

BIOLOGY, BS - GRADES 7-12 LIFE SCIENCE EDUCATION CONCENTRATION

Program Description

Introduction

The College of Science is committed to the support of students seeking to become science, mathematics and technology educators at all levels. The Science, Mathematics and Technology Education (SMTE) program offers content courses for students seeking K-12 science, mathematics and technology education. SMTE classes are also an integral part of the course work for degrees preparing students for Teacher Certifications. The SMTE program does not offer a degree; rather, degrees leading to Teacher Certification are offered by other Science programs and by the College of Education and Human Development. Students seeking to teach in the elementary and secondary schools of Texas must meet degree requirements as well as certification requirements. The requirements and procedure to become a science, mathematics or technology teacher in Texas are outlined below. Undergraduate students who are graduating from the College of Science or the College of Liberal Arts who are seeking initial teacher certification at the 4-8, 7-12 and EC-12 levels prior to graduation, automatically qualify for the Minor in Education.

How to Become a Science, Mathematics or Technology Teacher in Texas

In order to be recommended for teacher certification at this university, a candidate must fulfill three basic requirements:

1. have a bachelor's degree from an accredited college or university that includes an academic major and teacher training courses,
2. complete teacher training through an approved program, and
3. successfully complete the appropriate teacher certification tests for the subject and grade level that the candidate wishes to teach.

Additional information on the requirements to become a teacher in Texas can be obtained at the State Board of Educator Certification (SBEC) website: <http://www.sbec.state.tx.us/SBECOnline/certinfo/becometeacher.asp>. This website also provides information on the resources available to help students pay for a teacher training program.

SBEC has approved three levels of teacher certification for regular educators:

1. Early childhood to grade 6 which includes foundation subjects and enrichment areas such as art, PE, and music,
2. Grade 4-8 which includes the foundation areas only, and
3. Grade 7-12 certification.

Students can find information on the different certifications at the official Texas Examinations of Educator Standards (TEXES) Web site: <http://www.texas.ets.org>. Texas A&M University-Corpus Christi offers several degrees leading to a number of these teacher certifications. The College of Education and Human Development offers several degrees leading to teacher certification. The College of Science offers bachelor's degrees leading to teacher certification in the sciences, mathematics and technology at the 4-8 and the 7-12 levels:

- **Biology, BS - Grades 7-12 Life Science Education Concentration** (120-122 sem. hrs.) Details immediately follow below.
- Chemistry, BS - Grades 7-12 Physical Science Education Concentration (<http://catalog.tamucc.edu/undergraduate/science/teaching-certificates/chemistry-bs-grades-7-12-physical-science-education-concentration/>) (126-128 sem. hrs.)
- Environmental Science, BS - Grades 4-8 Science Education Concentration (<http://catalog.tamucc.edu/undergraduate/science/teaching-certificates/environmental-science-bs-grades-4-8-science-education-concentration/>) (125-130 sem. hrs.)
- Elementary Education, BS - Grades 4-8 with Mathematics Certification (<http://catalog.tamucc.edu/undergraduate/education-human-development/bachelors/elementary-education-bs/#requirementsstext>) (College of Education and Human Development)
- Mathematics, BS - Grades 7-12 Mathematics Education Concentration (<http://catalog.tamucc.edu/undergraduate/science/teaching-certificates/mathematics-bs-grades-7-12-education-concentration/>) (120 sem. hrs.)

Mathematics 7-12 teacher certification is also possible with an undergraduate major other than mathematics. Details can be found in the Mathematics, Grades 7-12 Teacher Certification Without a Mathematics Major (<http://catalog.tamucc.edu/undergraduate/science/teaching-certificates/mathematics-grades-7-12-teacher-certification-without-major/>) section.

The individual programs, Biology, Chemistry, Environmental Science, and Mathematics offer these degrees and courses.

Students seeking Teacher Certification are also strongly urged to contact the Certification Officer in the College of Education and Human Development about current requirements and procedures that must be met to obtain the certificate. In particular, students following a degree plan leading to teacher certification must be admitted to the Teacher Education Program at Texas A&M University-Corpus Christi **prior** to enrolling in any 4000 level EDCI or EDUC courses. Application forms for admission to the teacher education program may be obtained from the Undergraduate or Certification Office, room FC 201. The students are referred to the College of Education and Human Development section of this catalog for more information on the Teacher Education Program.

Grade Point Average for Admission to Teacher Education

A minimum grade point average of 2.75 (4.0 = A) in all work attempted, a minimum grade point average of 2.75 in all science, math, or specialization areas, and no grade below "C" in any science or mathematics course on a student's degree plan and/or education courses within the teacher education core block of courses are required. (See College of Education and Human Development, "Admission to Teacher Education" and "Admission to Clinical Teaching" for other requirements.)

Alteration of a Certification Plan

Any amendment to a degree plan originally filed must be approved by the student's academic advisor, the Department Chair, the Dean of the College of Science, and the Certification Officer of the College of Education and Human Development for the degree to be granted.

General Requirements

The Life Science Education plan is designed for those students who desire a Bachelor of Science Degree in Biology and a secondary teaching certificate in life science. The requirements for a Bachelor of Science in

Biology degree with grades 7-12 Life Science Education Concentration are a minimum of 120¹ semester hours. Forty-two are designated University core curriculum courses; 41 are biology teaching core courses, and 27 are teacher education core courses. Other requirements include a psychology course and upper division elective courses.

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Students may have to take additional hours to meet university requirements such as First-Year Seminar courses or major requirements that include 4 hour math and science courses.

Requirements	Credit Hours
First-Year Seminars (when applicable) ¹	0-2
Core Curriculum Program (http://catalog.tamucc.edu/undergraduate/university-college/programs/core-curriculum-program/)	42
Support Areas	12
Biology Teaching Core	41
Teacher Education Core Requirements	27
Total Credit Hours	122-124

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Full-time, first time in college students are required to take the first-year seminars. The First-Year Seminars will not count towards the 120 hour minimum requirements to graduate.

- UNIV 1101 University Seminar I (1 sch)
- UNIV 1102 University Seminar II (1 sch)

Program Requirements

Requirements

Code	Title	Hours
Full-time, First-year Students ¹		
UNIV 1101	University Seminar I	1
UNIV 1102	University Seminar II	1
Core Curriculum Program		
University Core Curriculum		42
Life Science Education students must take specific courses to ensure they have the proper prerequisites for more advanced coursework:		
<i>Mathematics</i>		
MATH 2413	Calculus I (lab hour counts under Component Area Option) ²	
<i>Life and Physical Sciences</i>		
BIOL 1406	Biology I (lab hour counts under Component Area Option)	
BIOL 1407	Biology II (lab hour counts under Component Area Option)	
<i>Component Area Option</i>		
BIOL 1406	Biology I (Lab Hours)	
BIOL 1407	Biology II (Lab Hours)	
MATH 2413	Calculus I (Lab Hours)	
CHEM 1411	General Chemistry I (lab hour counts under Support Areas)	

Social and Behavioral Sciences

EDUC 1354	Child Growth and Development	
Support Areas		
CHEM 1412	General Chemistry II	4
CHEM 3411	Organic Chemistry I	4
ENGL 3301	Technical and Professional Writing	3
CHEM 1411	General Chemistry I (1 sem. hr. lab)	1
Biology Teaching Core		
BIOL 1406	Biology I (included in University Core)	
BIOL 1407	Biology II (included in University Core)	
BIOL 2371	Principles of Evolution	3
BIOL 2401	Anatomy and Physiology I	4
BIOL 2416	Genetics	4
BIOL 2421	Microbiology	4
BIOL 3428	Principles of Ecology	4
MATH 2413	Calculus I (included in University Core)	
SMTE 4270	Science Education Topics I	2
SMTE 4217	Secondary Approaches to the Life Sciences	2
SMTE 4320	Secondary Science Laboratory Techniques	3
<i>Chemistry of Life/Cell Biology Requirement</i>		
BIOL 3403	Molecular Biology	4
or BIOL 3410	Cell Biology	
or CHEM 4401	Biochemistry I	
<i>Organismal (Animal) Requirement</i>		
BIOL 3413	Invertebrate Zoology	4
or BIOL 3414	Vertebrate Zoology	
<i>Organismal (Plant) Requirement</i>		
BIOL 2472	Principles of Botany	4
or BIOL 3455	Plant form and Function	
<i>Upper Division Biology Elective Requirement</i>		
Select one of the following electives:		3
BIOL 3325	Biostatistics	
BIOL 4301	Embryology	
BIOL 4302	Coral Reef Conservation	
BIOL 4304	Biology of Viruses	
BIOL 4319	Biology of Marine Mammals	
BIOL 4323	Global Change Ecology	
BIOL 4328	Fisheries	
BIOL 4330	Conservation Biology	
BIOL 4343	Oceans and Human Health	
BIOL 4370	Mariculture	
Other upper division Biology courses may be taken with approval		
Teacher Education Core Requirements		
EDUC 2211	Foundations of Education	2
SPED 3310	Individual Differences in Schools and Communities	3
READ 3353	Content Area Reading for Secondary Students	3
or READ 3352	Content Area Reading for Elementary Students	
EDUC 3211	Culturally and Linguistically Responsive Teaching	2
BIEM 4357	Methods of Teaching English as a Second Language	3
EDUC 4305	Seminar I	3

IDET 3210	Design and Development of Technology-Integrated Learning Environments	2
EDUC 4694	Clinical Teaching	6
EDUC 4395	Seminar II	3
Total Hours		124

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Students entering with some college credit may not be required to take one or both of the First-Year Seminar courses (see the "First-Year Seminar (<http://catalog.tamucc.edu/undergraduate/university-college/programs/first-year-learning-communities-program/>)" section of the Core Curriculum Program for rules and exceptions concerning these courses). The hours associated with the First-Year Seminars do not count toward the total number of semester credit hours needed to graduate.

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Students who are not eligible to enroll in MATH 2413 Calculus I (4 sch) will need to take additional prerequisite courses (3-9 sem. hrs.) depending on their math placement level (i.e., MATH 0300 Developmental Mathematics (3 sch), MATH 1314 College Algebra (3 sch) and MATH 1316 Trigonometry (3 sch), or MATH 2312 Precalculus (3 sch)).

Support Areas

To become certified to teach, one additional 3 sem. hr. English course (2000-level or higher) is required to meet certification requirements and this degree requires that students take ENGL 3301 Technical and Professional Writing (3 sch) to fulfill that requirement.

Teacher Education Core Requirements

Students who seek a 7-12 level Life Science teaching certificate should contact a Certification Officer in the College of Education and Human Development about requirements and procedures that must be met to obtain the certificate. The teacher education core must be taken in a specific order and it is recommended that students contact the College of Education and Human Development early in their academic careers for specific details on these courses.

Course Sequencing

First Year

Fall		Hours
BIOL 1406	Biology I	4
CHEM 1411	General Chemistry I	4
ENGL 1301	Writing and Rhetoric I	3
UNIV 1101	University Seminar I	1
EDUC 1354	Child Growth and Development	3
Hours		15

Spring

BIOL 1407	Biology II	4
CHEM 1412	General Chemistry II	4
ENGL 1302	Writing and Rhetoric II	3
UNIV 1102	University Seminar II	1
MATH 2413	Calculus I	4
Hours		16

Second Year

Fall		Hours
BIOL 2371 or BIOL 2416 or BIOL 2421	Principles of Evolution or Genetics or Microbiology	3-4

CHEM 3411	Organic Chemistry I	4
ENGL 2316 or ENGL 2332 or ENGL 2333	Literature and Culture or Literature of the Western World: From the Classics to the Renaissance or Literature of the Western World: From the Enlightenment to the Present	3
EDUC 2211	Foundations of Education	2
Creative Arts Core Requirement		3
American History Core Requirement		3

Hours 18-19

Spring

BIOL 2371 or BIOL 2416 or BIOL 2421	Principles of Evolution or Genetics or Microbiology	3-4
BIOL 2401	Anatomy and Physiology I	4
BIOL 2371 or BIOL 2416 or BIOL 2421	Principles of Evolution or Genetics or Microbiology	3-4
SPED 3310	Individual Differences in Schools and Communities	3
American History Core Requirement		3

Hours 16-18

Third Year

Fall

ENGL 3301	Technical and Professional Writing	3
SMTE 4270	Science Education Topics I	2
Organismal Animal Requirement		4
Organismal Plant Requirement		4
READ 3353 or READ 3352	Content Area Reading for Secondary Students or Content Area Reading for Elementary Students	3
EDUC 3211	Culturally and Linguistically Responsive Teaching	2

Hours 18

Spring

BIOL 3428	Principles of Ecology	4
Chemistry of Life/Cell Biology Requirement		4
SMTE 4320	Secondary Science Laboratory Techniques	3
SMTE 4217	Secondary Approaches to the Life Sciences	2
BIEM 4357	Methods of Teaching English as a Second Language	3

Hours 16

Summer

Upper Division Elective		3
POLS 2305	U.S. Government and Politics	3
POLS 2306	State and Local Government	3

Hours 9

Fourth Year

Fall

EDUC 4305	Seminar I	3
IDET 3210	Design and Development of Technology-Integrated Learning Environments	2

Hours 5

Spring

EDUC 4694	Clinical Teaching	6
EDUC 4395	Seminar II	3
Hours		9
Total Hours		122-125

Courses**BIOL 1308 Science for Life I (Non-Majors Biology)****3 Semester Credit Hours (3 Lecture Hours)**

A non-majors science course. Students will learn basic biological principles, identify the relevance of science in everyday life, and will understand the scientific method. This course does NOT substitute for BIOL 1406 - Biology I or BIOL 1407 - Biology II for science majors. Offered in Spring, Summer, Fall.

TCCNS: BIOL 1308

BIOL 1406 Biology I**4 Semester Credit Hours (3 Lecture Hours, 2 Lab Hours)**

Presentation of basic biological concepts including scientific method, cytology, energetics, nucleic acids and genetics. This course is suitable for all majors. Offered every semester.

Prerequisite: (MATH 1314, 1316, 2305, 2413, minimum score of 24 in 'ACT Math' or minimum score of 580 in 'SAT Math').

Co-requisite: SMTE 0091.

TCCNS: BIOL 1406

BIOL 1407 Biology II**4 Semester Credit Hours (3 Lecture Hours, 2 Lab Hours)**

This course is an overview of the major concepts in biological diversity and plant and animal biology. Laboratory work will include individual/team activities as well as technology-related assignments. Offered every semester.

Prerequisite: BIOL 1406.

Co-requisite: SMTE 0091.

TCCNS: BIOL 1407

BIOL 2300 Science Communication**3 Semester Credit Hours (3 Lecture Hours)**

This course involves presentation and discussion of selected topics relating to the professional skills of practicing biological scientists, including basic software instruction, a review of library services pertinent to science, the application of scientific literature research skills, hypothesis generation and statistical tests, critical reviews of scientific articles, and an introduction to ethical issues in science. Offered Spring and Fall.

BIOL 2371 Principles of Evolution**3 Semester Credit Hours (3 Lecture Hours)**

An overview of the mechanisms by which heritable information changes, adaptations develop, and species diversify. Provides a foundation for molecular, cellular, and organismal studies in the biological sciences. Offered Fall and Spring.

Prerequisite: BIOL 1407.

BIOL 2401 Anatomy and Physiology I**4 Semester Credit Hours (3 Lecture Hours, 2 Lab Hours)**

Structure and function of the human body emphasizing biological chemistry, cell biology, tissues, and the integumentary, skeletal, muscular, and nervous systems. Offered every semester. Not recommended for majors in the College of Science. To count this course toward a major in the Department of Life Sciences, a student must demonstrate that it is required by professional schools in their career track and obtain approval for a substitution from their faculty mentor. Students may not receive credit for both this course and either BIOL 3425 - Functional Anatomy or BIOL 3430 - Physiology.

Co-requisite: SMTE 0091.

TCCNS: BIOL 2401

BIOL 2402 Anatomy and Physiology II**4 Semester Credit Hours (3 Lecture Hours, 2 Lab Hours)**

Structure and function of the human body emphasizing blood, growth, development, genetics, and the endocrine, digestive, respiratory, cardiovascular, lymphatic, immune and urogenital systems. Offered every semester. Not recommended for majors in the College of Science. To count this course toward a major in the Department of Life Sciences, a student must demonstrate that is is required by professional schools in their career track and obtain approval for a substitution from their mentor. Students may not receive credit for both this course and either BIOL 3425 - Functional Anatomy or BIOL 3430 - Physiology.

Prerequisite: BIOL 2401.

Co-requisite: SMTE 0091.

TCCNS: BIOL 2402

BIOL 2416 Genetics**4 Semester Credit Hours (3 Lecture Hours)**

Principles of genetic transmissions and molecular basis of heredity and variation. Weekly recitation periods will involve team assignments, problem solving activities, and seminars. Offered Fall and Spring.

Prerequisite: BIOL 1406 and 1407.

TCCNS: BIOL 2416

BIOL 2420 Principles of Microbiology**4 Semester Credit Hours (3 Lecture Hours, 2 Lab Hours)**

Introduction to microorganisms with emphasis on those of importance in patient care. Principles of disinfection, sterilization, immunity. This class is intended for nursing majors; it cannot substitute for BIOL 2421 - Microbiology. Offered Fall and Spring.

Co-requisite: SMTE 0092.

TCCNS: BIOL 2420

BIOL 2421 Microbiology**4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)**

An introduction to microorganisms including the bacteria, fungi, and viruses. Laboratory involves microbiological techniques and development of basic laboratory skills. Offered Fall and Spring.

Prerequisite: BIOL 1406, 1407, CHEM 1411 and 1412.

Co-requisite: SMTE 0092.

TCCNS: BIOL 2421

BIOL 2472 Principles of Botany**4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)**

Introduction to the structure, function, diversity and application of plants. Laboratory focuses on anatomical features, physiological adaptations, classification, and life cycles. Offered odd Spring.

Prerequisite: BIOL 1407 and CHEM 1411.

Co-requisite: SMTE 0091.

BIOL 3300 Animal Nutrition**3 Semester Credit Hours (3 Lecture Hours)**

Examines dietary requirements of companion animals and livestock. Includes anatomy, physiology, and biochemistry of the gastrointestinal system, nutrient procurement and use, feed additives, growth stimulants, metabolic diseases, and diet therapy. Offered odd Spring. Cross-listed with BIMS 3300.

Prerequisite: BIOL 1407 and CHEM 3411 and (CHEM 3412 or 3412*).

* May be taken concurrently.

BIOL 3325 Biostatistics**3 Semester Credit Hours (3 Lecture Hours)**

The application of statistical analyses to biological data. Students will gain an understanding of how to apply statistical analyses to biological data through study of the principles of experimental design including how to frame informative research questions. At a fundamental level, these concepts are linked to the philosophy of science and our understanding of the way the world works. Juniors or Seniors only. Offered every Spring.

BIOL 3345 Cell Physiology**3 Semester Credit Hours (3 Lecture Hours)**

Course emphasizes cellular functions that underlie physiological processes, transport across membranes, membrane potential and excitability, the cell nucleus, and organelles and their relationship to energy, metabolism, and transport mechanisms within the cell. Offered odd Spring.

Prerequisite: (BIMS 2200 or BIOL 2300) and BIOL 3410.

BIOL 3403 Molecular Biology**4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)**

Principles of molecular biology including advanced concepts of gene structure, expression and regulation, chromatin structure, recombination, and current molecular biology techniques. Laboratory emphasis is on basic skills for nucleic acid analyses, including extraction, PCR amplification, quantification, restriction, and electrophoresis. DNA sequencing-based approaches are covered including bioinformatics for sequence comparisons, polymorphisms, and molecular identification. Offered every Spring. Cross listed with BIMS 3403.

Prerequisite: BIOL 2416 and 2421.

Co-requisite: SMTE 0092.

BIOL 3410 Cell Biology**4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)**

Study of cellular architecture and function. Topics include membranes, transport, organelles, cytoskeleton, and signaling mechanisms. Interrelationships of structure, function, energy and metabolism are explored. Laboratory will emphasize basic techniques of cell biology. Offered every Fall.

Prerequisite: BIOL 2416 and CHEM 3411.

Co-requisite: SMTE 0092.

BIOL 3413 Invertebrate Zoology**4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)**

Structure, life history, and evolution of the invertebrates with special emphasis on the phylogeny and ecological relationships of the major phyla. Laboratory will involve field trips and survey collections. Offered every Fall.

Prerequisite: BIOL 1407.

Co-requisite: SMTE 0091.

BIOL 3414 Vertebrate Zoology**4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)**

Structure, life history, and evolution of the vertebrates with special emphasis on the phylogeny and ecological relationships of the classes. Laboratory focuses on internal and external anatomy and identification of representative organisms. Offered every Spring.

Prerequisite: BIOL 1407.

Co-requisite: SMTE 0091.

BIOL 3425 Comparative Vertebrate Anatomy**4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)**

General trends in morphological development and adaptation as demonstrated by the anatomy of nonhuman vertebrate species. Offered every Spring. Students may not receive credit for both this course and either BIOL 2401 - Anatomy and Physiology I or BIOL 2402 - Anatomy and Physiology II. Juniors or Seniors only.

Prerequisite: BIOL 1407.

Co-requisite: SMTE 0091.

BIOL 3428 Principles of Ecology**4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)**

Introduction to the interrelationships of organisms and their environment. Population structure, community classification and regulation, and energy flow in ecosystems will also be covered. Laboratory sections will focus on experimental design and field techniques in ecology.

Prerequisite: BIOL 1407 and (BIOL 2200, 2300, BIMS 2200 or UNIV 1101 and UNIV 1102) and CHEM 1411 and (MATH 2413 or 2413*).

* May be taken concurrently.

Co-requisite: SMTE 0091.

BIOL 3430 Physiology**4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)**

The study of physiological processes that are the product of complex interactions between tissues, organs and organ systems, with emphasis on the circulatory, respiratory, endocrine, muscular, digestive, and urogenital systems. Particular focus on homeostasis, and the role of the environment and evolution on organ systems. Offered every Fall. Students may not receive credit for both this course and either BIOL 2401 - Anatomy and Physiology I, or BIOL 2402 - Anatomy and Physiology II.

Prerequisite: BIOL 1407.

Co-requisite: SMTE 0091.

BIOL 3455 Plant form and Function**4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)**

Anatomy of vegetative and reproductive organs of plants, unique cellular features, development and differentiation of cell and tissue types. Emphasis on physiological mechanisms of response and adaptation to the environment. Offered even Spring.

Prerequisite: BIOL 1407.

Co-requisite: SMTE 0091.

BIOL 3479 Plant Ecology**4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)**

Structure, physiology, life cycles, and economic impact of plants. Factors influencing diversity, succession and ecological distribution of plants. Offered odd Spring.

Prerequisite: BIOL 1407.

Co-requisite: SMTE 0091.

BIOL 4301 Embryology**3 Semester Credit Hours (3 Lecture Hours)**

This course explores the events that occur just prior to and during gestation. Includes gametogenesis, chromosomal and single gene aberrations, teratology, and the development of the body systems. Offered every Fall.

Prerequisite: BIOL 2416.

BIOL 4302 Coral Reef Conservation**3 Semester Credit Hours (3 Lecture Hours)**

Survey of challenges and threats facing coral reef ecosystems in the 21st century and discussion of conservation and management strategies. Topics include biology and ecology of reef ecosystems, climate change impacts, coral bleaching, over-fishing and effectiveness of and design of marine protected areas. Juniors or Seniors only. Offered every Fall.

BIOL 4304 Biology of Viruses**3 Semester Credit Hours (3 Lecture Hours)**

Introduction to the study of viruses, including viral life cycles, replication schemes and Baltimore classification of representative bacteriophages, plant and animal viruses. Emphasis on analysis and review of primary literature on viruses. Offered Summer II every year.

Prerequisite: BIOL 2416, 2421 and CHEM 1411.

BIOL 4307 Fungal Biology and Ecology**3 Semester Credit Hours (3 Lecture Hours)**

Overview of the fungi, including their characteristics, diversity, and ecology. Interactions between fungi and other organisms are explored along with the role and importance of the fungi. Juniors or Seniors only. Offered odd Spring. Stacked with BIOL 5307.

Prerequisite: BIOL 2421.

BIOL 4308 Biogeography**3 Semester Credit Hours (3 Lecture Hours)**

This course offers an overview of the theories, methods, and current directions in modern biogeography, emphasizing marine and terrestrial plant and animal species and communities. Offered even Spring.

BIOL 4311 Biological Bases of Behavior**3 Semester Credit Hours (3 Lecture Hours)**

This lecture-based course examines the processes by which neuronal circuits generate behaviors and the mechanisms by which experience modulates the activity of these circuits. Offered every Fall.

Prerequisite: BIMS 4323.

BIOL 4312 Mariculture Techniques**3 Semester Credit Hours (3 Lecture Hours)**

Application of biological, mechanical, and other concepts required to develop the skills and techniques necessary for efficient operation and management of public and private aquaculture facilities. Offered odd Fall.

Prerequisite: BIOL 4370.

BIOL 4315 Animal Behavior**3 Semester Credit Hours (3 Lecture Hours)**

What mechanisms cause behavior? How does behavior develop? How does behavior affect survival and reproduction? How does behavior evolve? These questions will be explored in vertebrate and invertebrate species. Junior or Senior only. Offered every Fall. Stacked with BIOL 5315.

BIOL 4319 Biology of Marine Mammals**3 Semester Credit Hours (3 Lecture Hours)**

Introduction to marine mammals, with a focus on their interactions with their biotic and abiotic environment. Juniors or Seniors only. Offered every Fall. Stacked with BIOL 5319.

Prerequisite: BIOL 1407.

BIOL 4323 Global Change Ecology**3 Semester Credit Hours (3 Lecture Hours)**

An introduction to the effects of climatic and anthropogenic change on terrestrial and aquatic structure and function. Includes readings from the current literature and discussion of controversial articles. Offered odd Spring.

Prerequisite: BIOL 3428.

BIOL 4328 Fisheries**3 Semester Credit Hours (3 Lecture Hours)**

A study of theory and techniques in fisheries science, including practical fisheries sampling designs and techniques, behavior of fisheries populations and application to resource management with emphasis in tide-influenced waters. Includes readings in the current literature. Offered even Spring.

Prerequisite: BIOL 1407.

BIOL 4330 Conservation Biology**3 Semester Credit Hours (3 Lecture Hours)**

Principles and theories relating to the conservation of biological diversity, including patterns and processes creating biological diversity, estimates of extinction rates, consequences of losses of biodiversity and causes of diversity loss. Juniors or Seniors only. Offered every Fall.

Prerequisite: BIOL 3428.

BIOL 4334 Biology and Ecology of Coral Reefs**3 Semester Credit Hours (3 Lecture Hours)**

This course will introduce the biology of corals, describe the abiotic and biotic interactions among coral reef ecosystem inhabitants, identify the threats of climate change, and discuss the conservation and management of reefs for the future. Offered every Spring.

Prerequisite: BIOL 3428.

BIOL 4336 Marine Ecology**3 Semester Credit Hours (3 Lecture Hours)**

Habitats and community structure in marine environments; biotic and abiotic factors governing the distribution of marine organisms. Offered every Spring.

Prerequisite: BIOL 3428.

BIOL 4340 Genomics, Proteomics and Bioinformatics**3 Semester Credit Hours (3 Lecture Hours)**

An introduction to integrative biological study using genome-wide approaches and bioinformatics. The "-omics" technologies (Genomics, Proteomics, Metabolomics, etc.) will be surveyed for current and potential contributions to understanding biological function at molecular, cellular, organismal and ecosystem levels. Offered every Fall. Stacked with BIOL 5340.

Prerequisite: BIOL 2416 and (BIOL 3410, 3403 or CHEM 4401).

BIOL 4343 Oceans and Human Health**3 Semester Credit Hours (3 Lecture Hours)**

Healthy oceans are essential to the habitability of our planet – for humans and all other forms of life. Students will explore links between oceans, pollution, human well-being, ecosystem services, resource management, and the science and legislation governing the enforcement of water quality standards. Juniors or Seniors only. Offered every Fall.

BIOL 4350 Research and Design**1-4 Semester Credit Hours (1-3 Lecture Hours, 3 Lab Hours)**

Course will include experimental design, literature review of a research topic and laboratory work on the research topic. Consent of Instructor.

BIOL 4353 Down the River: Biology of Gulf Coast Fishes**3 Semester Credit Hours (3 Lecture Hours)**

This course covers aspects of ecology and biogeography of riverine and estuarine fishes while exposing students to field sampling techniques and museum preparation of specimens. This will be a unique opportunity for students to gain an in-depth understanding of the biological complexity of Texas Gulf Coast river systems while gaining hands-on experience in field and museum ichthyological techniques that are employed by state, federal and academic researchers alike. Offered during Maymester.

Co-requisite: SMTE 0091.

BIOL 4355 Public Aquarium and Animal Care Operations**3 Semester Credit Hours (3 Lecture Hours)**

This course examines the unique requirements needed for public aquariums and zoos to balance animal care and health with public display for general education and conservation research. Offered during Summer.

Co-requisite: SMTE 0091.

BIOL 4360 Computation for 21st Century Biologists**3 Semester Credit Hours (3 Lecture Hours)**

This course is designed to prepare and enable students to use computational tools for bioinformatic applications in advanced courses and independent research projects. Students will be introduced to powerful open-source computing tools used in biological research for creation, organization, manipulation, processing, analysis, and archiving of big data. While not a formal requirement, it is assumed that students have a firm command of basic algebra. Juniors or Seniors only. Offered every Fall. Stacked with BIOL 5360.

BIOL 4370 Mariculture**3 Semester Credit Hours (3 Lecture Hours)**

Survey of the physiological, behavioral, environmental, and economic parameters governing the culture of selected aquatic species. Included are techniques employed worldwide to produce aquatic products. Offered every Fall. Cross-listed with FAMA 5370.

Prerequisite: BIOL 1407.

BIOL 4396 Directed Independent Study**1-3 Semester Credit Hours (1-3 Lecture Hours)**

Research in areas of current interest. Written report required. May be repeated for a maximum of 6 semester hours.

Prerequisite: BIOL 1407 and CHEM 1412.

BIOL 4399 Directed Independent Research**3-6 Semester Credit Hours (3-6 Lecture Hours)**

Independent laboratory- or field-based research project on topic of current interest. Project developed in conjunction with a faculty advisor. Written report required. May be repeated once for a total of 6 semester credit hours. Sophomores or Juniors or Seniors and Permission of Instructor (faculty advisor).

BIOL 4406 Immunology**4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)**

An overview of immunology with emphasis on current knowledge of the immune system. Detailed examination of the specific cells, cytokines, antibodies, and molecules that comprise the immune system. Laboratory exercises demonstrate the basic principles and techniques used in immunologic studies. Offered every Spring semester. Cross listed with BIMS 4406.

Prerequisite: BIOL 2421.

Co-requisite: SMTE 0092.

BIOL 4408 Microbial Diversity and Ecology**4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)**

Biodiversity and roles of microorganisms in natural environments. Interactions with other micro- and macro-organisms (humans, animals and plants) and with abiotic factors. Unique abilities of microorganisms such as nitrogen fixation and adaptation to extreme environments.

Offered every Fall. Stacked with BIOL 5408; Cross-listed with MARB 6408.

Prerequisite: BIOL 2421 and 3428.

Co-requisite: SMTE 0092.

BIOL 4410 Mammalogy**4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)**

Systematics and ecology of mammals including mammalian origins, structure and function, diversity, ecology, behavior, and conservation. Juniors or Seniors only. Offered even Fall. Stacked with BIOL 5410.

Prerequisite: BIOL 1407.

Co-requisite: SMTE 0091.

BIOL 4413 Entomology**4 Semester Credit Hours (3 Lecture Hours)**

A broad overview of the natural history, classification, phylogeny, ecology, behavior, development and physiology of insects and their kin. The lab will involve field work, collection and curation. Juniors and Seniors only. Offered even Spring. Stacked with BIOL 5413.

Prerequisite: BIOL 3413.

Co-requisite: SMTE 0091.

BIOL 4425 Ornithology**4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)**

Systematics, anatomy, physiology, ecology, behavior, and field identification of birds. Juniors and Seniors only. Offered odd Fall. Stacked with BIOL 5425.

Prerequisite: BIOL 1407.

Co-requisite: SMTE 0091.

BIOL 4429 Marine Botany**4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)**

The ecology of marine plants with emphasis on identification, life histories, and environmental factors of distribution. Offered every Fall. Stacked with BIOL 5429.

Prerequisite: BIOL 1407.

Co-requisite: SMTE 0091.

BIOL 4430 Marine Plankton**4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)**

In this class we will investigate the systematics, distribution, and ecology of major marine plankton groups and introduce major concepts in biological oceanography. Juniors or Seniors only. Offered odd Spring. Stacked with BIOL 5430; Cross-listed with MARB 6430.

BIOL 4432 Ichthyology**4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)**

Systematics, evolution, biology, and ecology of fishes. Laboratory identification of marine and freshwater fishes collected during field excursions. Juniors or Seniors only. Offered every Fall. Stacked with BIOL 5432; Cross-listed with MARB 6432.

Prerequisite: BIOL 1407.

Co-requisite: SMTE 0091.

BIOL 4433 Parasitology**4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)**

An introduction to parasitology with emphasis on internal parasites and appropriate references to human endoparasites and parasites of veterinary importance. Juniors and Seniors only. Offered every Spring.

Prerequisite: BIOL 2421.

Co-requisite: SMTE 0092.

BIOL 4439 Case Work Methods in Forensic Anthropology

4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)

This course combines the study of human bones (osteology) and skeletal anatomy with established and validated forensic anthropological methods to solve theoretical and actual forensic cases involving human remains. BIOL 2401 or permission of Instructor. Offered every Spring. Stacked with BIOL 5439; Cross-listed with BIMS 4439.

Prerequisite: BIOL 2401.

BIOL 4442 Herpetology

4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)

Systematics, ecology, and behavior of amphibians and reptiles. Juniors or Seniors only. Offered odd Spring. Stacked with BIOL 5442.

Prerequisite: BIOL 1407.

Co-requisite: SMTE 0091.

BIOL 4444 Estuarine Organisms

4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)

Systematics, distribution, and ecology of estuarine macrofauna. Required field trip. Individual study required. Juniors and Seniors only.

Prerequisite: BIOL 3413.

Co-requisite: SMTE 0091.

BIOL 4547 Marine Science Field Camp

5 Semester Credit Hours (3 Lecture Hours, 6 Lab Hours)

Students learn techniques required to properly conduct marine science field research. Practical, hands-on experience is gained in a variety of topics including biotic and abiotic sample collection and processing, quantitative analysis of field data, evaluation of environmental factors, survival and distribution of living organisms, and the structure of biotic communities. Juniors or Seniors. Offered Maymester.

BIOL 4590 Selected Topics

5 Semester Credit Hours (5 Lecture Hours)

Variable content. May be repeated for credit.

BIOL 4598 Biology Internship

6 Semester Credit Hours

Two to six semester credit hours may be earned by working in an internship position in a governmental agency, private industry, or other appropriate venue.

BIOL 4609 Field and Sampling Techniques

6 Semester Credit Hours (3 Lecture Hours, 6 Lab Hours)

The study of techniques required for proper field work in the biological sciences. The course includes ecological sampling methods, safety, logistics, equipment operation and maintenance and travel concerns. Offered in Summer.

Co-requisite: SMTE 0091.