

DEPARTMENT OF BIOLOGICAL SCIENCES

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Website: <http://www.shsu.edu/academics/biological-sciences/>

Mission

The Department of Biological Sciences is dedicated to the pursuit and dissemination of knowledge and scientific discovery in the life sciences through innovative teaching and research programs. The department strives to instill in its students the philosophy of lifelong scholarship, producing scientifically literate members of society who have the knowledge to contribute and compete in a rapidly changing world.

Academic Programs

Biology, the study of living things, is an exciting and dynamic field that offers many areas of focus. Students may choose to study how life functions at the molecular, cellular, organismal, or ecological levels. The biological sciences provide opportunities to study viruses, bacteria, fungi, plants, and animals and to investigate the biochemical, physiological, morphological, anatomical, behavioral, ecological, and evolutionary processes that make each organism unique.

Highlights

The Department of Biological Sciences is located in the Lee Drain Building (http://www.shsu.edu/map/gmap_data/info.php?loc=53), which houses facilities including the following teaching laboratories:

- the Warner Herbarium
- Sam Houston State University Arthropod Collection
- Sam Houston State Vertebrate Museum and Texas Bird Sound Library
- an animal rearing facility
- greenhouse
- outdoor aviary

And the following research laboratories:

- scanning electron microscopy
- molecular biology
- microbiology
- morphology

The department operates the Center for Biological Field Studies, a 250 acre field station within 5 miles of campus that is dedicated to biological and environmental research and teaching.

Student Organizations

- Beta Beta Beta (TriBeta) (<https://shsu.collegiatelink.net/organization/TriBeta>) is an undergraduate national Biological Honor society. The organization was founded in 1922 and the Delta Tau chapter at SHSU was chartered in 1965. TriBeta is dedicated to advancing the understanding and appreciation of the biological sciences and encouraging/supporting undergraduate student scientific research. TriBeta membership requires:
 - a declared major in Biology, Biomedical Sciences or related biological field
 - a dedicated interest in the life sciences (associate member) or completion of at least one 3000- or 4000-level biology course with a BIO GPA of 3.0 and overall SHSU GPA of 2.75 (regular member)

Membership invitations are sent to eligible students each fall and spring semester. Dr. Anne R. Gaillard (bio_ard@shsu.edu) serves as faculty advisor to TriBeta.

- Sam Houston Association of Medical Oriented Students (SHAMOS) (http://www.shsu.edu/~org_shamos) membership is available to any student interested in pursuing a career in the medical or allied health professions. Activities include fundraisers, community service projects, blood drives with the Gulf Coast Regional Blood Center, and canned food drives. SHAMOS sponsors an outside speaker program to inform students of the opportunities and benefits of the various disciplines of the medical arts (e.g., general and specialist dentistry, general and specialist medicine, occupational therapy, physician assistant, podiatry, forensic pathology, and EMS). Dr. Madhu Choudhary (mchoudhary@shsu.edu) and Dr. Aaron M. Lynne (aml027@shsu.edu) serve as faculty advisors to SHAMOS.

Internships and Undergraduate Research

The Department of Biological Sciences believes that "hands on" experiences, through either internships or faculty directed undergraduate research projects, are an important complement to a student's formal coursework. Moreover, undergraduate research experience is critical for

students applying to graduate programs or professional schools. We therefore strongly encourage Biology students to consider participating in an undergraduate research project. Students seeking information regarding internships and/or undergraduate research experiences should contact the Department Chair Dr. Chad Hargrave (CWH005@shsu.edu). Individual faculty members may be contacted for details regarding their research programs and independent research possibilities.

Scholarships

Academic scholarships are available from both the Department of Biological Sciences and the University to support student studies.

The Department of Biological Sciences scholarships include:

- Biology & Environmental Science Academic Scholarship
- Claude McLeod Academic Scholarship
- Emma Normand Academic Scholarship
- Everett Wilson Biology Endowment
- Harold F. Foerster Scholarship Endowment
- James D. Long Biology Endowment
- James Patrick Weber Environmental Science Award
- Patrick Neil O'Bryant Academic Scholarship
- Roy Turner Scholarship Endowment
- S.R. Warner Academic Scholarship
- William (Bill) R. Brinkley Scholarship Endowment
- Wilson-Warner Endowed Scholarship in the Biological Sciences

Departmental scholarship information may be obtained by writing to:

Scholarships
Department of Biological Sciences
Box 2116, SHSU
Huntsville, Texas 77341-2116

or by visiting www.shsu.edu/~bio_www/scholarships.html (http://www.shsu.edu/~bio_www/scholarships.html). Information on University scholarships may be obtained at Office of Academic Scholarships (<http://www.shsu.edu/dept/financial-aid/scholarships>) or telephone (936) 294-1672.

Program Specific Requirements

Candidates for the Bachelor of Science (BS) in Biology or Biomedical Sciences or Bachelor of Arts (BA) in Biology are required to complete an Exit Exam in Biology to be eligible for graduation. The Department of Biological Sciences administers the Exit Exam once during the Spring semester at no cost to the student. A student is eligible to take the Exit Exam upon completion of all required biology credits or during the semester immediately prior to graduation (August graduates must take the examination during the Spring semester immediately prior to graduation). The exam score, although part of the student's record, has no effect on the student's GPA.

Curriculum

Major in Biology

The Bachelor of Arts or Bachelor of Science in Biology are ideal degrees for students interested in gaining a broad background in the Biological sciences, while allowing flexibility to focus on a specific biology sub-discipline. All students majoring in Biology will develop competence in the fundamental principles of biology and will gain experience in botany, zoology, cellular biology, microbiology, genetics, ecology and evolution. Students take an active role in creating a degree plan that best meets their interests and their career goals. Most students pursue careers in terrestrial ecology, animal physiology, animal behavior, medical professions, biotechnology, or teacher education. Students interested in forensic science combine an extensive background in biology with substantial coursework in chemistry and criminal justice to prepare them for work with state and federal agencies.

Required Courses for the Major

The biology major may choose from two degree programs, the Bachelor of Arts or Bachelor of Science. All majors must complete the following core courses:

Required Courses

BIOL 1411	General Botany	4
BIOL 1413	General Zoology	4
BIOL 2440	Introductory Cell Biology	4

BIOL 3409	General Ecology	4
BIOL 3450	Introductory Genetics	4
BIOL 3470	General Microbiology	4
BIOL 4110	Undergraduate Seminar	1
BIOL 4111	Undergraduate Seminar	1
BIOL 4361	Introductory Evolutionary Bio	3
Total Hours		29

Students may choose their area of specialization contingent upon completion of the required core courses.

Major in Biomedical Sciences

The Biomedical Sciences degree offered by the Department of Biological Sciences provides a robust, yet flexible curriculum with an emphasis on studying the biological basis of health and disease. All students majoring in Biomedical Sciences will develop competence in the fundamental principles of biology and will gain experience in botany, zoology, cellular biology, microbiology, genetics, chemistry, mathematics and evolution. The Biomedical Sciences degree is designed to thoroughly prepare students for entrance into medical, dental, pharmacy, physician assistant, and other professional schools, as well as graduate study in the biomedical sciences and employment as a laboratory research assistant. No minor is required for the degree.

Required Courses for the Major

All Biomedical Sciences majors must complete the following core courses:

Course Requirements

BIOL 1411	General Botany	4
BIOL 1413	General Zoology	4
BIOL 2440	Introductory Cell Biology	4
BIOL 3450	Introductory Genetics	4
BIOL 3470	General Microbiology	4
BIOL 4361	Introductory Evolutionary Bio	3
CHEM 1411	General Chemistry I	4
CHEM 1412	General Chemistry II	4
CHEM 2323	Organic Chemistry I: Lecture	3
CHEM 2123	Organic Chemistry I Lab	1
CHEM 2325	Organic Chemistry II: Lecture	3
CHEM 2125	Organic Chemistry II: Lab	1
CHEM 3438	Biochemistry I	4
MATH 1420	Calculus I	4
BIOL 4374	Biostatistics	3
or MATH 1430	Calculus II	
PHYS 1301	General Phy-Mechanics & Heat	3
PHYS 1101	General Physics Laboratory I	1
PHYS 1302	Gen Phy-Snd,Lght, Elec, & Mag	3
PHYS 1102	General Physics Laboratory II	1
Total Hours		58

Students may choose their area of specialization contingent upon completion of the required core courses.

- Bachelor of Arts, Major in Biology (catalog.shsu.edu/archives/2016-2017/undergraduate/colleges-academic-departments/sciences/biological-science/ba-biology)
- Bachelor of Science, Major in Biology (catalog.shsu.edu/archives/2016-2017/undergraduate/colleges-academic-departments/sciences/biological-science/bs-biology)
- Bachelor of Science, Major in Biomedical Science (catalog.shsu.edu/archives/2016-2017/undergraduate/colleges-academic-departments/sciences/biological-science/bs-biomedical-science)
- Minor in Biology (catalog.shsu.edu/archives/2016-2017/undergraduate/colleges-academic-departments/sciences/biological-science/minor-biology)

- Minor in Environmental Science (catalog.shsu.edu/archives/2016-2017/undergraduate/colleges-academic-departments/sciences/biological-science/minor-environmental-science)
- Minor in Conservation Biology (catalog.shsu.edu/archives/2016-2017/undergraduate/colleges-academic-departments/sciences/biological-science/minor-conservation-biology)

BIOL 1401. Environmental Science. 4 Hours.

A general course designed to cover all areas relating to contemporary ecological problems. Topics include air, water, and soil pollution; radiation, limnology, climate, pesticides, wastes, and land conservation. This course is designed for non-science majors to help them meet their General Education science requirement. BIOL 1401 cannot be applied to either a major or a minor in Biology. Fall, Spring, Summer. Credit 4. Prerequisites: Demonstrated college-level readiness in reading, writing, and math.

BIOL 1408. Contemporary Biology. 4 Hours.

Presentation for the non-science major of contemporary hypotheses and the unifying principles of biology, including but not limited to: scientific method and hypothesis testing, the definition of life, cell theory, the central dogma of biology (transcription of DNA to RNA to protein), genetic regulation and heredity, metabolism and homeostasis, organismal evolution, biodiversity, and ecology. The class builds scientific literacy and critical thinking skills for use in everyday life. Credit in BIOL 1408 as a laboratory science is contingent upon completion of a the laboratory section. This course is designed for non-science majors to help them meet their General Education science requirement and cannot be applied to either a major or minor in Biology. Fall, Spring, Summer. Credit 4. Prerequisites: Demonstrated college-level readiness in reading, writing, and math.

BIOL 1411. General Botany. 4 Hours.

General principles of botany are presented. Emphasis is placed on morphology, taxonomy, genetics, physiology, and ecology of plants in an evolutionary and ecological context. Students may begin sequence with either BIOL 1411 or BIOL 1413. Includes a 3 hour lab. Fall, Spring, Summer. Credit 4. Prerequisites: Demonstrated college-level readiness in reading, writing, and math.

BIOL 1413. General Zoology. 4 Hours.

General principles of zoology are presented in an evolutionary context. Emphasis is placed on the anatomy, behavior, and ecology of animals. Students are introduced to evolutionary and ecological principles of biology. Students may begin sequence with either BIOL 1411 or BIOL 1413. Includes a 3 hour lab. Fall, Spring, Summer. Credit 4. Prerequisites: Demonstrated college-level readiness in reading, writing, and math.

BIOL 1436. Foundations Of Science. 4 Hours.

The course focuses on the nature of science as a reliable method of acquiring knowledge about the natural world. Students will learn how to apply key scientific facts, concepts, laws and theories to distinguish science from non-science, bad science, and pseudoscience by analyzing a variety of claims and case studies. By employing an innovative, interdisciplinary approach to science education, this course is designed to increase science literacy and critical thinking skills for introductory-level students. This course is designed for non-science majors to help them meet their General Education science requirement and cannot be applied to either a major or a minor in Biology. Students must enroll concurrently in the corresponding lab for this course. Includes a lab. Fall, Spring, Summer. Credit 4. Prerequisites: Demonstrated college-level readiness in reading, writing, and math.

BIOL 2301. Cell Biology and Genetics. 3 Hours.

An integrated conceptual study of the biochemical, molecular, and cellular processes that support life from a health and disease perspective. The molecular mechanisms that regulate cell function, the molecular signaling processes that form the basis of integrated function and the response to disease, and the mechanisms underlying inherited traits and genetic disease will be presented. Emphasis is placed on defining and characterizing normal cell function. This course may not be used by Biology majors or minors as credit toward graduation. Fall & Spring. Credit 3. Prerequisites: Minimum grade of C in BIOL 2401 and 2402, and CHEM 1305 /1100 or CHEM 1407 and CHEM 1306/1106 or CHEM 1406 ; Sophomore Standing; or Permission of the Instructor. Demonstrated college-level readiness in reading, writing, and math. **TO BE DELETED PENDING APPROVAL BY THE TSUS BOARD OF REGENTS AND THECB.**

BIOL 2401. Human Anatomy. 4 Hours.

This course deals with structure and form of the human body. It includes studies of cells, tissues, and organ systems. Registration is primarily for students in prenursing or majors in kinesiology or health. Two-hour laboratory. Fall, Spring, Summer as needed. Credit in this course cannot be applied to either a major or minor in Biology. Credit 4. Prerequisites: Demonstrated college-level readiness in reading, writing, and math.

BIOL 2402. Human Physiology. 4 Hours.

This course will help students identify and understand the function of several important human organ systems and how these systems maintain homeostasis. Topics and the mechanisms involving circulation, digestion, metabolism, muscle action and respiration will receive the most emphasis. This course is designed to emphasize a clinical knowledge of physiology and techniques required by students studying nursing, physical therapy, and related health fields. Two-hour laboratory. Fall, Spring, Summer as needed. Credit 4. Demonstrated college-level readiness in reading, writing, and math.

Prerequisite: Minimum grade of C in BIOL 2401 and CHEM 1406 or CHEM 1411 .

BIOL 2420. Intro Applied Microbiology. 4 Hours.

An introduction to microorganisms, their morphology, growth requirements, methods of culture, and the manner in which they affect health. Reactions of the body toward pathogenic organisms and the principles of immunity and chemotherapy are considered. Two-hour laboratory. Writing enhanced. Fall, Spring, Summer as needed. Credit in this course cannot be applied to a major or minor in Biology. Credit 4. Prerequisites: Minimum grade of C in BIOL 2401 and BIOL 2402 , and C or better in CHEM 1411 or CHEM 1406 . Demonstrated college-level readiness in reading, writing, and math.

BIOL 2440. Introductory Cell Biology. 4 Hours.

An introduction to the study of cells, including scientific method, biochemistry, metabolism, cell energetics, membranes, cellular evolution, DNA, protein synthesis, the cytoskeleton, cell division, and the cellular basis of inheritance, with emphasis on the development of problem solving skills. Two-hour laboratory. Fall, Spring, Summer. Credit 4. Prerequisites: Minimum grade of C in BIOL 1411, BIOL 1413, and CHEM 1411. Demonstrated college-level readiness in reading, writing, and math.

BIOL 3364. Plant Taxonomy. 3 Hours.

A study of the characteristics and classification of plants emphasizing systematic techniques. Focus on identification of the more common plant families allows transfer of knowledge to other regions of the country and world. Two-hour laboratory. Spring. Writing enhanced. Credit 3. Prerequisites: Minimum grade of C in BIOL 1411, BIOL 1413. Demonstrated college-level readiness in reading, writing, and math.

BIOL 3409. General Ecology. 4 Hours.

A study of physical and biotic components of the environment, responses of organisms to their environment, community ecology, natural ecosystems, and human's interaction with ecosystems. Field studies are an integral part of the laboratory. Three-hour laboratory and field work. Fall, Spring. Credit 4. Prerequisites: Minimum grade of C in BIOL 1411 and BIOL 1413. Demonstrated college-level readiness in reading, writing, and math.

BIOL 3410. Human Biology. 4 Hours.

This course deals with the study of structure and function of the human body. The structure of various organ systems are discussed and their function as organs and systems described. Two-hour laboratory. Offered as needed. Credit 4. Prerequisites: Minimum grade of C in BIOL 1411, BIOL 1413, BIOL 2440. This course may not be used for graduation credit by Medical & Allied Health Students. Demonstrated college-level readiness in reading, writing, and math.

BIOL 3420. Comparative Vertebrate Anatomy. 4 Hours.

A study of representative vertebrates, their anatomy, ontogeny, and phylogeny. The course is strongly recommended for premedical/professional students. Three-hour laboratory. Even year, Fall. Credit 4. Prerequisites: Minimum grade of C in BIOL 1411, BIOL 1413 or consent of the instructor. Demonstrated college-level readiness in reading, writing, and math.

BIOL 3430. Plant Physiology. 4 Hours.

General course dealing with principal life processes of plants. Topics include photosynthesis, respiration, nutrition, flowering, dormancy, hormones, growth, and development. Three-hour laboratory. Writing enhanced. Even year, Spring. Credit 4. Prerequisites: Minimum grade of C in BIOL 1411, BIOL 1413, BIOL 2440, CHEM 1411 and CHEM 1412. Demonstrated college-level readiness in reading, writing, and math.

BIOL 3440. General Physiology. 4 Hours.

The study of the primary mechanisms by which autotrophic and heterotrophic organisms function. Important fundamental aspects of cellular, regulatory, and systemic physiology are presented emphasizing the functional aspect of living systems at the cellular and molecular levels. Students are expected to develop an integrated understanding of the areas presented and recognize the interdependence of these mechanisms in the maintenance of homeostasis. Three-hour laboratory. Writing enhanced. Spring. Credit 4. Prerequisites: Minimum grade of C in BIOL 1411, BIOL 1413, BIOL 2440, CHEM 1411, CHEM 1412, CHEM 2323/2123. Demonstrated college-level readiness in reading, writing, and math.

BIOL 3450. Introductory Genetics. 4 Hours.

Study is made of the physical bases of inheritance and principles of heredity and variation. Topics include Mendelian genetics, cytogenetics, molecular basis of genetics, gene expression and regulation, and DNA technologies. Two-hour laboratory. Writing enhanced. Fall, Spring, and Summer as needed. Credit 4. Prerequisites: Minimum grade of C in BIOL 2440, CHEM 1411 and CHEM 1412. Demonstrated college-level readiness in reading, writing, and math.

BIOL 3460. Pathophysiology. 4 Hours.

A study of basic physiological systems and underlying system dysfunctions associated with human disease processes across the life span. Relationships between etiologic agents and their consequence to human form and function will be stressed. Critical thinking processes integrating symptoms, treatment and prognosis will be applied to physiological perspectives. Four hours lecture per week. Fall. Credit 4. Prerequisites: Minimum grade of C in BIOL 2440, and BIOL 3450 or BIOL 3440 or consent of the instructor. Demonstrated college-level readiness in reading, writing, and math.

BIOL 3461. Fish Wildlife Recreation Mngt. 4 Hours.

The history and basic principles, philosophy and concepts of wildlife management as they relate to habitats, people, and the problems associated with their interactions. Two-hour laboratory and field work. Odd year, Spring. Credit 4. Prerequisites: Minimum grade of C in BIOL 1411, BIOL 1413, and BIOL 3409. Demonstrated college-level readiness in reading, writing, and math. **COURSE TITLE CHANGE TO WILDLIFE BIOLOGY PENDING APPROVAL BY THE TSUS BOARD OF REGENTS AND THECB.**

BIOL 3469. Economic Entomology. 4 Hours.

A study of basic principles of entomology as related to modern principles of insect pest management. Included are discussions of the biology and control of economically important insects in Texas. Collections of insects are made. Not open to students with credit in BIOL 4410. Two hours lecture and two hours laboratory as needed. Even year, Fall. Credit 4. Prerequisites: Minimum grade of C in BIOL 1311/1111, 1313/1113, and 2440. Demonstrated college-level readiness in reading, writing, and math. **TO BE DELETED PENDING APPROVAL BY THE TSUS BOARD OF REGENTS AND THECB.**

BIOL 3470. General Microbiology. 4 Hours.

An introduction to microorganisms including bacteria, viruses and fungi. Major areas considered are morphology, physiology, genetics, and pathology. Microorganisms are studied in relation to soil, water, food, industrial processes, and disease. Three-hour laboratory. Writing enhanced. Fall, Spring. Credit 4. Prerequisites: Minimum grade of C in BIOL 1411, BIOL 1413, BIOL 2440, CHEM 1412. Demonstrated college-level readiness in reading, writing, and math.

BIOL 3480. Vertebrate Embryology. 4 Hours.

This is a study of the early development of representative vertebrates from fertilization until differentiation of organs has been completed. Three-hour laboratory. Writing enhanced. Even year, Fall. Credit 4. Prerequisites: Minimum grade of C in BIOL 1411, BIOL 1413, BIOL 2440. Demonstrated college-level readiness in reading, writing, and math. **CHANGE IN COURSE TITLE TO DEVELOPMENTAL BIOLOGY PENDING APPROVAL BY THE TSUS BOARD OF REGENTS AND THECB.**

BIOL 3490. Histology. 4 Hours.

A study of animal tissues with emphasis on human materials. Identification and preparatory techniques are stressed. Three-hour laboratory. Writing enhanced. Even year, Fall. Credit 4. Prerequisites: Minimum grade of C in BIOL 1411, BIOL 1413, BIOL 2440, CHEM 1412. Demonstrated college-level readiness in reading, writing, and math.

BIOL 3492. Plant Morphology. 4 Hours.

Survey of the plant kingdom with emphasis on morphogenesis, comparative structure and life cycles of representative plant forms. Three-hour laboratory. Even year, Fall. Credit 4. Prerequisites: Minimum grade of C in BIOL 1411, BIOL 1413, and BIOL 2440. Demonstrated college-level readiness in reading, writing, and math.

BIOL 4080. Field and Experiential Biology. 1-3 Hours.

This course provides students with a first-hand off-campus opportunity to experience biology in a specialized setting. Potential settings include both domestic and international sites, and may consist of particular ecological regions, biological reserves, field data collection sites, laboratories, and clinics. Course prerequisites will be tailored to the specific off-campus course offering. Prerequisite: Minimum grade of C in BIOL 1411, BIOL 1413, and BIOL 2440. Variable credit. Summer. Demonstrated college-level readiness in reading, writing, and math.

BIOL 4095. Undergrad Rsrch Tpcs-Biology. 4 Hours.

This course is designed to allow selected, advanced students in specific areas of biology to participate directly in biological research. The research project will be developed jointly by the student and a faculty mentor, and must be pre-approved by the Chair of the Department of Biological Sciences. Variable Credit (1-4). Prerequisites: Biology major, minimum Junior standing. Demonstrated college-level readiness in reading, writing, and math.

BIOL 4096. Spcl Topics In Undergrad Bio. 3 Hours.

This course of faculty-led study is designed to provide exposure of undergraduate students to new biological topics and concepts in a course setting, prior to that course's formal Department, College, and University course adoption. This course may be repeated for different Special Topics (different courses). Variable Credit (1-4). Prerequisites: Biology major, minimum Junior standing. Demonstrated college-level readiness in reading, writing, and math.

BIOL 4110. Undergraduate Seminar. 1 Hour.

Discussions of current literature in the biological sciences. Required of senior Biology majors. Fall, Spring. Credit 1. Prerequisites: Biology major, Senior standing. Demonstrated college-level readiness in reading, writing, and math.

BIOL 4111. Undergraduate Seminar. 1 Hour.

Discussions of current research presented by faculty participating in the Department of Biological Sciences weekly seminar series. Fall, Spring. Credit 1. Prerequisites: Biology major, Senior standing. Demonstrated college-level readiness in reading, writing, and math.

BIOL 4306. Philosophy Of Biology. 3 Hours.

This course will help the student understand the philosophical issues associated with defining and applying theoretical terms and constructs within evolutionary biology. Writing enhanced. Even year, Spring. Credit 3. Prerequisites: Minimum grade of C in BIOL 1411, BIOL 1413, BIOL 2440, and 8 hrs. advanced biology, and Junior standing. Demonstrated college-level readiness in reading, writing, and math.

BIOL 4320. Environmental Toxicology. 3 Hours.

This course presents basic toxicology as a qualitative and quantitative science of the effects of poisons (toxins) upon the environment, individuals, and populations. The course will also provide a comparison of the toxicology of human and other species' exposure to common environmental contaminants. Writing enhanced. Two one-hour lectures and one two-hour laboratory. Credit 3. Prerequisites: BIOL 1411, BIOL 1413, and BIOL 2420 or BIOL 3470; MATH 3379 or BIOL 3473; 8 hrs. CHM, and Junior standing. Demonstrated college-level readiness in reading, writing, and math.

BIOL 4330. Aquatic Biology. 3 Hours.

Physical, chemical, and biological features of inland waters; organisms of freshwater; factors in biological productivity; methods and equipment. Largely a field course dealing with various approved methods of studying freshwater systems. This course is designed to meet the needs of chemists, teachers of science, biologists, and environmental scientists. Two-hour laboratory. Spring. Credit 3. Prerequisites: Minimum grade of C in BIOL 1411, BIOL 1413 and Junior standing. Demonstrated college-level readiness in reading, writing, and math.

BIOL 4340. Electron Microscopy. 3 Hours.

This course is designed to teach students the methods of preparing specimens for electron microscope analysis and to use the electron microscope as a tool to conduct research. Students will become competent in using the electron microscope for visual analysis or chemical elemental analysis. Writing enhanced. Spring. Credit 3. Prerequisites: Minimum grade of C in BIOL 1411, BIOL 1413, BIOL 2440, and 12 hrs. advanced biology, and Junior standing. Demonstrated college-level readiness in reading, writing, and math. **TO BE DELETED PENDING APPROVAL BY THE TSUS BOARD OF REGENTS AND THECB.**

BIOL 4350. Immunology. 3 Hours.

Humoral and cell-mediated immunobiology, genetics, and chemistry are considered along with immunoanalyses and pathologies. Spring. Credit 3. Prerequisites: Minimum grade of C in BIOL 1411, BIOL 1413, BIOL 2440, BIOL 3470, CHEM 2323/2123 and Junior standing. Demonstrated college-level readiness in reading, writing, and math.

BIOL 4360. Genetic Anlys of Human Disease. 3 Hours.

(Prior SH course id: BIO 436); A study of the transmission and molecular basis of human genetic traits and genetic diseases. Various simple and complex genetic disorders will be examined using pedigree, molecular, and biochemical analyses. Novel approaches to the diagnosis and treatment of human genetic disorders will be discussed. Special topics examining the ethical, legal, and social issues and concerns of genetic testing and discrimination, germ line therapy, genetic enhancement, and human cloning will be examined. Odd year, Spring. Writing enhanced. Credit 3. Prerequisites: Minimum grade of C in BIOL 3450, and Junior standing. Demonstrated college-level readiness in reading, writing, and math.

BIOL 4361. Introductory Evolutionary Bio. 3 Hours.

Evolution is the core theory of modern biology. Students will be introduced to the major principles of evolutionary biology, from the history of evolutionary thought through theory and current concepts of evolution. Emphasis will be placed on molecular and cellular evolution, mechanisms of evolution including natural selection, gene flow, founder effect, and speciation. Writing enhanced. Fall, Spring. Credit 3. Prerequisites: Minimum grade of "C" in BIOL 1411, BIOL 1413, BIOL 2440, and 8 hrs. advanced biology, and Junior standing. Demonstrated college-level readiness in reading, writing, and math.

BIOL 4362. Paleobiology. 3 Hours.

This course examines temporal and spatial changes of life on earth in an evolutionary context, particularly large scale events such as radiations and extinctions. Emphasis is placed on anatomy and taxonomy of fossil invertebrates and vertebrates. The laboratory component encompasses the collection, preparation, and description of a variety of fossil types. As needed Credit 3. Prerequisite: Minimum grade of C in BIOL 1411, BIOL 1413, or permission of the instructor.

BIOL 4363. Genomics and Bioinformatics. 3 Hours.

This course will discuss advances in genomics and bioinformatics. Students will study computational and bioinformatic approaches to understand the genome structure, function, and evolution. Topics will include DNA sequencing, sequence assembly, gene and protein sequence alignments, whole genome comparison, annotation of DNA sequences, promoter analysis, transcriptomics, proteomics, and phylogenetic analysis. As needed. Credit 3. Prerequisites: Minimum grade of C in BIOL 3450, and Junior standing.

BIOL 4370. Microbial Ecology. 3 Hours.

This course introduces the student to basic ecological concepts through the study of microbial communities. Interactions at the microscopic and macroscopic levels will be discussed along with biogeochemical cycles. Bioremediation concepts will also be explored. Two one-hour lectures and one three-hour laboratory. As needed. Credit 3. Prerequisites: BBIOL 1411, BIOL 1413, BIOL 2440, and BIOL 2420 or 3470, CHEM 2125 /2325, and Junior standing. Demonstrated college-level readiness in reading, writing, and math.

BIOL 4374. Biostatistics. 3 Hours.

This course includes an introduction to statistical methods and their application to real biological problems. Topics include descriptive statistics, probability distributions, estimation, hypothesis testing, correlation and regression, and analysis of variance. Use of the computer in statistical analyses will also be stressed. Fall. Credit 3. Prerequisites: 8 hrs. advanced biology, and MATH 1314, MATH 1410 or MATH 1420 and Demonstrated college-level readiness in reading, writing, and math.

BIOL 4380. Medical Microbiology. 3 Hours.

An advanced study of the microorganisms that cause disease and of the disease processes with focus on bacteria and viruses. Emphasis will be placed on pathology, epidemiology and treatment/prevention of specific infectious diseases of medical importance. Spring. Credit 3. Prerequisites: Minimum grade of C in BIOL 3470 and Junior standing or consent of the instructor. Demonstrated college-level readiness in reading, writing, and math.

BIOL 4394. Biological Sciences Internship. 3 Hours.

A supervised, off-campus intern work experience in an approved area of the biological sciences with business, industry or government. This elective course provides the student with direct professional work experience in such areas as biotechnology, biomedical research, ecological assessment, wildlife biology, and science/nature education. Academic credit is based on a written technical report and an oral presentation. Writing enhanced. Credit 3. Prerequisites: Biology major, 6 hrs. of advanced biology, Junior standing, 3.0 GPA and approval of Department Chair.

BIOL 4410. General Entomology. 4 Hours.

A study is made of insect morphology, taxonomy, development, and life histories. Collection and identification by use of keys are stressed. Two-hour laboratory. Even year, Spring. Credit 4. Prerequisites: Minimum grade of C in BIOL 1411, BIOL 1413, BIOL 2440. Junior standing. Demonstrated college-level readiness in reading, writing, and math.

BIOL 4430. Vertebrate Natural History. 4 Hours.

This course deals with the taxonomy, natural history, and ecology of vertebrates. Laboratories emphasize the identification of Texas Vertebrates and field techniques used in their study. Two-hour laboratory. Even year, Spring. Credit 4. Prerequisites: Minimum grade of C in BBIOL 1411, BIOL 1413, and Junior standing. Demonstrated college-level readiness in reading, writing, and math.

BIOL 4460. Parasitology. 4 Hours.

Morphology, life cycles, physiological adaptations, evolution, and distribution of parasitic animals. Three-hour laboratory. Fall. Credit 4. Prerequisites: Minimum grade of C in BIOL 1411, BIOL 1413, and Junior standing. Demonstrated college-level readiness in reading, writing, and math.

BIOL 4470. Animal Behavior. 4 Hours.

A study of the mechanisms and functional explanations of behavior. Experimental approaches to addressing questions of behavior will be emphasized. Topics will include behavioral genetics, neuroethology, migration, habitat selection, foraging, communication, social behavior, reproductive strategies, and human sociobiology. Field studies and independent projects will be integral components of this course. Two-hour laboratory. Writing enhanced. Fall. Credit 4. Prerequisites: Minimum grade of C in BIOL 1411, BIOL 1413, and Junior standing. Demonstrated college-level readiness in reading, writing, and math.

BIOL 4471. Invertebrate Zoology. 4 Hours.

This course will explore the diversity of invertebrate types morphologically, embryologically and physiologically. The ecological role of invertebrates will be emphasized. Three-hour laboratory. Even year, Fall. Credit 4. Prerequisites: Minimum grade of C in BIOL 1411, BIOL 1413, BIOL 2440, and Junior standing. Demonstrated college-level readiness in reading, writing, and math.

BIOL 4480. Molecular Biology. 4 Hours.

A hands-on study of the structure and function of molecules important for the Central Dogma of molecular biology, including DNA and protein, with emphasis on electrophoretic analysis and gene cloning. Three-hour laboratory. Writing enhanced. Fall, Spring. Credit 4. Prerequisites: Minimum grade of C in BIOL 1411, BIOL 1413, BIOL 2440, BIOL 3450, BIOL 3470, CHEM 2125 /2325, and Junior Standing. Demonstrated college-level readiness in reading, writing, and math.

BIOL 4481. Physiological Ecology. 4 Hours.

This course is a study of the functional processes of organisms within the context of ecological and evolutionary theory, focusing on mechanisms of organismal function, energetics, and the energetic consequences of homeostasis when function is influenced by the environment and other ecological and evolutionary processes. This course does not meet the physiology requirement or recommendation for physiology of medical/dental or allied health programs. Three-hour laboratory. Writing enhanced. Odd year, Spring. Prerequisites: Minimum grade of C in BIOL 3450, BIOL 3409, Concurrent enrollment allowed; Junior standing. Demonstrated college-level readiness in reading, writing, and math.

BIOL 4490. Cell Biology. 4 Hours.

A study of eukaryotic cell structure and function, including protein synthesis, membrane structure and function, intracellular trafficking, cell communication, cell motility, mitosis, and cell cycle control, with emphasis on the use of model organisms. Three-hour laboratory. Writing enhanced. Fall. Credit 4. Prerequisites: Minimum grade of C in BIOL 1411, BIOL 1413, BIOL 2440, BIOL 3450, CHEM 1411 and CHEM 1412, and Junior standing. Demonstrated college-level readiness in reading, writing, and math.

BIOL 4493. Endocrinology. 4 Hours.

This course is designed to familiarize the student with the structure, development, comparative anatomy, and physiology of the endocrine system. Two-hour laboratory. Writing enhanced. Odd year, Spring, or as needed. Credit 4. Prerequisites: Minimum grade of C in BIOL 3450 and Junior standing. Demonstrated college-level readiness in reading, writing, and math.

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