisite: BIO 2410 and BIO 2411 and BIO 2450 all with grades of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 4441. Cellular Physiology.**

Advanced cellular biology, including membrane physiology, thermodynamics, energy transduction and distribution, and cellular movement in non-muscle and muscle cells. Laboratory includes discussion of current research and exercises in cellular physiology. (WI) Prerequisites: BIO 2450 and [CHEM 2330 or CHEM 2341 or CHEM 2342] both with grades of "D" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 4446. Microbial Ecology.**

This course will illustrate the wide variety of bacteria in nature, their interactions with other organisms and the environments, and their roles in global cycling of elements such as carbon, nitrogen, and sulfur. Undergraduate research is a major component of this course. (WI) Prerequisites: BIO 2400 and BIO 2450 both with grades of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 4447. Microbial Physiology.**

This course will cover fundamental concepts in bacterial and archaeal physiology, including central and specialized metabolism. Undergraduate research is a major component of this course. (WI) Prerequisites: BIO 2400 and BIO 2450 and CHEM 2142 and CHEM 2342 all with grades of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 4448. Bacterial Genetics.**

This course will cover concepts and mechanisms involved in the genetics of Archaea and Bacteria. Prerequisite: BIO 2400 and BIO 2450 both with grades of "C" or better. (WI).

**4 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 4454. Plant Ecology.**

Physiological ecology and community structure and function in the organization of terrestrial plant ecosystems. Quantitative vegetational sampling and the use of field and laboratory physiological equipment are included in the laboratory. (WI) Prerequisite: BIO 2450 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 4455. Plant Physiology.**

Basic principles of plant physiology are studied in lecture and laboratory. One semester of organic chemistry is strongly recommended. Prerequisite: BIO 2450 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 4464. Vertebrate Anatomy.**

This course is a comparative study of vertebrate anatomy. Fossil histories are evaluated to understand how vertebrate radiation occurred in the geological past, along with changes in structure of organs and organ systems. Lab includes dissection of representative members of each major vertebrate group. Prerequisite: BIO 2450 with a grade of "C" or better. (WI).

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Lab Required|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 4465. General Entomology.**

Principles of morphology, physiology and taxonomy of insects. Laboratory time will be devoted to a taxonomic study of the common orders and families of insects. Prerequisites: BIO 2411 and BIO 2450 both with grades of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**BIO 4470. Limnology.**

The physical, chemical, and biological factors affecting productivity in lakes, ponds, and streams. Limnological sampling methods, chemical, and biological analysis of samples and hydrographic surveying are included in the laboratory. (WI) Prerequisites: BIO 2450 and CHEM 1342 both with grades of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 4472. Animal Behavior.**

This course presents all the major facets of the study of animal behavior, giving special attention to its evolution and ecological significance. We will discuss major conceptual models guiding past and present research in the field. Laboratories will emphasize experimental techniques and statistical analysis. (WI) Prerequisites: BIO 2450 and [BIO 2400 or BIO 2410 or BIO 2411] both with grades of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required|Writing Intensive

**Grade Mode:** Standard Letter

**BIO 4480. Cytology and Microtechnique.**

A study of cellular structure and microscopic technique. The lecture portion of the course presents cytology of all cell types and theoretical aspects of microscopy including light and electron-based technologies. The laboratory portion of the course provides training in standard light and electron microscopy, laser scanning confocal microscopy, and digital microscopy. Prerequisite: BIO 2450 with a grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter



**BIO 4481. Internship in Biological Laboratory Technologies.**

The student will participate in the work of a selected biology unit (private, commercial, or governmental). A research paper, reporting the internship experience conducted at the biological unit under the supervision of a faculty member, will be required. This course may be credited toward a biology major with prior approval of the biology department adviser and chair. Prerequisite: BIO 2450 with a grade of "C" or better.

**4 Credit Hours. 0 Lecture Contact Hours. 15 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**BIO 4490. Principles of Developmental Biology.**

This course will cover basic principles of developmental biology in both plant and animal systems. The course will mainly address cell, molecular and genetic mechanisms underlying the development of model organisms, mainly focusing on *Drosophila* (animal) and *Arabidopsis* (plant). Prerequisite: BIO 2450 with grade of "C" or better.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

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## Courses in General Science (GS)

**GS 2310. Life Science Concepts.**

This laboratory course is designed to acquaint the student with the fundamentals of biological science and introductory chemistry. It cannot be taken for credit by science majors.

**3 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.**

**Course Attribute(s):** Life & Phys Sciences Core 030|Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**GS 3310. Earth Science Concepts.**

This laboratory course acquaints students with the fundamentals of chemistry and earth space science. It is non-creditable for science majors but is a required course for select education majors. Prerequisites:

PHYS 1310 or PHYS 1315 or PHYS 1320 or PHYS 1325 or PHYS 1360 or PHYS 1365 or PHYS 1370 or PHYS 1410 or PHYS 1420 any with grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter