# Biological and Environmental Sciences

Venugopalan Cheriyath (Interim Department Head)
Location: Science Building, Room 260, 903-468-815, Fax 903-886-5997
Biological and Environmental Sciences Web Site (http://www.tamuc.edu/academics/colleges/scienceEngineeringAgriculture/departments/biologicalEnvironmentalSciences/default.aspx)

The Department of Biological and Environmental Sciences offers several undergraduate programs, including Bachelor of Sciences and Bachelor of Arts in Biological Sciences, Bachelor of Science in Environmental Science, and Bachelor of Science in Wildlife and Conservation Science. The Biological Sciences major has several emphasis areas, such as Pre-Medicine, Pre-Physician Assistant, Pre-Dental, Pre-Pharmacy, Pre-Physical Therapy, Pre-Optometry, Cell and Molecular Biology, and Wildlife Ecology. The department also offers minors in Biology and Environmental Sciences, which include teacher certification in 7-12 life science.

Additionally, the department provides accelerated BS/MS programs in Biological Sciences with thesis and non-thesis options for students to earn their master's degree in five years.

Graduate programs in the department include a Master of Science degree in Biological Sciences with thesis or non-thesis options, including a fully online MS degree in Biological Sciences with non-thesis option. Graduates from the department are well-prepared for graduate school and careers in education, industry, and government.

*Students seeking a bachelor's degree in the following majors must complete:*

1. degree requirements for a Bachelor of Arts or Science degree, and
2. Core Curriculum Requirements (https://coursecatalog.tamuc.edu/undergrad/core-curriculum-requirements/) (refer to those sections of this catalog).

## I. Major in Biological Sciences

The Department of Biological and Environmental Sciences offers a wide range of degree options, including a general degree in biological sciences and several emphases such as Pre-Medicine, Pre-Physician Assistant, Pre-Dental, Pre-Pharmacy, Pre-Physical Therapy, Pre-Optometry, Cell and Molecular Biology, and Wildlife Ecology. This program provides students with a comprehensive understanding of biological sciences, ranging from molecular to ecosystem levels. It is ideal for students who are interested in pursuing careers in health sciences, biological, biomedical, biotechnology, and ecosystem research. We encourage prospective students to speak with one of our advisors for more information.

Ms. Abigail Parmar (Abigail.Parmer@tamuc.edu (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/biological-environmental-sciences/Abigail.Parmer@tamuc.edu)) (903-886-5773)

Dr. J.P. Slovak (**John.Slovak@tamuc.edu**) (903-886-5368)

Dr. Venu Cheriyath (Venu.Cheriyath@tamuc.edu (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/biological-environmental-sciences/Venu.Cheriyath@tamuc.edu)) (903-468-6064)

Dr. DongWon Choi (**DongWon.Choi@tamuc.edu**) (903-468-8153)

Dr. Hunkar Gizem Yesilyurt (**HunkarGizem.Yesilyurt@tamuc.edu**) (903-886-5602)

Dr. Hyun-Joo Nam (Hyun-Joo.Nam@tamuc.edu) (903-468-3271)

Dr. Jeffrey Kopachena (Jeff.Kopachena@tamuc.edu) (903-886-5395)

Dr. Bjorn Schmidt (**Bjorn.Schmidt@tamuc.edu**) 903-886-5938)

## II. Major in Environmental Sciences

The Environmental Sciences major is tailored for students seeking a career in the flourishing realm of environmental science. Graduates of the program have the opportunity to work with private environmental companies, and corporations or with federal, state, county, or municipal governments. Prospective students who are interested in the program are highly encouraged to speak with one of the program advisors.

Dr. Lin Guo (Lin.Guo@tamuc.edu (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/biological-environmental-sciences/Lin.Guo@tamuc.edu)) (903-886-5371)

Dr. Naima Khan (Naima.Khan@tamuc.edu (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/biological-environmental-sciences/Naima.Khan@tamuc.edu)) (903-468-8648)

## III. Major in Wildlife and Conservation Science

The Wildlife and Conservation Science program offered by the Department of Biological and Environmental Sciences is suitable for students with a passion for ecology, wildlife management, and the conservation of biodiversity. The program offerings are fully compliant with the requirements set by the Wildlife Society and the U.S. Fish and Wildlife Service. Graduates of this program become skilled professionals with opportunities for employment across private, state, and Federal agencies. This program also provides a strong foundation for students planning to pursue graduate studies in these fields. Interested students are advised to reach out to the program advisor for more information.

Dr. Jeff Kopachena (Jeff.Kopachena@tamuc.edu (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/biological-environmental-sciences/Jeff.Kopachena@tamuc.edu)) (903-886-5395)

Dr. Johanna Delgado-Acevedo (Johanna.Delgado-Acevedo@tamuc.edu) (903-886-5378)

Dr. Kelly Reyna (Kelly.Reyna@tamuc.edu) (940-395-5128)

## IV. Teacher Education Programs

Students seeking a bachelor's degree in the teacher education program must complete:

1. degree requirements for a Bachelor of Arts or Science degree (refer to the bachelor's degree requirements section of this catalog),
2. Core Curriculum Requirements (https://coursecatalog.tamuc.edu/undergrad/core-curriculum-requirements/) (refer to that section of this catalog),
3. requirements for admission to and retention in the Teacher Education Program (refer to the Center for Educator Certification and Academic Services section of this catalog), and
4. professional development courses (refer to the appropriate departmental section in this catalog, i.e. Department of Curriculum and Instruction or Department Educational Leadership).

In addition, courses in the major must be completed as shown below. "B.S. in Biological Sciences: Secondary Certification: (Grades 7 - 12) Life Sciences" For required courses see the academic advisor, Dr. J.P. Slovak (John.Slovak@tamuc.edu) (903-886-5368).

## V. Pre- Medical and Related

The BA/BS in Biological Sciences degree is one preparatory program for students wishing to go to medical school or other professional health sciences-related fields. Students will work with faculty advisors to select emphasis areas best suited for the medical fields they plan to pursue. Students interested in pre-professional studies in medicine, allied health, pharmacy, dentistry, osteopathy, optometry, nursing, medical technology, and physical therapy, should contact departmental advisors:

Dr. JP Slovak (John.Slovak@tamuc.edu ) (903-886-5368)

Dr. Venu Cheriyath (**Venu.Cheriyath@tamuc.edu**) (903-468-6064)

Dr. Hunkar Gizem Yesilyurt (HunkarGizem.Yesilyurt@tamuc.edu ) (903-886-5602)

Dr. Hyun-Joo Nam (Hyun-Joo.Nam@tamuc.edu (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/biological-environmental-sciences/Hyun-Joo.Nam@tamuc.edu)) (903-468-3271)

Dr. DongWon Choi (**DongWon.Choi@tamuc.edu**) (903-468-8153)

## VI. Accelerated BS/MS Program

Students who have completed 90 credit hours in their Biology major and have a minimum institutional GPA of 3.25 are eligible for the BS/MS accelerated program in Biological Sciences. If accepted, they must maintain the same GPA standard. Please keep in mind that the thesis option for the Biological Sciences MS degree is only available on campus. Accelerated BS/MS students can take up to 12 credit hours of graduate courses during their senior year and will complete the MS degree in a minimum of five years instead of the usual six-year minimum. Interested students are encouraged to contact the graduate program coordinator or the admission supervisor:

Dr. Bjorn Schmidt (Bjorn.Schmidt@tamuc.edu) (903-886-5938)

Ms. Dayla Burgin (Dayla.Burgin@tamuc.edu (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/biological-environmental-sciences/Dayla.Burgin@tamuc.edu)) (903-886-5167)

## VII. Other Programs

Students can choose from a variety of other options depending on their academic requirements. The Department of Biological and Environmental Sciences offers the following additional programs:

Second Major in Biological Sciences (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/biological-environmental-sciences/biological-sciences-second-major/)

Minor in Biology (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/biological-environmental-sciences/biological-sciences-minor/)

Minor in Environmental Science (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/biological-environmental-sciences/environmental-science-minor/)

Fast-Track Bachelors + Masters Biological Sciences (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/biological-environmental-sciences/bs-ms-bsci/)

Biological Sciences B.A./B.S. (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/biological-environmental-sciences/biological-sciences-ba-bs/)

Biological Sciences B.S. - Secondary Certification (Grades 7-12) Life Sciences (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/biological-environmental-sciences/biological-sciences-bs-secondary-certification-grades-8-12-life-sciences/)

Biological Sciences Minor (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/biological-environmental-sciences/biological-sciences-minor/)

Biological Sciences Second Major (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/biological-environmental-sciences/biological-sciences-second-major/)

BS-Biological Sciences-Cell Molecular Biology-Emphasis: BA/BS-BSCI (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/bio-cell-mol-bio-emphasis/)

BS-Biological Sciences-Pre-Dental-Emphasis: BA/BS BSCI (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/pre-dental/)

BS-Biological Sciences-Pre-Med-Emphasis: BA/BS BSCI (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/pre-med/)

BS-Biological Sciences-Pre-Optometry-Emphasis: BA/BS BSCI (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/pre-optometry/)

BS-Biological Sciences-Pre-PA-Emphasis: BA/BS BSCI (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/pre-pa/)

BS-Biological Sciences-Pre-Pharmacy-Emphasis: BA/BS BSCI (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/pre-pharmacy/)

BS-Biological Sciences-Pre-PT-Emphasis: BA/BS BSCI (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/pre-pt/)

BS-Biological Sciences-Wildlife Ecology-Emphasis: BA/BS BSCI (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/wildlife-ecology-emphasis/)

Environmental Science B.S. (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/biological-environmental-sciences/environmental-science-bs/)

Environmental Science Minor (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/biological-environmental-sciences/environmental-science-minor/)

Wildlife and Conservation Science B.S. (https://coursecatalog.tamuc.edu/undergrad/colleges-and-departments/college-of-science-and-engineering/biological-environmental-sciences/wildlife-conservation-science-bs/)

**BIOL 1309 - Human Biology: Structure and Function**
Hours: 3
This course is designed to apply the principles of biology to man as a functional unit of our social organization.

**BIOL 1409 - Human Biology: Structure and Function**
Hours: 0-4
This course is designed to apply the principles of biology to man as a functional unit of our social organization. Students must register for both lecture and lab sections.

**BIOL 2420 - General Microbiology**
Hours: 0-4
Four semester hours (3 lecture, 3 lab). (1) Study of microbiology emphasizing fundamental principles and applications (not interchangeable with BSC 306). Previously BSC 254.

**BSC 1406 - Introductory Biology I**
Hours: 4
This course is the first half of the Introductory Biology series. It is designed for the following majors: Broadfield Biology, Pre-Med, Pre-Allied Health, and Pre-Vet. Topics covered include biological evolution, biochemistry, cellular and molecular biology, genetics, and microbiology. Note All courses carrying four semester hours have labs. Students must register for both lecture and lab sections

**BSC 1407 - Introductory Biology II**
Hours: 4
This course is designed for students in Agricultural Science, Plant and Soil Science, Animal Science, Wildlife and Conservation Science, and in Environmental Science. Students are introduced to animal cellular biology and physiology, animal diversity and classification, and the biogeography and ecology of animal populations. Topics covered include cellular metabolism, animal physiology and genetics, developmental biology and architectural patterns, evolution, and the diversity of animal life. Students must register for both lecture and lab sections. Prerequisite BSC 1406 with a minimum grade of C.

**BSC 1411 - Botany**
Hours: 4
This course is designed for students majoring in Agricultural Science, Plant and Soil Science, Wildlife and Conservation Science, and in Environmental Science. Students are introduced to the structure and function of plants as well as their diversity and ecology. Topics covered include plant cellular and gross anatomy, plant physiology and biochemistry, genetics, evolution, classification, and biogeography. Students must register for both lecture and lab sections.

**BSC 1413 - Zoology**
Hours: 4
This course is designed for students in Agricultural Science, Plant and Soil Science, Animal Science, Wildlife and Conservation Science, and in Environmental Science. Students are introduced to animal cellular biology and physiology, animal diversity and classification, and the biogeography and ecology of animal populations. Topics covered include cellular metabolism, animal physiology and genetics, developmental biology and architectural patterns, evolution, and the diversity of animal life. Students must register for both lecture and lab sections.

**BSC 2401 - Hum Anatomy/Physiology I**
Hours: 0-4
Study of the structure and functions of human organ systems. Students must register for both lecture and lab sections.

**BSC 2402 - Hum Anatomy/Physiology II**
Hours: 4
Study of the structure and function of human organ systems (continuation of BSc 251). Students must register for both lecture and lab sections. Pre-requisite: BSC 2401

**BSC 256 - Medical Terminology**
Hours: 3
This course will study the basic structure of medical words. Included will be prefixes, suffixes, roots, combining forms, and plurals. Emphasis will be placed on pronunciation and spelling. This course cannot be used or substituted for any course in any degree program in Biological Sciences.

**BSC 297 - Special Topics**
Hours: 1-4

**BSC 303 - Cell Biology**
Hours: 4
This course is intended for biology and pre-professional majors with a solid understanding of general biology and general chemistry. This course covers the chemical nature of the cell. It deals with the variety of chemicals found in cells as well as the subcellular structures and components. It includes an extensive review of enzymes, cell membranes and transport, cell signalling, motility of cells and within cells, and extracellular adhesion and signals. The regulation, chemical synthesis, and transport of both RNA and proteins are also covered. Students must register for both lecture and lab sections. Prerequisites: A minimum grade of C is required in the following prerequisite courses: BSC 1407, and CHEM 1312, a grade of "C" or more must be earned in the course.

**BSC 304 - Genetics**
Hours: 4
This course is intended for biology and pre-professional majors with a solid understanding of general biology and general chemistry. Cell Biology is very helpful, and may be taken concurrently. This course covers essentially DNA, studying it at the molecular, organismal, and population levels. Students will cover the mechanisms of inheritance, including Mendelian and non-Mendelian inheritance and genetic recombination in viruses through humans. At the molecular level, topics include the structure and organization of DNA, DNA replication, techniques of DNA analysis (including recombinant DNA and DNA sequencing), and transgenic organisms. The final section of the course covers an introduction to population genetics with a thorough treatment of the Hardy-Weinberg equilibrium and evolution. Students must register for both lecture and lab sections. Prerequisites: BSC 303 with a minimum grade of C or concurrent registration in BSC 303.

**BSC 305 - General Physiology**
Hours: 4
This course is designed for majors with a well-rounded background in biology. It provides students with an understanding of basic physiological principles and the functional organization of living systems. Emphasis will be placed on human physiology and the integrated functions of organ systems. Students are expected to learn the basic principles and concepts of human physiology both at the molecular and cellular levels, to learn to reason scientifically, and to understand and describe the cooperative function of multiple organ systems in the human body. Students must register for both lecture and lab sections. Prerequisite BSC 303 Cell Biology with a minimum grade of C.

**BSC 306 - Applied Microbiology**
Hours: 4
This course is for biology undergraduate students designed to provide important key principles of microbial life. The important key principles will then be applied to real-life examples to better understand dynamics of microbial world as a part of global ecosystem. Although relatively simple and primitive, microorganisms are considered as the most successful form of life. They are virtually everywhere and they are in tight relationship with other forms of life on earth. Unlike macroorganisms (i.e. animals, plants, insects, etc), microorganisms carry out their life processes such as energy metabolism, growth, and reproduction independently from other cells. This unique feature makes microorganisms a great tool to study the nature of life. Students must register for both lecture and lab sections. Prerequisites: BSC 303; a grade of "C" or more must be earned in the course.

**BSC 307 - Ecology**
Hours: 3
Ecology is the study of living things and their interaction with their environment. This class takes a hierarchical look at ecological processes from ecosystems to populations. Specific topics include the flow of energy and matter through global and local ecosystems, factors affecting production and biodiversity, zones of tolerance, ecological succession, ecotones and ecoclines, community ecology, niche theory, population models, and evolutionary arms races. Prerequisites: BSC 1407 or BSC 1413 or ENVS 303.

**BSC 310 - Animal Behavior**
Hours: 3
An introduction to the principles of animal behavior with an emphasis on Methods of Observation and the proximate and ultimate causes of behavior. Aspects of physiology and development of behavior, instinct and learning and modern cognitive ethology will be addressed. Prerequisites: BSC 1407 or BSC 1413.

**BSC 314 - Comparative Vertebrate Physiology**
Hours: 3
The course is a comparative study of basic physiological principles and functional organization with emphasis on the functioning of organ systems in various vertebrate classes and their adaptation to the environment leading to an understanding of evolutionary relationships. The course evaluates i) the mechanisms by which animals perform their life-sustaining functions, ii) the ways in which diverse phylogenetic groups of animals both resemble each other and differ, iii) the ways in which physiology and ecology interact, and iv) the importance of all levels of organization, from genes to proteins and tissues to organs, for the full understanding of physiological systems. Crosslisted with: ANS 314.

**BSC 315 - Ecological Genetics**
Hours: 3
Ecological genetics is about how environmental and population-level processes affect the genetic structure of populations. The course begins with a basic overview Mendelian genetics followed by an in-depth study of population genetics and the intrinsic and extrinsic processes that influence the genetic composition of populations and metapopulations. Because the interaction between genes and the environment fundamentally affect the viability of populations, ecological genetics has broad relevance for understanding population stability and maintenance healthy populations. Prerequisites: BSC 1407 or BSC 1413 with a minimum grade of C. Crosslisted with: AG 315.

**BSC 316 - Becoming a Wildlife Professional**
Hours: 3
Working with wildlife can be a thrilling adventure steeped in the wonders of the natural world, but entering the field demands a strong personal commitment. Students will gain knowledge in the proper training and guidance needed to transform themselves into competitive applicants for wildlife jobs and forge successful careers. Student will learn about many entry-level jobs available for the next generation of wildlife biologists and conservationists. Over 100 diverse career options for aspiring wildlife workers will be presented, including work in biological field research, forestry, rehabilitation, ranching, photography, and refuge management. Students will learn the best ways to prepare for a vocation in the wildlife profession while obtaining pragmatic advice about applying for and obt

**BSC 335 - Wildlife Management I**
Hours: 3
The purpose of this course is to introduce students to the many aspects of wildlife and conservation science. It will provide an introduction to the history of wildlife management and conservation, ecosystems and ecology, population modeling, animal behavior, food and cover, wildlife diseases, predators and predation, and hunting and trapping. Offered: FALL

**BSC 336 - Wildlife Management II**
Hours: 3
This course is designed to complement Wildlife Management I and provides an introduction to the many aspects of wildlife ecology and conservation science. Topics covered include water and soils, farmlands, rangelands, and forests, parks and refuges, urban wildlife management, and non-game and endangered species. Offered: SPRING

**BSC 337 - Field Methods in Wildlife and Conservation Science**
Hours: 4
This course provides students with practical training in the methods used to collect quantitative data on plant and animal populations, animal movements and home ranges, habitat associations, and animal behavior. Field exercises are integrated with lecture material emphasizing study design, statistics, and data interpretation. Crosslisted with: AG 337.

**BSC 338 - Wildlife Management Techniques**
Hours: 3
This class will develop the principles and techniques for managing wildlife populations. Topics covered will include experimental design, hypothesis testing, scientific writing, techniques for capturing and marking wildlife, age and sex determination, parameter estimation (population size, density, survival, etc.), radio-telemetry, home range and resource selection. Students enrolled in this course must be willing to participate in a field-based classroom research project when and where feasible. Crosslisted with: AG 338.

**BSC 339 - Becoming a Wildlife Professional**
Hours: 3
Working with wildlife can be a thrilling adventure steeped in the wonders of the natural world, but entering the field demands a strong personal commitment. Students will gain knowledge in the proper training and guidance needed to transform themselves into competitive applicants for wildlife jobs and forge successful careers. Student will learn about many entry-level jobs available for the next generation of wildlife biologists and conservationists. Over 100 diverse career options for aspiring wildlife workers will be presented, including work in biological field research, forestry, rehabilitation, ranching, photography, and refuge management. Crosslisted with: AG 339.

**BSC 371 - Science and Math Education Theory and Practice**
Hours: 1
Learning theory and teaching practices for science learning assistants. Topics include questioning strategies, conceptual development, formative assessment, argumentation, metacognition, and nature of science. Crosslisted with: PHYS 371, CHEM 371, MATH 371.

**BSC 381 - Big Game Management**
Hours: 3
This class will expose students to concepts of managing major big game species in North America (i.e. white-tailed deer, feral hog, desert mule deer, pronghorn antelope, desert bighorn sheep, javelina, mountain lion, bear), with focus on the conservation practices of those species in Texas. Overview of topics include taxonomy, life history, harvest management, habitat management, population estimation, and conservation ecology of exotic species. Additional topics cover wildlife diseases, genetics, economic significance, and human dimensions. Indoor lab exercise will cover identification and aging of species. Field trips will expose students to actual management practices conducted in the field and provide an opportunity for applied skills in planning field studies, data collection, analysis, and synthesis of a management plan. Crosslisted with: AG 381.

**BSC 383 - Waterfowl Management**
Hours: 3
The course will expose students to concepts of managing waterfowl in North America (i.e.with focus on the conservation practices of those species in Texas. Overview of topics include taxonomy, life history, harvest management, habitat management, population estimation, and conservation ecology of exotic species. Additional topics cover wildlife diseases, genetics, economic significance, and human dimensions. Indoor lab exercise will cover identification and aging of species. Field trips will expose students to actual management practices conducted in the field and provide an opportunity for applied skills in planning field studies, data collection, analysis, and synthesis of a management plan. Crosslisted with: AG 383.

**BSC 385 - International Wildlife Conservation**
Hours: 3
The course covers select topics in wildlife conservation such as biodiversity, habitat management, and cultural and political influences for the conservation of fauna in major biomes of Africa, Asia, Europe, Latin America, Oceania and other regions of the world. Students will i) build an understanding of and appreciation for diverse perspectives in wildlife management approaches throughout the world, ii) Competently assess and apply past and current ecological principles to evaluating international approaches to wildlife conservation, iii) Demonstrate constructive dialog with diverse perspectives focusing on international wildlife conservation, and iv) Critically assess an international wildlife conservation policy issue using examples from scientific literature. Crosslisted with: AG 385.

**BSC 397 - Special Topics**
Hours: 1-4

**BSC 401 - Research Literature and Seminar**
Hours: 3
This course provides students with the fundamentals of scientific thinking and scientific writing. The course starts with a brief overview of the history and philosophy of science as it pertains to biology. Students will learn about each steps in scientific processes including empiricism, parsimony, and developing and testing hypotheses. Students will be taught how to write in scientific style, how to critically read and analyze scientific articles, how to avoid obfuscatory scrivenry, establishing flow, organizing a scientific document, how to present scientific data and statistics, how to cite figures and tables, how to cite scientific sources, how to avoid plagiarism; and concepts of bioethics Discussions and presentations of issues of current interest in the biological sciences and of related career opportunities also will be covered. Prerequisites: BSC 304, 305, 306, 307, concurrent enrollment in one or more of these classes or permission of instructor.

**BSC 402 - Ornithology**
Hours: 3
This course begins with an overview of current theories regarding the origins of birds and flight. This is followed by a brief survey the living orders and their biogeography. Other topics include the mechanics and adaptations for flight, avian physiology and anatomy, migration, communication and behavior, ecology, and avian conservation. Crosslisted with: AG 402.

**BSC 404 - Vertebrate Biology**
Hours: 3
This course takes a systematic approach to understanding vertebrate evolution, diversity and biology. It will follow the development of each vertebrate taxon through the fossil record from late Cambrian to the present. This is followed by discussions of vertebrate zoogeography, habitat and foraging, feeding modes, dispersal and migration, mating systems and parental care. Crosslisted with: AG 404.

**BSC 405 - Wildlife Internship**
Hours: 1-6
This course, required for Wildlife and Conservation Science Majors, provides the opportunity for students to gain hands-on experience in preparation for careers in wildlife conservation and management and wildlife or ecological research. Assignments will be at an approved work situation under supervision of a designated faculty member. Ten to twenty hours per week will be required. Crosslisted with: AG 405.

**BSC 406 - Mammalogy**
Hours: 3
Mammalogy - Three semester hours The objective of this course is to survey the phylogenetic relationships, diversity, biology, and ecology of mammals, including an understanding of the characterization of the orders and families of the extant mammals based on morphological traits, evolutionary Crosslisted with: AG 406.

**BSC 410 - Fundamentals of Bioremediation**
Hours: 3
This undergraduate course explores fundamental aspects of using microorganisms and plants for the remediation of inorganic and organic pollutants impacted soil, groundwater and surface water; and discuss the applications of bioremediation methods for contaminated field in real world.

**BSC 412 - Fundamentals of Biostatistics**
Hours: 3
The objective of this course is to provide students with the knowledge and understanding of the methods of statistical analysis applicable to biological research. Emphasis will be placed on the concepts and application of statistical thinking. Basic probability theory, parametric and non-parametric statistics including t-tests, analysis of variance, correlation, regression, and other quantitative methods will be introduced. Prerequisites: MATH 1314.

**BSC 414 - Evolutionary Biology**
Hours: 3
In-depth view of evolutionary theory including gene flow, genetic drift, mutation, molecular evolution, mechanisms of speciation, phylogenies, and the evolution of sex, and sexual selection.

**BSC 415 - Upland Game Bird Ecology and Management**
Hours: 3
Status, ecology, management, and conservation issues of North American upland game birds. Student will understand the role of upland game bird professionals. Develop knowledge of the status of North American upland game birds. Understand the basic principles of upland game bird ecology and management. Learn to apply knowledge to solve conservation problems. Crosslisted with: AG 415.

**BSC 416 - Wildlife Population Biology**
Hours: 3
This course outlines processes governing the abundance and distribution of animals and plants, and the consequences for natural resource management. Practical applications lie in wildlife management, sustainable harvesting of resources, pest control and conservation of endangered species. Topics will include mathematical models of population growth, population viability analysis, and metapopulations, dispersal, population harvesting, predation, population cycles, and competition. Prerequisites: MATH 142 or MATH 2312. Crosslisted with: AG 416.

**BSC 417 - Geospatial Mapping**
Hours: 3
Three semester hours. (3 lecture, 0 lab) The course will provide basic knowledge of the fundamentals of Geographic Information Systems (GIS), including GIS theory and applications. The course will take a hands-on and problem solving approach to learning GIS and will cover basic GIS including map characteristics and projections, spatial data models, relational databases, and spatial analysis with a focus on natural resource research and management and environmental science. Prerequisites: BSC 1407 or BSC 1413. Crosslisted with: AG 417.

**BSC 418 - Undergraduate Research**
Hours: 1-3
Individual research project under the guidance of a biology faculty member. May be repeated for up to six (6) hours credit. Prerequisites: Consent of the faculty prior to registration.

**BSC 419 - Gene Control**
Hours: 3
This course will provide a rigorous knowledge in regulation of gene expression so that students will be ready for graduate level courses. Although this course will introduce students to prokaryotic gene transcription and gene regulation, the emphasis will be on the molecular biology of gene control in eukaryotes. This course will familiarize the student with current technology and driving principles of the field of gene regulation. Prerequisites: BSC 303 and BSC 304 with a grade of C or more.

**BSC 420 - Immunology**
Hours: 3
This course is designed for majors with a well-rounded background in biology. Therefore, this course provides students with an understanding of basic immunological principles and the functional organization of living systems. Emphasis will be placed on human physiology and the cooperative interplay between innate and acquired immunity. Students are expected to learn the basic principles and concepts of immunology both at the molecular and cellular levels, to learn to reason scientifically, and to understand and describe the function of immune systems in the human body. Prerequisites: BSC 303 and 305 with a grade of C or more.

**BSC 421 - Essentials of Plant Microbiome**
Hours: 3
This undergraduate course mainly introduces what are plant microbiome; covers the relationships between plant and microorganisms; and discuss the applications of plant microbiome for nutrients uptake, soil health improvement and pollutants cleaning.

**BSC 422 - Comp Vertebrate Anatomy**
Hours: 0-4
Comparative Vertebrate Anatomy. Four semester hours. (3 lecture, 4 lab) The lecture material in this course explore the evolution of vertebrate structure and design among vertebrate taxa. Emphasis is placed on the integument, skeletal, muscular, digestive, urogenital, respiratory, circulatory and nervous systems. Laboratory dissections, using the dogfish and the cat as models, are used to complement the lecture material.

**BSC 423 - Introduction to Soil and Biogeochemistry**
Hours: 3
The biogeochemistry of soil investigates processes that drive the environmental cycles of matter, nutrients, and energy through time and space. This undergraduate course mainly introduces the physico-chemical and microbial nutrient transformations and exchange processes in soil and water, for example food-water-energy exchange nexus. In summary, students will receive in depth knowledge of biogeochemical properties of the major global systems (terrestrial, atmospheric, and oceanic systems), biogeochemical cycles of carbon, nitrogen, phosphorus, and sulfur, and patterns of productivity, pollution, and consequences of environmental change from local to regional to global scale.

**BSC 424 - SEA-PHAGES I: Discovery of Bacteriophages**
Hours: 3
This course is designed to immerse students in fundamental biological concepts and scientific reasoning through original, hypothesis-driven research. As part of the Howard Hughes Medical Institutes SEA-PHAGES (Science Education Alliance-Phage Hunters Advancing Genomics and Evolutionary Science) research team, students will engage in hands-on molecular techniques to discover, propagate, and characterize bacteriophages isolated from soil samples across diverse biomes. They'll also sharpen their scientific communication skills by maintaining a laboratory notebook and presenting their findings in a final poster project. This unique opportunity allows students to explore novel bacteriophages while learning key concepts in molecular biology, microbiology, and evolution through practical experiments. The course includes a mix of lectures and lab work. Prerequisites: BSC 303 Cell Biology with a grade of C or more.

**BSC 425 - Fundamentals of Neuroscience**
Hours: 3
This course is intended for advanced undergraduate biology students who understand genetics and cell biology/biochemistry. The course is a survey introducing various aspects of neuroscience and is textbook based. The cell types of the nervous system are introduced, with emphasis on the molecular specializations used for these cells to function and develop connections to other cells. The structure, function, and processing of all 6 senses (including kinesthesia) are covered, as are muscle control circuits. More complex functions of the nervous system, including control of eye movements, hunger, sleep, addiction, speech, and learning and memory are also covered.

**BSC 426 - Fundamentals of Human Anatomy**
Hours: 4
This four hour course examines gross and microscopic human anatomy. The blended course covers classroom lecture plus laboratory with hands on (Models) experience of human anatomy. Prerequisite: BSC 1407 or BSC 305 with a grade of C.

**BSC 427 - Pharmacology**
Hours: 3
Pharmacology This course is designed for undergraduate students with a background in biology, cell biology and chemistry. Therefore, this course provides students with a greater understanding of general concepts of pharmacology. Next, specific drugs and sites of drug action are further examined beginning with the peripheral, followed by the central nervous system. We then will focus on the pharmacology of the heart, the vascular and renal systems, followed by pharmacology of the respiratory system, then endocrine system and drugs affecting the immune system. Finally we examine the pharmacology of infectious disease. Pre-requisites: BSC 303/CHEM 1411

**BSC 428 - Introductory Medical Microbiology**
Hours: 3
Introductory Medical Microbiology. Three Semester Hours. This is a course for junior or senior biology undergraduate students designed to help understand the basic principles of pathogenic microorganisms, infection, and human-pathogen interactions. Specific topics covered during this class include pathogenic microorganisms, diagnostic laboratory procedures, infection controls, and emerging diseases. This course includes many etiological agents responsible for infectious diseases and will focus on the principles of pathogenic mechanisms, rather than individual cases of diseases, in order to foster a student’s ability to develop the fundamental understanding required for their future clinical career.

**BSC 430 - Introductory Virology**
Hours: 3
Introductory Virology (Three Hours). This course is designed to introduce the significance of viruses to biology, the origin of life, and our current world. Viruses are the most numerous and the most ubiquitous form of life, although whether viruses are life or not is still an open debate. They are virtually everywhere and they are in tight relationship with other forms of life on earth. This course will focus on the principle nature of viral life; obligate parasite and host dependency. Topics include introduction to viruses, host specificity, viral replication cycles, virus classification & nomenclature, viral diseases, how viruses interact with host body, and host resistance to viruses. Prerequisites: BSC 306.

**BSC 431 - Eukaryotic Cell Biology**
Hours: 3
This course is the study of advanced knowledge of the eukaryotic cell including contemporary concepts of membranes, signal transduction mechanisms, messengers and receptors, extracellular structures, cell adhesions and attachment proteins, cell cycle and regulation, protein synthesis, sorting and targeting, cytoskelton and cell movements. Prerequisites: BSC 303 Cell Biology or concurrent enrollment.

**BSC 435 - Wildlife Habitat Ecology and Management**
Hours: 3
This class will expose the student to the history and concepts of an animal’s habitat beginning with the ideas of Aldo Leopold to current ideas of what habitat is. Students will be introduced to principles and techniques of habitat management as they apply to forest, rangeland, wetland, and agricultural ecosystems. Current concepts of Conservation Biology such as fragmentation, meta-population ecology, and corridor ecology will also be covered. Students enrolled in this course must be willing to attend field trips when and where feasible to see actual management practices conducted in the field. Crosslisted with: AG 435.

**BSC 436 - Plant Diversity & Conservation**
Hours: 3
Plant Diversity and Conservation. Three semester hours. The course focuses on patterns and distribution of plant diversity and threats to plant diversity. Range of strategies and approaches used in plant conservation will be discussed. Crosslisted with: AG 436.

**BSC 437 - Ecological Restoration**
Hours: 3
Ecological Restoration of Plant Communities - Three semester hours The class is an introduction to landscape scale, process-oriented approaches to ecological restoration. Topics include enhancing resource capture, techniques in re-vegetation and restoration of historic vegetation. Prescribed fire and grazing as restoration and management techniques will also be addressed.

**BSC 438 - Wetland Ecology and Management**
Hours: 4
This class will address the ecology of wetlands from a systems approach, starting first with what defines a wetland both legally and functionally, and covering important and defining principles of hydro-period, soils, wetland plants, wetland succession, delineation, and wetlands as wildlife habitat. The lab will immerse students in field exercises ranging from wetland plant collection and identification, and wetland bird identification. Students enrolled in this course must be willing to attend field trips when and where feasible to see different wetland types and the function and values they provide. Prerequisites: BSC 307 Ecology. Crosslisted with: AG 438.

**BSC 440 - Human Dimensions of Wildlife**
Hours: 3
Human Dimensions of Wildlife Management explains how a wildlife professional can more effectively manage species and social-ecological systems by fully considering the role that humans play in every stage of the wildlife management process. Human Dimensions of Wildlife Management provides the essential information that students and practitioners need to be effective problem solvers to handle a variety of situations, such as managing deer populations in residential areas, encounters between predators and people, or managing citizen input on wildlife issues. Topics will include human dimensions of wildlife management and conservation, wildlife use (hunting and fishing), working with public and private landowners, involving citizen scientists, managing citizen input, using economics to inform Crosslisted with: AG 440.

**BSC 461 - Biology for Mid School Teacher**
Hours: 3
Biology for Middle School Teachers. Three semester hours. (2) This course will examine the necessary content for students wishing to teach at the fourth through eighth grade level. This course will combine both content and pedagogy. Emphasis will be placed on the content as expressed the Texas Essential Knowledge and Skills. This course cannot be used for advanced credit for a biology major or minor. Prerequisites: MATH 1314 and 8 sh of biological science or consent of instructor.

**BSC 462 - Agroecology**
Hours: 3
Agroecology is a three hour course to understand agroecological concepts that incorporate ideas about a more environmentally and socially sensitive approach to agriculture, one that focuses not only in production, but also in ecological sustainability of a production system. Crosslisted with: AG 462.

**BSC 463 - Landscape Ecology**
Hours: 3
BSC 463 landscape Ecology is a three hour course designed to provide an overview of the relationships between ecological processes in the environment and particular ecosystems using a variety of landscape scales, development of spatial patterns, and organizational levels of research and policy. Crosslisted with: AG 463.

**BSC 464 - Principles of Sustainability**
Hours: 3
BSC 464 Principles of Sustainability is a three hour course designed to provide an overview of the social and biological principles of sustainability. An emphasis will also be placed on understanding on the education, health, population dynamics, culture, agriculture, food security, and natural resources aspects of sustainability.

**BSC 489 - INDEPENDENT STUDY**
Hours: 0-5
Independent Study. One to four semester hours. Individualized instruction/research at an advanced level in a specialized content area under the direction of a consenting faculty member. May be repeated when the topic varies. Prerequisite: Consent of department head.

**BSC 490 - H Honors Thesis**
Hours: 3
Honors Thesis.

**BSC 491 - H Ind Honors Readings**
Hours: 0-4
Individual Honors Reading.

**BSC 492 - Developmental Biology**
Hours: 3
This course is designed to explore the fundamental concepts and mechanisms that regulate the wonder of animal development from fertilization of the egg to formation of the adult organism, including such topics as cycle of life, differential gene expression, cell-cell communication, fertilization, early development, formation of germ layers (ectoderm, mesoderm, endoderm) and their derivatives, inductive cell/tissue interactions, stem cells, organogenesis, environment/genetics/birth defects, evolutionary changes and more. Prerequisites: BSC 303, a grade of "C" or more must be earned in the course; BSC 305 a grade of "C" or more must be earned in the course.

**BSC 493 - SEA-PHAGES II: Molecular and Bioinformatics Techniques**
Hours: 4
This is the second part of the Howard Hughes Medical Institute's SEA-PHAGES (Science Education Alliance-Phage Hunters Advancing Genomics and Evolutionary Science) program. This course is designed to immerse students in fundamental biological concepts and scientific reasoning through original, hypothesis-driven research. Students will characterize phages discovered by previous cohorts or explore other novel genomes using a comprehensive array of molecular and bioinformatics techniques. They will perform comparative genomics, complete genome annotation, and utilize molecular and recombinant DNA techniques to characterize these novel genomes. The course will be delivered in a blended format, combining traditional lectures with hands-on laboratory sessions. Students must register for both lecture and lab sections. Prerequisites: BSC 303 with a grade of C or more.

**BSC 497 - Special Topics**
Hours: 1-4
Special Topics. One to four semester hours. Organized class. May be repeated when topics vary.

**BSC 498 - Health Professions Internship**
Hours: 3
The internship intends to provide students pursuing a career in the health professions exposure to a professional healthcare environment along with interaction with professionals from various fields of healthcare. The student learning experience is faculty supervised and requires journal documentation and a final report. Students with a GPA of 3.25 at the end of 90 credits hrs is eligible to register with the recommendation advisor. Department approval required. Prerequisites: Students with a GPA of 3.25 at the end of 90 credits hrs is eligible to register with the recommendation advisor. Department approval required.

**ENVS 1301 - Introduction to Environmental Science**
Hours: 3
Survey course designed to cover major areas relating to contemporary ecological/environmental problems and to introduce the student to the multiple roles of the environmental professional in addressing these problems.

**ENVS 103 - Natural Disasters**
Hours: 3
Scientific principles and case studies of natural disasters, including those related to geological, meteorological, biological, cosmological, and man-made hazards and disasters. Note, this can be used to fulfill a core curriculum science requirement.

**ENVS 301 - Risk Assessment**
Hours: 3
This course is designed to provide an overview of ecological/environmental risk assessments. Students are involved in group projects to produce an ERA based on an existing abandoned hazardous waste site on EPA’s National Priorities List. Students also complete a project to develop an Environmental Impact Statement based on a hypothetical government agency project proposal. Prerequisites: None

**ENVS 302 - Phase I Environmental Site Assessments**
Hours: 3
Project-based course on protocol and methods for conducting Phase I Environmental Site Assessments as mandated by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Phase I Environmental Site Assessments are a common type of investigation conducted by environmental professionals within environmental consulting firms.

**ENVS 303 - Research Methods in Environmental Sciences**
Hours: 3
This course is intended to provide an introduction to a wide range of methods for conducting research in the environmental field for students. Students will learn how to create the research question, search the literature, develop the methods, collect and analyze data, draw conclusions, publish and present the results. It will also include the techniques of scientific writing and reviewing, grant writing and oral presentations.

**ENVS 305 - Environmental Hydrology**
Hours: 4
An overview of all aspects of the field of hydrology, including the hydrologic cycle, surface water, and groundwater. The bulk of the course concerns groundwater and focuses on practical methods for ascertaining aquifer characteristics necessary to evaluating groundwater supplies and groundwater contamination problems and remediation. Students must register for both lecture and lab sections

**ENVS 308 - Water Quality**
Hours: 3
Water Quality is a course about the design of engineered environmental systems for water and wastewater treatment in domestic or industrial applications. Topics include water chemistry; material balances; chemical, physical and biological processes, theory of processes used to treat water and wastewater; applications of theory to design and operate treatment systems, including biological treatment, adsorption, coagulation, precipitation, decantation, filtration, and disinfection.

**ENVS 312 - Introduction to Environmental Toxicology**
Hours: 3
This course is designed to provide an overview of environmental toxicology, including an examination of the major classes of pollutants, their fate in the environment, their disposition in organisms, and their mechanisms of toxicity. An emphasis will also be placed on assessing the toxicity of pollutants in biological and environmental systems.

**ENVS 402 - Air Pollution Control**
Hours: 3
This course will introduce the sources of air pollution; analyze its effects on human and other organisms; study of federal, state, and local regulatory requirements; analyze mechanisms and methods for air pollution control and management.

**ENVS 403 - Environmental Ethics and Law**
Hours: 3
This course is designed to acquaint the student with the numerous ethical issues and perspectives confronting society and environmental scientists. The course also provides an overview of environmental laws on regulations and practice in navigating through these laws.

**ENVS 405 - Internship in Environmental Science**
Hours: 1-3
This course offers an opportunity for students to gain hands-on experience in the fields of environmental research, education, and sciences. This program enables students to work on specific projects under the direction of professional staff and is tailored to provide the maximum educational benefit to each participant. Students will be able to chose among private, government, and non-governmental organizations (NGO's) that have established collaboration with the Department of Environmental Sciences at Texas A&M University - Commerce.

**ENVS 406 - Environmental Remediation**
Hours: 3
Environmental Remediation provides a detailed survey of the various methods used in the remediation of contaminated sites; review of federal and state regulations; chemistry of hazardous materials; responding to incidents involving the release of toxic substances; selection of remedial technology; and design of remedial plans.

**ENVS 489 - Independent Studies**
Hours: 1-4

**ENVS 490 - H Honors Thesis**
Hours: 3

**ENVS 491 - H Ind Honors Readings**
Hours: 3

**ENVS 497 - Special Topic**
Hours: 0-4
Special Topics - 0 - 4 semester hours may vary

**ESCI 461 - Earth Science for Teachers**
Hours: 3
Earth Science for Teachers. Three semester hours. (2) This course is designed for middle school (4-8) teachers with an emphasis placed on the four disciplines of Earth Science: geology, oceanography, meteorology and astronomy. Organization, materials selection, and set up of laboratory activities appropriate for achieving curriculum objectives will also be included. Prerequisites: Math 141 and 8 sh of science.

**GEOL 1303 - Physical Geology**
Hours: 3
A systematic study of minerals, rocks, and the processes which shape and modify the surface features of the earth. Plate tectonics, volcanoes, earthquakes, and the practical aspects of geology are studied as they relate to man's adjustments to the geologic environment.

**GEOL 1304 - Historical Geology**
Hours: 3
Summary of the physical and biological history of the earth, with emphasis on North America. Review of the sequence of physical geological events and evolutionary changes in life. Includes the reconstruction of geologic history of various regions through interpretation of geologic maps, structure sections and simple pale ontological techniques. Field trip included. Note This is a University Studies course, previously ESCI 1304.

**GEOL 1403 - Physical Geology**
Hours: 4
(Formerly ESci 1403). A systematic study of minerals, rocks, and the processes which shape and modify the surface features of the earth. Energy, plate tectonics, volcanoes, earthquakes, and the practical aspects of geology are studied as they relate to man's adjustments to the geologic environment.

**GEOL 1404 - Historical Geology**
Hours: 4
Summary of the physical and biological history of the earth, with emphasis on North America. Review of the sequence of physical geological events and evolutionary changes in life. Includes the reconstruction of geologic history of various regions through interpretation of geologic maps, structure sections and simple pale ontological techniques.