

(BA or BS in Mathematics), Physical Science (BS in Chemistry), and Technology (BST in Industrial Technology). Students seeking any of these certifications need to follow coursework leading to a degree in the appropriate science field, in addition to taking the required certification courses. Relevant information can be found within each departmental section of the catalog. Initial or additional certification may also be acquired as a post-baccalaureate or graduate student.

Students interested in certification are strongly encouraged to see the Science and Engineering Advisor early in their undergraduate program or certification process.

Department of Biology

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DEGREE PROGRAMS OFFERED

Bachelor of Science (BS), major in Biology

Bachelor of Science (BS), major in Biology (Life Science Teacher Certification)

Bachelor of Science (BS), major in [Aquatic Biology](#)

Bachelor of Science (BS), major in [Microbiology](#)

Bachelor of Science (BS), major in [Wildlife Biology](#) (leading to certification as a wildlife biologist)

MINOR OFFERED

Biology

Biology is the study of living systems and how they function. Because the biological sciences have had and will have profound impact on human society in all areas - longevity, environmental quality, ethics of biotechnology - knowledge of the biological sciences is an essential aspect of higher education.

Biologists find employment in research laboratories, regulatory agencies, and education. Interested students should see the major area advisors.

Biology majors take a minimum of 11 courses that include the core curriculum of Functional Biology, Organismal Biology, Genetics, a biological diversity course, a physiology course, Ecology, and Evolution. At the sophomore level and above, a variety of courses in cellular and organismal biology assure a broad education in any of the regions of specialization. Additional required courses in chemistry, mathematics and physics provide a broad scientific background. A minor outside the Biology Department is required for all areas of study except for the Wildlife Biology program. The BS in Biology is often the choice for those seeking pre-medical and pre-dental education.

Teacher Certification

Students may earn the Life Science (Texas Grades 8-12) certification through a BS in Biology. Initial or additional certification may also be acquired as a post-baccalaureate or graduate student. Students interested in certification are strongly encouraged to see the Science and Engineering Advisor early in their undergraduate program or certification process.

For students who are seeking teacher certification within their major and are not in the College of Science and Engineering, but would like a second teaching field in Life Science (Texas Grades 8-12) the requirements are: BIO 1330/1130, 1331/1131, 2410, 2450, 4408, 4416 or 4454; CHEM 1341/1141, 1342/1142.

**Bachelor of Science (BS)
Major in Biology**
Minimum required: 120 semester hours

General Requirements:

1. A minimum of 9 writing intensive hours and a total of 36 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
2. See the Academic Services section of this catalog for general education core curriculum requirements.
3. If two years of the same foreign language were taken in high school, then no additional language hours will be required for the degree. In the absence of such high school language, two semesters of the same modern language must be taken at the college level.
4. Choose one Advanced Physiology course from: BIO 3421 (fall or spring), 3465 (fall), or 4441 (spring).
5. BIO 4299 requires faculty and departmental chair approval to count toward the 15 hours of advanced BIO electives. Biology advanced electives cannot include: BIO 3351, 4305, 4402, 4403, and 4408.
6. Recommended minor is chemistry or biochemistry. Minor and electives should be chosen in consultation with the academic advisor.
7. Math requirements may be satisfied by taking MATH 2321 and MATH 2328, or MATH 2321 and MATH 2331, or MATH 2471 and MATH 2472.

Freshman Year - 1st Semester		Freshman Year - 2nd Semester		Sophomore Year - 1st Semester		Sophomore Year - 2nd Semester	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
BIO 1430 or 1330/1130	4	BIO 1431 or 1331/1131	4	BIO 2450	4	BIO 2400, 2410, or 2411	4
CHEM 1141, 1341	4	CHEM 1142, 1342	4	CHEM 2141, 2341	4	CHEM 2142, 2342	4
US 1100	1	ENG 1320	3	MATH (see gen. req. 7)	3	MATH (see gen. req. 7)	3
ENG 1310	3	HIST 1310	3	HIST 1320	3	ART, DAN, MU, or TH 2313	3
POSI 2310	3	PFW one course	1			POSI 2320	3
PFW one course	1						
Total	16	Total	15	Total	14	Total	17

Junior Year - 1st Semester		Junior Year - 2nd Semester		Senior Year - 1st Semester		Senior Year - 2nd Semester	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
BIO 4416	4	BIO Advanced Physiology (see gen. req. 4)	4	BIO Advanced Electives (see gen. req. 1 & 5)	8-9	BIO 4301	3
PHYS 1315, 1115	4	PHYS 1325, 1125	4	Minor/Advanced Electives (see gen. req. 1 & 6)	7-8	BIO Advanced Electives (see gen. req. 1 & 5)	6-7
COMM 1310	3	ENG Literature (see gen. req. 2)	3			Minor/Advanced Electives (see gen. req. 1 & 6)	2-3
PHIL 1305 or 1320	3	Social Science component (see gen. req. 2)	3			Electives (see gen. req. 6)	2
Total	14	Total	14	Total	15-17	Total	13-15

Bachelor of Science (BS)
Major in Biology
(Life Science Teacher Certification)
Minimum required: 127 semester hours

General Requirements:

1. A minimum of 9 writing intensive hours and a total of 36 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
2. See the Academic Services section of this catalog for general education core curriculum requirements.
3. If two years of the same foreign language were taken in high school, then no additional language hours will be required for the degree. In the absence of such high school language, two semesters of the same modern language must be taken at the college level.
4. Neither BIO 4305 nor BIO 4408 count as advanced electives in any other degree program in Biology.
5. Choose two courses from the following with advisor approval: BIO 3308, 3406, 4410, 4420, 4421, 4422, 4425, 4434, 4446, 4454 or 4465.
6. A Secondary Education minor is required.
7. Math requirements may be satisfied by taking MATH 2321 and MATH 2328, or MATH 2321 and MATH 2331, or MATH 2471 and MATH 2472.

Freshman Year - 1st Semester		Freshman Year - 2nd Semester		Sophomore Year - 1st Semester		Sophomore Year - 2nd Semester	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
BIO 1430 or 1330/1130	4	BIO 1431 or 1331/1131	4	BIO 2450	4	BIO 2410	4
CHEM 1141, 1341	4	CHEM 1142, 1342	4	CHEM 2141, 2341	4	CHEM 2142, 2342	4
US 1100	1	ENG 1320	3	MATH (see gen. req. 7)	3	MATH (see gen. req. 7)	3
ENG 1310	3	HIST 1310	3	PHYS 1315/1115	4	PHYS 1325,1125	4
POSI 2310	3	COMM 1310	3	PHIL 1305 or 1320	3	PFW one course	1
PFW one course	1						
Total	16	Total	17	Total	18	Total	16

Sophomore Year - Summer I		Sophomore Year - Summer II		Junior Year - 1st Semester		Junior Year - 2nd Semester	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
ENG Literature (see gen. req. 2)	3	ART, DAN, MU, or TH 2313	3	BIO 2400 or 2411	4	BIO Advanced Elective (see gen. req. 5)	4
HIST 1320	3	POSI 2320	3	CI 3325	3	Social Science component (see gen. req. 2)	3
				BIO 4416	4	BIO Advanced Elective (see gen. req. 5)	3-4
				CI 4332	3	ENG 3303	3
Total	6	Total	6	Total	14	Total	13-14

Senior Year - 1st Semester		Senior Year - 2nd Semester	
Course	Hr	Course	Hr
CI 4370	3	EDST 4681	6
BIO 4408 or BIO 4305 (see gen. req. 4)	3-4		
CI 4343	3		
RDG 3323	3		
BIO 4301			
Total	15-16	Total	6

Bachelor of Science (BS)
Major in Aquatic Biology
 Minimum required: 120 semester hours

General Requirements:

1. A minimum of 9 writing intensive hours and a total of 36 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
2. See the Academic Services section of this catalog for general education core curriculum requirements.
3. If two years of the same foreign language were taken in high school, then no additional language hours will be required for the degree. In the absence of such high school language, two semesters of the same modern language must be taken at the college level.
4. BIO 4299 requires faculty and departmental chair approval to count toward the advanced electives. Biology advanced electives cannot include: BIO 3351, 4305, 4402, 4403, and 4408.
5. Recommended minor is chemistry or biochemistry. Minor and electives should be chosen in consultation with the academic advisor.
6. Math requirements may be satisfied by taking MATH 2321 and MATH 2328, or MATH 2321 and MATH 2331, or MATH 2471 and MATH 2472.

Freshman Year - 1st Semester		Freshman Year - 2nd Semester		Sophomore Year - 1st Semester		Sophomore Year - 2nd Semester	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
BIO 1430 or 1330/1130	4	BIO 1431 or 1331/1131	4	BIO 2450	4	BIO 2411	4
CHEM 1141, 1341	4	CHEM 1142, 1342	4	CHEM 2141, 2341	4	CHEM 2142, 2342	4
US 1100	1	ENG 1320	3	MATH (see gen. req. 6)	3	MATH (see gen. req. 6)	3
ENG 1310	3	HIST 1310	3	HIST 1320	3	ART, DAN, MU, or TH 2313	3
POSI 2310	3	PFW one course	1			POSI 2320	3
PFW one course	1						
Total	16	Total	15	Total	14	Total	17

Junior Year - 1st Semester		Junior Year - 2nd Semester		Senior Year - 1st Semester		Senior Year - 2nd Semester	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
BIO 3421 or 3465	4	BIO Advanced Elective (see gen. req. 4)	3	BIO 4415	4	BIO 4301	3
PHYS 1315,1115	4	PHYS 1325,1125	4	BIO 3460	4	BIO 4416	4
COMM 1310	3	ENG Literature (see gen. req. 2)	3	BIO 4470	4	Minor/Advanced Electives (see gen. req. 1 & 5)	4
PHIL 1305 or 1320	3	Social Science component (see gen. req. 2)	3	Minor/Advanced Electives (see gen. req. 1)	2-3	Electives (see gen. req. 5)	2
		Minor/Advanced Electives (see gen. req. 1 & 5)	3-4				
Total	14	Total	16-17	Total	14-15	Total	13

Bachelor of Science (BS)
Major in Microbiology
 Minimum required: 120 semester hours

General Requirements:

1. A minimum of 9 writing intensive hours and a total of 36 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
2. See the Academic Services section of this catalog for general education core curriculum requirements.
3. If two years of the same foreign language were taken in high school, then no additional language hours will be required for the degree. In the absence of such high school language, two semesters of the same modern language must be taken at the college level.
4. Sixteen hours of advanced BIO electives are required of which 12 hours must be chosen from: BIO 3442 (fall), 4426 (spring), 4445 (fall), 4446 (spring), or 4447 (spring).
5. BIO 4447 can only be used to satisfy the physiology requirement or the advanced microbiology course requirement, but not both.
6. Recommended minor is chemistry or biochemistry. Minor and electives should be chosen in consultation with the academic advisor.
7. Math requirements may be satisfied by taking MATH 2321 and MATH 2328, or MATH 2321 and MATH 2331, or MATH 2471 and MATH 2472.

Freshman Year - 1st Semester		Freshman Year - 2nd Semester		Sophomore Year - 1st Semester		Sophomore Year - 2nd Semester	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
BIO 1430 or 1330/1130	4	BIO 1431 or 1331/1131	4	BIO 2450	4	BIO 2400	4
CHEM 1141, 1341	4	CHEM 1142, 1342	4	CHEM 2141, 2341	4	CHEM 2142, 2342	4
US 1100	1	ENG 1320	3	MATH (see gen. req. 7)	3	MATH (see gen. req. 7)	3
ENG 1310	3	HIST 1310	3	ART, DAN, MU, or TH 2313	3	POSI 2320	3
POSI 2310	3	PFW one course	1	HIST 1320	3		
PFW one course	1						
Total	16	Total	15	Total	17	Total	14

Junior Year - 1st Semester		Junior Year - 2nd Semester		Senior Year - 1st Semester		Senior Year - 2nd Semester	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
BIO Advanced Elective (see gen. req. 4)	8	BIO 4441 or 4447 (see gen. req. 4 & 5)	4	BIO Advanced Electives (see gen. req. 1, 4, & 5)	4	BIO 4416	4
PHYS 1315, 1115	4	BIO Advanced Electives (see gen. req. 1, 4, & 5)	4	Minor/Advanced Electives (see gen. req. 6)	7-8	BIO 4301	3
PHIL 1305 or 1320	3	PHYS 1325, 1125	4	Social Science component (see gen. req. 2)	3	Minor/Advanced Electives (see gen. req. 1 & 6)	1-2
		COMM 1310	3			ENG Literature (see gen. req. 2)	3
						Electives (see gen. req. 6)	2
Total	15	Total	15	Total	14-15	Total	13-14

Bachelor of Science (BS)
Major in **Wildlife Biology**
(leading to certification as a wildlife biologist)
Minimum required: **129** semester hours

General Requirements:

1. A minimum of 9 writing intensive hours and a total of 36 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
2. See the Academic Services section of this catalog for general education core curriculum requirements.
3. If two years of the same foreign language were taken in high school, then no additional language hours will be required for the degree. In the absence of such high school language, two semesters of the same modern language must be taken at the college level.
4. Choose one Advanced Physiology course from: BIO 3421 (fall or spring), 3465 (fall), or 4441 (spring).
5. Choose two Advanced Biology electives from: BIO 3461 (Spring), BIO 4410 (Fall/Summer I) or BIO 4454 (Spring).
6. Choose one Advanced Biology elective from: BIO 4421 (Spring) or **BIO 4418** (Summer I) or BIO 4350I (Fall).
7. Choose two Advanced Biology electives from: BIO 4420 (Summer I), BIO 4422 (Fall) or BIO 4434 (Spring).

Freshman Year - 1st Semester		Freshman Year - 2nd Semester		Sophomore Year - 1st Semester		Sophomore Year - 2nd Semester	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
BIO 1430 or 1330/1130	4	BIO 1431 or 1331 /1131	4	BIO 2450	4	BIO 2411	4
CHEM 1141, 1341	4	CHEM 1142, 1342	4	CHEM 2130, 2330	4	PHYS 1315/1115	4
US 1100	1	ENG 1320	3	MATH 2321	3	MATH 2328	3
ENG 1310	3	HIST 1310	3	ART, DAN, MU, or TH 2313	3	ENG Literature (see gen. req. 3)	3
POSI 2310	3	PFW one course	1	HIST 1320	3	POSI 2320	3
PFW one course	1						
Total	16	Total	15	Total	17	Total	17

Junior Year - 1st Semester		Junior Year - 2nd Semester		Junior Year - Summer I		Junior Year - Summer II	
Course	Hr	Course	Hr	Course	Hr	Course	Hr
BIO 2410	4	BIO Advanced Physiology (see gen. req. 4)	4	PHIL 1305 or 1320	3	BIO Advanced Electives (see gen. req. 7)	4
BIO Advanced Electives (see gen. req. 5)	4	BIO Advanced Electives (see gen. req. 5)	4	Social Science component (see gen. req. 3)	3		
BIO 4416	4	BIO Advanced Electives (see gen. req. 6)	3-4				
COMM 1310	3	ENG 3303	3				
Total	15	Total	14-15	Total	6	Total	4

Senior Year - 1st Semester		Senior Year - 2nd Semester	
Course	Hr	Course	Hr
BIO 4304	3	BIO 4301	3
BIO Advanced Electives (see gen. req. 7)	4	BIO 4425	4
BIO 4423	4	BIO 4435	4
		BIO 4350F	3
Total	11	Total	14

Minor in Biology

A minor in Biology includes: BIO 1430 or 1330/1130, 1431 or 1331/1131, 2450, and 9 advanced BIO hours, not to include BIO 3351, 4299, 4305, 4402, 4403, or 4408. CHEM 1341, 1141 and 1342, 1142 are prerequisites for BIO 2450. A grade of “C” or higher is required in all prerequisite courses.

Courses in Biology (BIO)

BIO 1320 and 1421 may be taken in any order. BIO 1320 and 1421 will not meet the requirements for medical or dental schools.

- 1130 Functional Biology Laboratory. (0-3) Fundamental techniques and instruments used in cell biological research will be taught while emphasizing safety, measurements, and scientific methods. Students will design and implement controlled experiments, identify independent and dependent variables, analyze data, draw conclusions, and communicate results with appropriate tables and graphs in oral presentations and written scientific papers. Co-requisite or prerequisite BIO 1330.
- 1131 Organismal Biology Laboratory. (0-3) This course introduces the students to the basics of experimental design, scientific method and inquiry, use of statistical analyses and writing research papers. Topics covered include Mendelian and population genetics, natural selection, population ecology, phylogeny, and behavioral ecology. Co-requisite or prerequisite BIO 1331.
- 1320 (BIOL 1308) Modern Biology I, Molecules, Cells, and Physiology. (3-0) Provides students with basic scientific and biological principles. Current problems in biology and the ethics of science are presented with perspectives of public policy from a scientific viewpoint. This course, when accompanied by BIO 1421, will fulfill the Natural Science Core Component. This course is not recommended for majors in the natural sciences, including biology.
- 1330 Functional Biology. (3-0) This course provides the students with a strong foundation in cellular and molecular biology. Topics include biochemistry, energy metabolism, molecular bases of gene regulation and protein functions, cell division and control, and cell signaling. This course is required for all biology majors and is not recommended for non-science majors. Co-requisite or prerequisite BIO 1130.
- 1331 Organismal Biology (3-0). This course provides science majors with a foundation in organismal biology, Mendelian and population genetics, evolution and ecology. Topics include patterns of inheritance, genetics, evolution, speciation, phylogenetics, and behavioral, population, community, and ecosystem ecology. This course is required for all biology majors and is not recommended for non-science majors. Co-requisite or prerequisite BIO 1131.
- 1421 (BIOL 1409) Modern Biology II, Organisms, Evolution, and Environment. (3-3) This course provides the non-science major the strong and diverse background necessary to understand the structural and functional diversity of organisms, evolution and behavior, and interactions among organisms and their environment. Topics include issues such as the genetic basis of behavior, overpopulation and extinction, ozone depletion, and conservation biology. This course is not recommended for majors in the natural sciences, including biology.
- 2400 (BIOL 2421) Microbiology. (3-3) Principles of microbiology, morphology, anatomy, physiology and taxonomy of representative groups of non-pathogenic organisms. Laboratory methods stress studies of pure cultures, the use of laboratory apparatus in quantitative determinations and the detection and identification of microbial populations in the environment. Prerequisites: BIO 1330/1130 or 1430; BIO 1331/1131 or 1431; and CHEM 1341 with grades of “C” or higher.
- 2410 Intermediate General Botany. (3-3) An introduction to the biology of plants and plant-like organisms, emphasizing their role in ecosystem processes, relationships between structure and function, and the evolutionary relationships among the major plant groups. Prerequisites: BIO 1330/1130 or 1430 and BIO 1331/1131 or 1431 with a grade of “C” or higher.
- 2411 Intermediate Zoology. (3-3) Provides biology majors a strong foundation in animal biology at the organismal level. The format will include details of animal form and function as well as concepts relating to classification, phylogeny, evolution, and ecology. Topics will include natural history, biogeography, adaptations to local environments, shared characters, and behavior. All material is presented in an accepted phylogenetic sequence. Prerequisites: BIO 1330/1130 or 1430; BIO 1331/1131 or 1431 with grades of “C” or higher.
- 2430 (BIOL 2404) Human Physiology and Anatomy. (3-4) A course on human physiology covering the various organ systems. Principles of molecular biology, cell and tissue structure, anatomy and relationship of structure and function are stressed. May not be credited toward a Biology major or minor.
- 2440 (BIOL 2420) Principles of Microbiology. (3-3) The basic principles of microbiology, morphology, physiology, immunology and the relationship of microorganisms to diseases. This course is designed primarily to meet the requirements for students in allied health sciences and other programs requiring only one semester of microbiology. This course may not be credited toward a Biology major or minor. Prerequisites: BIO 1330 and CHEM 1341.
- 2450 (BIOL 2416) Genetics. (3-3) An introduction to basic principles of genetics by studies of Mendelian, molecular, quantitative and population genetics. Topics include classical transmission genetics, gene mapping, DNA replication and repair, transcription, translation, control of gene expression, genetic engineering techniques, Hardy-Weinberg equilibrium, evolutionary change via natural selection, and genetic drift. Prerequisites: BIO 1330/1130 or 1430; BIO 1331/1131 or 1431; CHEM 1141/1341; CHEM 1142/1342 with grades of “C” or higher.
- 2451 Human Anatomy and Physiology I. (3-2) Part I of a two semester course on the structure and function of the human body. Designed specifically to prepare students for nursing and other health professions. Prerequisites: BIO 1330, CHEM 1141 and 1341 with grades of “C” or higher.
- 2452 Human Anatomy and Physiology II. (3-2) **This course is the second part of a two semester course on the structure and function of the human body designed specifically to prepare students for nursing and other health professions. Prerequisites: BIO 1330, CHEM 1341, BIO 2451, with**

- grades of "C" or higher.
- 3300 Cell and Molecular Biology. (3-0) Fundamentals of structure and function of prokaryotic and eukaryotic cells. Course includes cell and organelle structure, basic biochemistry, principles of thermodynamics and energy transformation, nucleic acid and protein synthesis, enzyme kinetics, cell motility and cell signaling. Prerequisites: BIO 1430 or 1330/1130 and BIO 2450 and CHEM 1342 with grades of "C" or higher, or permission of instructor.
- 3308 Global Ecology. (3-0) An interdisciplinary introduction to the science of global environmental change. Emphasis will be placed on understanding principles of earth system science, the scientific basis underlying the major components of global environmental change, the linkages between these components, and the central role of humanity in contributing to the observed changes. Prerequisites: BIO 1330/1130 or 1430; 1331/1131 or 1431. (MC) (WI)
- 3351 Forensic and Human Genetics. (3-0) This course introduces students to basic principles of Mendelian, molecular, and forensic genetics as it relates to the problems of human populations. This course is intended for non-science majors. May not be credited towards a biology major or minor. Prerequisites: BIO 1320 and 1421 or BIO 1330/1130 or BIO 1430 and BIO 1331/1131 or BIO 1431.
- 3406 Economic Botany. (3-3) An introduction to the utilization of plants by humans and their economic and ecological significance. Laboratories will stress plant features beneficial to economic and societal needs. Prerequisite: BIO 2450 with a grade of "C" or higher.
- 3410 Phycology. (3-3) A study of algal organisms, comparative and culture techniques. Prerequisites: 8 hours from BIO 1410, 2410, 2450, 3400, 3450 with a grade of "C" or higher.
- 3421 Vertebrate Physiology. (3-3) The study of the physiology of vertebrate organ systems, including the nervous system, musculoskeletal system, endocrine system, cardiovascular system, respiratory system, digestive system, reproductive system and urinary system. Mammalian systems will be emphasized. Prerequisites: BIO 2450 with a grade of C or higher.
- 3430 Mycology. (3-3) A study of the fungal kingdom including slime molds and lichens. Laboratory studies will emphasize taxonomy, morphology and culture techniques. Prerequisites: BIO 2410 or 2400, 2450 with a grade of "C" or higher.
- 3442 Virology. (3-4) The structure, multiplication and genetics of bacterial, plant, and animal viruses. The role of viruses in human and plant disease. Prerequisites: BIO 2400, 2450 with a grade of "C" or higher. (WI)
- 3460 Aquatic Biology. (3-3) An introduction to plant and animal life in the fresh water habitats of the local area. Prerequisites: BIO 2411, 2450 with a grade of "C" or higher; one year of Chemistry. (WI)
- 3461 Plant Taxonomy. (3-3) Principles of identification and classification of plants; nomenclature and characteristics of various plant groups with emphasis on the higher plants. Prerequisites: BIO 2450 with a grade of "C" or higher.
- 3465 Plant Physiology. (3-3) Basic principles of plant physiology studied in lecture and laboratory. Prerequisites: BIO 2450 with a grade of "C" or higher or consent of instructor. One semester of organic chemistry is strongly recommended.
- 3470 Invertebrate Zoology. (3-4) A study of the comparative morphology, evolution, systematics and natural history of invertebrates. Prerequisites: BIO 2411, 2450 with a grade of "C" or higher.
- 3480 Histology. (3-4) A study of the structural and functional relationships between cells and tissues in organs. The laboratory includes the study of prepared slides and of microtechnique. This course is designed to meet the needs of pre-professional students. Prerequisites: BIO 2411, 2450 with a grade of "C" or higher.
- 3490 Principles of Developmental Biology. (3-3) This course will cover basic principles of developmental biology in both plant and animal systems. Course will mainly address cell, molecular and genetic mechanisms underlying the development of model organisms. Prerequisites: BIO 1330/1130 or 1430; BIO 2450.
- 4299 Undergraduate Research. (0-4) Supervised individual research projects in a mentor-student relationship with a biology professor. Available only to biology majors with junior standing and at least a "B" average. May be repeated once for credit. Prerequisites: BIO 2450 with a grade of "C" or higher and consent of the supervising professor.
- 4300 Neurobiology. (3-0) This course will give students an overview of neuroscience, particularly the areas of neuroanatomy, neurophysiology, and evolutionary and developmental neurobiology. Prerequisite: BIO 2450 with a grade of "C" or higher. (MC)
- 4301 Evolution. (3-0) Basic genetic principles applied to natural selection, adaptation, populations, speciation and man's future. Consideration is given to the origin of life, nature of chromosomal variation, evolution of genetic systems and certain other selected topics. Prerequisite: BIO 2450 with a grade of "C" or higher.
- 4304 Wildlife and Recreation: Impact, Policy, and Management. (3-0) Students will be introduced to the impact human recreational activities have on wildlife habitats and populations. Management practices to enhance human-wildlife encounters or to minimize detrimental effects on wildlife populations will be presented. Prerequisite: BIO 4416.
- 4305 Nature Study. (3-3) A comprehensive survey of natural events. Includes laboratory and field work emphasizing observation, collection and discovery of relationships. Creditable only for those seeking elementary certification. Required for those seeking grade 4-8 Science and Mathematics/Science certification.
- 4350 Special Topics in Biology. (3-0) Selected advanced topics in biology. May be repeated for credit. Prerequisites will be determined by topic and faculty offering the course.
- 4350A Cell Biology of Cancer. (3-0) A study of the cell signaling pathways and molecular genetics of cancer, including hands-on participation in ongoing research. Prerequisite: permission of instructor.
- 4350B Biological Implications of Water Planning in Texas. (3-0) Current topics in understanding the biological implications of water planning in Texas. This course will be of particular interest to students who have a background in aquatic biology and who intend to stay in Texas post-graduation. Prerequisites will be determined by topic and faculty offering the course. May be repeated once with different emphasis.

- 4350D Watershed Management Frameworks and Applications. (3-0) Introduction to integrated watershed assessment and management tools for identifying programmatic water quality and quantity issues and their root causes and solutions, and their practical application. The scientific and socio-economic elements are considered within the context of planning and developing watershed protection plans and programs. Prerequisite: Instructor approval.
- 4350E Techniques in Aquatic Biology. (3-0) This course will provide hands on experience with a suite of physical, chemical, and biological sampling techniques and gear used in applied river studies. Students will be exposed to the fundamentals of data quality objectives, accuracy, precision, detection limits, data visualization, exploratory analysis, univariate and multivariate statistics.
- 4350F Biological Resources: Conservation and Planning. (3-0) This course is an introduction to the protection and sustainable use of populations, species, habitats, and ecosystems. Course also includes study of the methods used to analyze biodiversity and population regulation. Prerequisites: BIO 4416 or concurrent enrollment.
- 4350G Medical Microbiology. (3-0) This lecture-based course will cover pathogenic bacteria and their relationship to disease, emphasizing identification of selected groups of pathogens, epidemiology and the biological basis for virulence. Prerequisite: BIO 2400. Students may take only one of BIO 4350G or BIO 4445 for credit.
- 4350H Immunobiology. (3-0) This lecture-based course will cover the biology of the immune system and its relationship to disease, emphasizing B and T cell immunity, immune diseases, hypersensitivities, transplantation, and cancer. Prerequisite: BIO 2400 with a minimum grade of C and BIO 2450 with a minimum grade of C. Students may take only one of Bio 4350H or BIO 4426 for credit.
- 4350I Bird Conservation and Management (2-3) This course is an introduction to the conservation and management of bird populations in an ecological context. Course covers a variety of species and spatial scales from landscape to ecoregion. Laboratory portion will involve field trips, intensive computer-based labs, and class discussion. Prerequisites: BIO 4416 or concurrent enrollment.
- 4350J Environmental Physiology of Animals. (3-0) This course is a study of how animals respond physiologically to changes in environmental temperature, moisture, salinity, partial pressure of gases, and toxins. Prerequisites: Grades of "C" or better in BIO 1330, 1331, and 2450.
- 4369 Biosystematics. (3-0) Biological systematics is a multidisciplinary component of most biological disciplines. Course topics include classification schemes, homology, homoplasy, the application of nomenclature, and phylogeny reconstruction. The course will also present relevant issues in conservation, biodiversity cataloguing, museum and collection management, and identification methods/dichotomous keys. Prerequisite: BIO 2450 with a grade of "C" or higher.
- 4402 Earth Science I. (3-3) The description and interpretation of Earth phenomena considered from the standpoint of meteorology and astroscience. Includes field observations, methods of measurement and interpretation of data related to the physical environment and space technology. May not be counted toward a major or minor in biology. Required for those seeking grade 4-8 Science and Mathematics/Science certification.
- 4403 Earth Science II. (3-3) The description and interpretation of Earth phenomena considered from the standpoint of geology and oceanography. Includes field observations, methods of sampling and interpretation of data related to the physical environment. May not be counted toward a major or a minor in biology. Required for those seeking grade 4-8 Science and Mathematics/Science certification.
- 4408 Science Processes and Research. (3-3) Students will analyze research design, design research, interpret data, and communicate results. Stress on broad-field structure and integration of major science concepts and science knowledge. Should be taken the semester prior to student teaching. Required for those seeking 8-12 Life Sciences and Science teacher certification. May not count as one of the four upper-level Biology courses required of general Biology majors, or one of the three upper-level Biology courses required of Biology minors.
- 4410 Field Biology of Plants. (3-3) Ecological relationships and natural history of plants, including historical geology, geography, soils, vegetational regions and surface geology of central Texas. Emphasis is placed on plant-soil-water relationships to develop conservation concepts. Students will make a representative collection of plants. Prerequisite: BIO 2450 with a grade of "C" or higher.
- 4411 Morphology of the Vascular Plants. (3-3) The structure, life-cycles and evolution of fossil and living vascular plants. Emphasis on such topics as the origin of land plants, evolution of the ovule, angiospermy, the flower and fruit. Prerequisites: BIO 2450 with a grade of "C" or higher; one year of Chemistry.
- 4412 Plant Anatomy. (3-3) The anatomy of vascular plants stressing descriptive, development and comparative aspects of seed plants and the anatomical adaptations of plants to environmental factors. Prerequisites: BIO 2450 with a grade of "C" or higher; one year of Chemistry.
- 4413 Parasitology. (3-4) The biology and biological significance of the common parasites of man and animals. Prerequisites: BIO 2411, 2450 with a grade of "C" or higher.
- 4415 Ichthyology. (3-3) An introduction to the morphology, taxonomy, natural history and evolution of fishes. Field trips will be made to collect specimens and laboratory periods will be devoted to morphological and systematic analysis. Prerequisites: BIO 2411, 2450 with a grade of "C" or higher.
- 4416 General Ecology. (3-3) The ecological relationships that exist between organisms and those relationships that exist between organism and environment. Laboratory sessions will be devoted to literature review and/or specific ecological problems. This course or BIO 4454 is required of all biology majors. Prerequisites: BIO 2450; BIO 2410, 2411, or 2400 with a grade of "C" or higher. (WI)
- 4418 Field Ornithology. (3-0) This course is designed to introduce and provide an advanced knowledge of the application of various field, laboratory, and statistical methods and techniques in the study of avian species. The course will include topics related to survey methodology, sampling design, marking/banding, measurement/sample extraction, and aging/sexing of avian species.

- 4420 Natural History of the Vertebrates. (3-3) Environmental relationships and natural history of vertebrates. Emphasis is upon taxonomy, speciation and biotic provinces. The laboratory will include field trips for the study and collection of animals in their natural habitats. Students will assemble a representative collection of animals. Prerequisites: BIO 2411, 2450 with a grade of "C" or higher and permission of instructor required for non-wildlife majors. (WI)
- 4421 Ornithology. (3-3) Introduction to anatomy, behavior, ecology and identification of birds of Texas. Laboratory will emphasize field studies of birds and their habitat requirements. Prerequisites: BIO 2411, 2450 with a grade of "C" or higher.
- 4422 Mammalogy. (3-3) The taxonomy, distribution, ecology, behavior and evolution of mammals with particular emphasis on wild animals of the southwest. Laboratory will emphasize anatomy, identification, preparation of specimens and field exercises in the methods of population analysis. Prerequisites: BIO 2411, 2450 with a grade of "C" or higher. BIO 4416 is also recommended.
- 4423 Wildlife Management. (3-3) Applications of the principles of ecology and natural history to the management of wildlife habitats and control of wildlife populations. Laboratory will involve demonstrations and practice exercises with wildlife management techniques and instrumentation and field trips to observe wildlife management projects. Prerequisites: BIO 2410, 2411, and 2450 with a grade of "C" or higher. BIO 4416, 4421, or 4422 is also recommended. (WI)
- 4425 Biometry. (3-3) Basic principles of statistical methods as applied to biological problems such as sampling techniques, analysis of data, experimental design and population dynamics. Emphasis will be on practical application. Prerequisites: BIO 2450 with a grade of "C" or higher; MATH 1315.
- 4426 Immunology. (3-4) A study of the immune response, antigen/antibody reactions, major histocompatibility complex, and immunopathology. Prerequisites: BIO 2400, 2450 with a grade of "C" or higher. One semester of organic chemistry is recommended. (WI)
- 4434 Herpetology. (3-3) A course treating the origin and evolution of amphibians and reptiles; their reproductive and physiological tactics; taxonomy/systematics; and population biology. Emphasis will be placed on North American species and those groups inhabiting Texas. Prerequisites: BIO 2411, 2450 with a grade of "C" or higher.
- 4435 Techniques in Wildlife Management. (3-3) The basic methodology of practical wildlife management. This involves techniques in monitoring and data collection related to population dynamics and habitat parameters of wildlife species. Prerequisites: BIO 2411, 2450 with a grade of "C" or higher and permission of instructor required for non-wildlife majors.
- 4441 Cellular Physiology. (3-3) Advanced cellular biology, including membrane physiology, thermodynamics, energy transduction and distribution, and cellular movement in non-muscle and muscle cells. Laboratory includes discussion of current research and exercises in cellular physiology. Prerequisites: BIO 2450 with a grade of "C" or higher; one semester of organic chemistry. (WI)
- 4442 Experimental Techniques. (3-3) Use of methods and instruments applicable to biological investigations, including colorimetry; UV-spectrophotometry; fluorescence; flame and atomic absorption spectrophotometry; paper, gas, gel filtration and ion exchange chromatography; radioactive counting; and electrophoresis. Prerequisite: BIO 2450 with a grade of "C" or higher.
- 4445 Pathogenic Microbiology. (3-4) Pathogenic bacteria and their relationship to disease, emphasizing identification of selected groups of pathogens, epidemiology and the biological basis for resistance. Prerequisites: BIO 2400, 2450 with a grade of "C" or higher. (WI)
- 4446 Microbial Ecology. (3-4) This course will illustrate the wide variety of bacteria in nature, their interactions with other organisms and the environments, and their roles in global cycling of elements such as carbon, nitrogen, and sulfur. The laboratories will feature enrichments for selected groups of microorganisms (sulfate reducers, nitrogen fixers) and analysis of these isolates by microscopy, gas chromatography and radiochemical substrate utilizations. Prerequisites: BIO 2400, 2450 with a grade of "C" or higher. (WI)
- 4447 Microbial Physiology and Genetics. (3-3) This course will cover fundamental concepts in bacterial physiology and genetics, including central and specialized metabolism, and unique aspects of bacterial genetics. Prerequisites: BIO 2400, 2450; CHEM 2142, 2342 with a grade of "C" or higher. (WI)
- 4450 Physiological Ecology of Animals. (3-3) This course brings together the principal concepts of environmental physiology of animals inhabiting the major ecological realms of the earth (land, air, sea, and fresh water). The biological problems associated with living in the various ecological realms will be discussed, and the biochemical and physiological adaptations of animals to their diverse habitats will be studied. Prerequisite: BIO 2450 with a grade of "C" or higher.
- 4454 Plant Ecology. (3-3) Physiological ecology and community structure and function in the organization of terrestrial plant ecosystems. Quantitative vegetational sampling and the use of field and laboratory physiological equipment are included in the laboratory. This course or BIO 4416 is required of all Biology majors. Prerequisite: BIO 2450 with a grade of "C" or higher. (WI)
- 4464 Vertebrate Anatomy. (3-3) This course is a comparative study of vertebrate anatomy. Fossil histories are evaluated to understand how vertebrate radiation occurred in the geological past, along with changes in structure of organs and organ systems. Lab includes dissection of representative members of each major vertebrate group. Prerequisite: BIO 2450. (MC) (WI)
- 4465 General Entomology. (3-3) Principles of morphology, physiology and taxonomy of insects. Laboratory time will be devoted to a taxonomic study of the common orders and families of insects. Prerequisites: BIO 2411, 2450 with a grade of "C" or higher.
- 4470 Limnology. (3-3) The physical, chemical, and biological factors affecting productivity in lakes, ponds, and streams. Limnological sampling methods, chemical, and biological analysis of samples and hydrographic surveying are included in the laboratory. Prerequisites: BIO 2450 with a grade of "C" or higher; one year of chemistry. (WI)
- 4472 Animal Behavior. (3-3) This course presents all the major facets of the study of animal behavior, giving special attention

to its evolution and ecological significance. We will discuss major conceptual models guiding past and present research in the field. Laboratories will emphasize experimental techniques and statistical analysis. Prerequisites: BIO 2450; BIO 2400, 2410, or 2411 with a grade of "C" or higher. (WI)

- 4480 Cytology and Microtechnique. (3-3) A study of cellular structure and microscopic technique. The lecture portion of the course presents cytology of all cell types and theoretical aspects of microscopy including light and electron-based technologies. The laboratory portion of the course provides training in standard light and electron microscopy, laser scanning confocal microscopy, and digital microscopy. Prerequisite: BIO 2450 with a grade of "C" or higher.
- 4481 Internship in Biological Laboratory Technologies. (0-15) The student will participate in the work of a selected biology unit (private, commercial, or governmental). A research paper, reporting the internship experience conducted at the biological unit under the supervision of a faculty member, will be required. This course may be credited toward a biology major with prior approval of the Biology Department advisor and chair. Prerequisite: BIO 2450 with a grade of "C" or higher.

Courses in General Science (GS)

- 3310 General Science. (3-2) A laboratory course designed to acquaint the student with the fundamentals of chemistry and earth space science. Non-creditable for science majors. A required course for Elementary EC-4 Generalist certification, grades 4-8 Science certification, and grades 4-8 Mathematics/Science certification. Prerequisites: PHYS 1310, 1320, and 1110 or PHYS 1315/1115 or 1410, PHYS 1325/1125 or 1420 completed with a grade of "C" or higher. (MP)
- 3320 General Science. (3-2) A laboratory course designed to acquaint the student with the fundamentals of biological science. Non-creditable for science majors. A required course for Elementary EC-4 Generalist certification, grades 4-8 Science certification, grades 4-8 Mathematics/Science certification. Prerequisite: BIO 1320, 1421, BIO 1330/1130 or 1430, or BIO 1331/1131 or 1431 completed with a grade of "C" or higher.

Department of Chemistry and Biochemistry

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DEGREE PROGRAMS OFFERED

- Bachelor of Science (BS), major in Biochemistry
Bachelor of Science (BS)/ Master of Science (MS), major in Biochemistry
Bachelor of Science (BS), major in Chemistry
Bachelor of Science (BS), major in Chemistry (Chemistry Teacher Certification)
Bachelor of Science (BS), major in Chemistry (Physical Science Teacher Certification)
Bachelor of Science (BS)/ Master of Science (MS), major in Chemistry

MINORS OFFERED

- Biochemistry
Chemistry

Chemistry is the central science and the study of chemistry provides the essential knowledge needed to address many of society's most pressing needs, such as feeding, clothing, and housing the peoples of the world; tapping new sources of energy; improving health and conquering disease; providing renewable substitutes for dwindling resources; strengthening our national security; and monitoring and protecting our environment. Basic research in chemistry will help future generations address their evolving needs and ensure a higher quality of life.

Chemists and biochemists can work in almost any field and find careers in teaching, research, production, quality control, technical services, and/or sales. Graduates from the Department of Chemistry and Biochemistry have an excellent record of job placement in industrial, academic, and government positions. Many also seek advanced degrees or pursue careers in medicine, dentistry, or pharmacy.

Chemistry and biochemistry majors gain skills in quantitative thinking and problem solving. Majors can work as laboratory instructors for lower division courses or as research assistants in faculty research laboratories. Students often participate in internships and research programs both on and off campus during the summer. The faculty, facilities, library holdings, and chemistry curriculum of the Department of Chemistry and Biochemistry have been accredited by the American Chemical Society. Recipients of a BS in Chemistry or BS in Biochemistry, who have fulfilled the minimum requirements for professional chemists, are awarded certificates by the American Chemical Society. Receipt of the ACS certificate is recommended as preparatory training for work in industry or for continued graduate studies in chemistry or biochemistry.

Students seeking a BS in Chemistry begin their studies taking foundation courses in chemistry, physics and mathematics. After