# Department of Biology

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## Degree Programs Offered

- BS, major in Biology
- BS, major in Biology (with Life Science teacher certification)
- BS, major in Biology – Aquatic Biology
- BS, major in Biology – Microbiology
- BS, major in Biology – Wildlife Biology (with Wildlife certification)

## Minor Offered

- Biology

Biology is the study of living systems and how they function at the molecular and organismal levels. 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 usually find employment in research or education. Many graduates work with state agencies or the health science/medical centers and biotechnology laboratories. Interested students should see the chair or the major area advisors.

Biology majors take a minimum of 11 courses that include the core curriculum of Functional Biology, Organismal Biology, Genetics, a diversity course, a physiology course, Ecology, and Evolution. At the sophomore level and above, a variety of courses in molecular 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 with certification. 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 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, but would like a second teaching field in Life Science (Texas Grades 8-12) the requirements are: BIO 1430, 1431, 2410, 2450, 4408, 4416 or 4454; CHEM 1341/1141, 1342/1142.

# Bachelor of Science
# 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 University College 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.

| **Freshman Year – 1st Semester** | **Hours** |
|---|---|
| BIO 1430 | 4 |
| CHEM 1141, 1341 | 4 |
| US 1100 | 1 |
| ENG 1310 | 3 |
| HIST 1310 | 3 |
| PFW one course | 1 |
| **Total** | **16** |

| **Freshman Year – 2nd Semester** | **Hours** |
|---|---|
| BIO 1431 | 4 |
| CHEM 1142, 1342 | 4 |
| ENG 1320 | 3 |
| HIST 1320 | 3 |
| PFW one course | 1 |
| **Total** | **15** |

| **Sophomore Year – 1st Semester** | **Hours** |
|---|---|
| BIO 2450 | 4 |
| CHEM 2141, 2341 | 4 |
| MATH 2321 | 3 |
| POSI 2310 | 3 |
| **Total** | **14** |

| **Sophomore Year – 2nd Semester** | **Hours** |
|---|---|
| BIO 2400, 2410, or 2411 | 4 |
| CHEM 2142, 2342 | 4 |
| MATH 2331 | 3 |
| ART, DAN, MU, or TH 2313 | 3 |
| POSI 2320 | 3 |
| **Total** | **17** |

| **Junior Year – 1st Semester** | **Hours** |
|---|---|
| BIO 4416 | 4 |
| PHYS 1410 | 4 |
| COMM 1310 | 3 |
| PHIL 1305 | 3 |
| **Total** | **14** |

| **Junior Year – 2nd Semester** | **Hours** |
|---|---|
| BIO Advanced Physiology (see gen. req. 4) | 4 |
| PHYS 1420 | 4 |
| ENG Literature (see gen. req. 2) | 3 |
| Social Science component (see gen. req. 2) | 3 |
| **Total** | **14** |

| **Senior Year – 1st Semester** | **Hours** |
|---|---|
| BIO Advanced Electives (see gen. req. 1 & 5) | 8-9 |
| Minor/Advanced Electives (see gen. req. 1 & 6) | 7-8 |
| **Total** | **15-17** |

| **Senior Year – 2nd Semester** | **Hours** |
|---|---|
| BIO 4301 | 3 |
| BIO Advanced Electives (see gen. req. 1 & 5) | 6-7 |
| Minor/Advanced Electives (see gen. req. 1 & 6) | 2-3 |
| Electives (see gen. req. 6) | 2 |
| **Total** | **13-15** |

# Bachelor of Science
# Major in Biology
# (with Life Science Teacher Certification)

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 University College 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 4408 does not count toward a non-teacher certification program in Biology.
5. Choose two courses from the following with advisor approval: BIO 3422 (spring), 4410 (fall), 4420 (summer II), 4421 (spring), 4422 (fall), 4434 (see dept), or 4465 (fall).
6. A Secondary Education minor is required.

| **Freshman Year – 1st Semester** | **Hours** |
|---|---|
| BIO 1430 | 4 |
| CHEM 1141, 1341 | 4 |
| US 1100 | 1 |
| ENG 1310 | 3 |
| HIST 1310 | 3 |
| PFW one course | 1 |
| **Total** | **16** |

| **Sophomore Year – 1st Semester** | **Hours** |
|---|---|
| BIO 2450 | 4 |
| CHEM 2141, 2341 | 4 |
| MATH 2321 | 3 |
| PHYS 1410 | 4 |
| ENG Literature (see gen. req. 2) | 3 |
| **Total** | **18** |

| **Sophomore Year – Summer I** | **Hours** |
|---|---|
| PHIL 1305 | 3 |
| POSI 2310 | 3 |
| **Total** | **6** |

| **Junior Year – 1st Semester** | **Hours** |
|---|---|
| BIO 2410 | 4 |
| CI 3325 | 3 |
| BIO Advanced Electives (see gen. req. 5) | 4 |
| COMM 1310 | 3 |
| CI 3310 | 3 |
| **Total** | **14** |

| **Senior Year – 1st Semester** | **Hours** |
|---|---|
| CI 4370 | 3 |
| BIO 4408 (see gen. req. 4) | 4 |
| CI 4343 | 3 |
| RDG 3323 | 3 |
| BIO 4301 | 3 |
| **Total** | **16** |

| **Freshman Year – 2nd Semester** | **Hours** |
|---|---|
| BIO 1431 | 4 |
| CHEM 1142, 1342 | 4 |
| ENG 1320 | 3 |
| HIST 1320 | 3 |
| Social Science component (see gen. req. 2) | 3 |
| **Total** | **17** |

| **Sophomore Year – 2nd Semester** | **Hours** |
|---|---|
| BIO 2400 or 2411 | 4 |
| CHEM 2142, 2342 | 4 |
| MATH 2331 | 3 |
| PHYS 1420 | 4 |
| PFW one course | 1 |
| **Total** | **16** |

| **Sophomore Year – Summer II** | **Hours** |
|---|---|
| ART, DAN, MU, or TH 2313 | 3 |
| POSI 2320 | 3 |
| **Total** | **6** |

| **Junior Year – 2nd Semester** | **Hours** |
|---|---|
| BIO Advanced Elective (see gen. req. 5) | 4 |
| CI 4332 | 3 |
| BIO 4416 | 4 |
| ENG 3303 | 3 |
| **Total** | **14** |

| **Senior Year – 2nd Semester** | **Hours** |
|---|---|
| EDST 4681 | 6 |
| **Total** | **6** |

# Bachelor of Science
# Major in Biology-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 University College 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.

| **Freshman Year – 1st Semester** | **Hours** |
|---|---|
| BIO 1430 | 4 |
| CHEM 1141, 1341 | 4 |
| US 1100 | 1 |
| ENG 1310 | 3 |
| HIST 1310 | 3 |
| PFW one course | 1 |
| **Total** | **16** |

| **Sophomore Year – 1st Semester** | **Hours** |
|---|---|
| BIO 2450 | 4 |
| CHEM 2141, 2341 | 4 |
| MATH 2321 | 3 |
| POSI 2310 | 3 |
| **Total** | **14** |

| **Junior Year – 1st Semester** | **Hours** |
|---|---|
| BIO 3421 or 3465 | 4 |
| PHYS 1410 | 4 |
| COMM 1310 | 3 |
| PHIL 1305 | 3 |
| **Total** | **14** |

| **Senior Year – 1st Semester** | **Hours** |
|---|---|
| BIO 4415 | 4 |
| BIO 3460 | 4 |
| BIO 4470 | 4 |
| Minor/Advanced Electives (see gen. req. 1) | 2-3 |
| **Total** | **14-15** |

| **Freshman Year – 2nd Semester** | **Hours** |
|---|---|
| BIO 1431 | 4 |
| CHEM 1142, 1342 | 4 |
| ENG 1320 | 3 |
| HIST 1320 | 3 |
| PFW one course | 1 |
| **Total** | **15** |

| **Sophomore Year – 2nd Semester** | **Hours** |
|---|---|
| BIO 2411 | 4 |
| CHEM 2142, 2342 | 4 |
| MATH 2331 | 3 |
| ART, DAN, MU, or TH 2313 | 3 |
| POSI 2320 | 3 |
| **Total** | **17** |

| **Junior Year – 2nd Semester** | **Hours** |
|---|---|
| BIO Advanced Elective (see gen. req. 4) | 3 |
| PHYS 1420 | 4 |
| ENG Literature (see gen. req. 2) | 3 |
| Social Science component (see gen. req. 2) | 3 |
| Minor/Advanced Electives (see gen. req. 1 & 5) | 3-4 |
| **Total** | **16-17** |

| **Senior Year – 2nd Semester** | **Hours** |
|---|---|
| BIO 4301 | 3 |
| BIO 4416 | 4 |
| Minor/Advanced Electives (see gen. req. 1 & 5) | 4 |
| Electives (see gen. req. 5) | 2 |
| **Total** | **13** |

## Bachelor of Science
## Major in Biology-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 University College 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.

| **Freshman Year – 1st Semester** | **Hours** |
|---|---|
| BIO 1430 | 4 |
| CHEM 1141, 1341 | 4 |
| US 1100 | 1 |
| ENG 1310 | 3 |
| HIST 1310 | 3 |
| PFW one course | 1 |
| **Total** | **16** |

| **Sophomore Year – 1st Semester** | **Hours** |
|---|---|
| BIO 2450 | 4 |
| CHEM 2141, 2341 | 4 |
| MATH 2321 | 3 |
| ART, DAN, MU, or TH 2313 | 3 |
| POSI 2310 | 3 |
| **Total** | **17** |

| **Junior Year – 1st Semester** | **Hours** |
|---|---|
| BIO Advanced Electives (see gen. req. 1, 4 & 5) | 8 |
| PHYS 1410 | 4 |
| PHIL 1305 | 3 |
| **Total** | **15** |

| **Senior Year – 1st Semester** | **Hours** |
|---|---|
| BIO Advanced Electives (see gen. req. 1, 4 & 5) | 4 |
| Minor/Advanced Electives (see gen. req. 6) | 7-8 |
| Social Science component (see gen. req. 2) | 3 |
| **Total** | **14-15** |

| **Freshman Year – 2nd Semester** | **Hours** |
|---|---|
| BIO 1431 | 4 |
| CHEM 1142, 1342 | 4 |
| ENG 1320 | 3 |
| HIST 1320 | 3 |
| PFW one course | 1 |
| **Total** | **15** |

| **Sophomore Year – 2nd Semester** | **Hours** |
|---|---|
| BIO 2400 | 4 |
| CHEM 2142, 2342 | 4 |
| MATH 2331 | 3 |
| POSI 2320 | 3 |
| **Total** | **14** |

| **Junior Year – 2nd Semester** | **Hours** |
|---|---|
| BIO 4441 or 4447 (see gen. req. 4 & 5) | 4 |
| BIO Advanced Electives (see gen. req. 1, 4 & 5) | 4 |
| PHYS 1420 | 4 |
| COMM 1310 | 3 |
| **Total** | **15** |

| **Senior Year – 2nd Semester** | **Hours** |
|---|---|
| BIO 4416 | 4 |
| BIO 4301 | 3 |
| Minor/Advanced Elective (see gen. req. 1 & 6) | 1-2 |
| ENG Literature (see gen. req. 2) | 3 |
| Electives (see gen. req. 6) | 2 |
| **Total** | **13-14** |

## Bachelor of Science
## Major in Biology-Wildlife Biology (leading toward wildlife certification)
Minimum required: 133 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 University College 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).

| **Freshman Year – 1st Semester** | **Hours** |
|---|---|
| BIO 1430 | 4 |
| CHEM 1141, 1341 | 4 |
| US 1100 | 1 |
| ENG 1310 | 3 |
| HIST 1310 | 3 |
| PFW one course | 1 |
| **Total** | **16** |

| **Sophomore Year – 1st Semester** | **Hours** |
|---|---|
| BIO 2450 | 4 |
| CHEM 2130, 2330 | 4 |
| MATH 2321 | 3 |
| ART, DAN, MU, or TH 2313 | 3 |
| POSI 2310 | 3 |
| **Total** | **17** |

| **Junior Year – 1st Semester** | **Hours** |
|---|---|
| BIO 2410 | 4 |
| BIO 4410 | 4 |
| BIO 4416 | 4 |
| COMM 1310 | 3 |
| **Total** | **15** |

| **Junior Year – Summer I** | **Hours** |
|---|---|
| PHIL 1305 | 3 |
| Social Science component (see gen. req. 3) | 3 |
| **Total** | **6** |

| **Senior Year – 1st Semester** | **Hours** |
|---|---|
| BIO 4304 | 3 |
| BIO 4422 | 4 |
| BIO 4423 | 4 |
| MATH 2328 or HP 3302 | 3 |
| **Total** | **14** |

| **Freshman Year – 2nd Semester** | **Hours** |
|---|---|
| BIO 1431 | 4 |
| CHEM 1142, 1342 | 4 |
| ENG 1320 | 3 |
| HIST 1320 | 3 |
| PFW one course | 1 |
| **Total** | **15** |

| **Sophomore Year – 2nd Semester** | **Hours** |
|---|---|
| BIO 2411 | 4 |
| PHYS 1410 | 4 |
| MATH 2331 | 3 |
| ENG Literature (see gen. req. 3) | 3 |
| POSI 2320 | 3 |
| **Total** | **17** |

| **Junior Year – 2nd Semester** | **Hours** |
|---|---|
| BIO Advanced Physiology (see gen. req. 4) | 4 |
| BIO 3461 | 4 |
| BIO 4421 | 4 |
| ENG 3303 | 3 |
| **Total** | **15** |

| **Junior Year – Summer II** | **Hours** |
|---|---|
| BIO 4420 | 4 |
| **Total** | **4** |

| **Senior Year – 2nd Semester** | **Hours** |
|---|---|
| BIO 4301 | 3 |
| BIO 4425 | 4 |
| BIO 4435 | 4 |
| GEO 4338 | 3 |
| **Total** | **14** |

## Minor in Biology

A minor in Biology includes: BIO 1430, 1431, 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)

While they may be taken in either sequence, it is strongly recommended that students take BIO 1320 then 1421 in consecutive semesters/sessions. BIO 1320 and 1421 will not meet the requirements for medical or dental schools.

**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.

**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.

**1430 (BIOL 1406) Functional Biology.** (3-3) Provides the science major with a strong foundation in cellular and molecular biology and physiology. Topics include biological chemistry, metabolism, the molecular bases of cellular functions and genetics, the molecular biology of reproduction and development, cell signaling, neurobiology and the special senses, and human physiology and the immune system. Not recommended for non-majors.

**1431 (BIOL 1407) Organismal Biology.** (3-3) Provides the science major with a strong foundation in organismal biology, Mendelian and population genetics, evolution, and ecology. Topics include taxonomy, patterns of diversity, ecosystems and human biology, behavior, reproductive biology, and comparative physiology. Not recommended for non-majors.

**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 1430, 1431, and CHEM 1341 with a grade 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 1430 and 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 1430 and 1431 with a grade 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.

**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, and gene mapping, DNA replication and repair, transcription, translation, control of gene expression, genetic engineering techniques, Hardy-Weinberg equilibrium, evolutionary change via natural selection, and genetic drift. Prerequisites: BIO 1430, 1431; CHEM 1141, 1341, 1142, and 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: CHEM 1141 and 1341 with grades of "C" or higher.

**2452 Human Anatomy and Physiology II.** (3-2) Part II 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: CHEM 1141 and 1341 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 and CHEM 1342 with grades of "C" or higher, or permission of instructor.

(WI) **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 1430, 1431 with a grade of "C" or higher. (MC)

**3351 Forensic and Human Genetics.** (3-0) An introduction 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 1430 and 1431.

(WI) **3370 The Biology of Marine Mammals.** (3-0) This course will examine the evolution, behavior, and physiological adaptations (morphological, sensory, energetic, reproductive, and communicative) of the major groups of marine mammals: cetaceans, pinnipeds, and siennas. Prerequisites: BIO 2411, 2450 with a grade of "C" or higher.

**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.

(WI) **3422 Biological Oceanography.** (3-3) This course examines chemical and physical aspects of oceans and estuaries as they relate to biological oceanography, specifically primary and secondary productivity, energy flow, and adaptations of marine organisms. Two field trips are taken to the Gulf Coast of Texas. Prerequisites: BIO 2450, 2410 or 2411 with a grade of "C" or higher; GEO 3335.

**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.

(WI) **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.

**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 2410, 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 1430 and 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.

**4306 Population Genetics.** (3-0) Examines the fundamental mathematical models used by population geneticists and the theory underlying them, emphasizing modern genetic approaches. Prerequisite: BIO 2450 with a grade of "C" or higher.

**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 Cellular Physiology of Cancer.** (3-0)

**4350B Biological Implications of Water Planning in Texas.** (3-0)

**4350C Field Ornithology.** (3-0)

**4350D Watershed Management Frameworks and Applications.** (3-0)

**4350E Techniques in Aquatic Biology. (3-0)**

**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.

(WI) **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) **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.

**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.

(WI) **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.

**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.

(WI) **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.

**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.

(WI) **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.

**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.

(WI) **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

**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.

(WI) **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)

**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.

(WI) **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.

**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 adviser 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 1410, 1420 completed with a grade of "C" or higher.

**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, 1430, or 1431 completed with a grade of "C" or higher.