

# BIOLOGY (BIO)

**NOTE: All prerequisites for Biology (BIO) courses must be completed with a grade of "C-" or better.**

## Biology (BIO) Courses

### **BIO 1001. Introduction to Careers in the Health Professions. (1-0) 1 Credit Hour.**

An exploration of careers in the health sciences for pre-medical sciences students. Topics include academic preparedness, course planning, effective use of advising and career preparation resources, and identification of opportunities for research, leadership, and clinical exposure. Restricted to Biology majors. Course Fee: STSI \$7.20; LRS1 \$15.4.

### **BIO 1173. Introduction to Computational Biology. (3-0) 3 Credit Hours.**

Prerequisite: MAT 1023. Introduction to computation for biologists, using a modern, open-source programming language such as Python or R. Programming concepts, including data types, functions, loops, and logic are explored within a context of realistic biological problems and data sets. Basic data visualization techniques are also explored. Generally offered: Fall, Spring, Summer. IUS1 \$15; LRS1 \$46.20; STSI \$21.60.

### **BIO 1201. Biosciences I Laboratory for Science Majors. (0-3) 1 Credit Hour. (TCCN = BIOL 1106)**

Prerequisite: Completion of or concurrent enrollment in one of the following: STA 1053, MAT 1023, MAT 1073, or higher. Corequisite: BIO 1203 for biology majors. This laboratory-based course accompanies BIO 1203, Biosciences I for Science Majors. Laboratory activities will reinforce the fundamental principles of living organisms, including physical and chemical properties of life, organization, function, evolutionary adaptation, and classification. Study and examination of the concepts of cytology, reproduction, genetics, and scientific reasoning are included. Course Fees: IUB1 \$10; L001 \$30; LRS1 \$15; STSI \$7.

### **BIO 1203. Biosciences I for Science Majors. (3-0) 3 Credit Hours. (TCCN = BIOL 1306)**

Prerequisite: Completion of or concurrent enrollment in one of the following: STA 1053, MAT 1023, MAT 1073, or higher. Corequisite: BIO 1201 is required for biology majors. This is the first course in a two-part introduction to the science of biology for students majoring in biology or interested in pre-health professions. Topics include biochemistry, cell biology, genetics, and molecular biology. May be applied toward the Core Curriculum requirement in Life and Physical Sciences. (Formerly BIO 1113 and BIO 1404 in previous catalogs. Credit can only be earned for one of the following courses: BIO 1203, BIO 1404, or BIO 1113.) Generally offered: Fall, Spring, Summer. Course Fees: LRC1 \$12; LRS1 \$45; STSI \$21.

### **BIO 1221. Biosciences II Laboratory for Science Majors. (0-3) 1 Credit Hour. (TCCN = BIOL 1107)**

Prerequisite: BIO 1203 and BIO 1201 (or equivalent). Corequisite: BIO 1223 is required for biology majors. This laboratory-based course accompanies BIO 1223, Biosciences II for Science Majors. Laboratory activities will reinforce study of the diversity and classification of life, including animals, plants, protists, fungi, and prokaryotes. Special emphasis will be given to anatomy, physiology, ecology, and evolution of plants and animals. Course Fees: IUB1 \$10; L001 \$30; LRS1 \$15; STSI \$7.

### **BIO 1223. Biosciences II for Science Majors. (3-0) 3 Credit Hours. (TCCN = BIOL 1307)**

Prerequisite: BIO 1203. Corequisite: BIO 1221 is required for biology majors. This is the second course in a two-part introduction to the science of biology for students majoring in biology or interested in pre-health professions. Topics include evolutionary biology, biotic diversity, plant structure and function, and ecology. May be applied toward the Core Curriculum requirement in Life and Physical Sciences. (Course formerly listed as BIO 1143, BIO 1413, and BIO 1414 in previous catalogs. Credit cannot be earned for more than one of the following: BIO 1143, BIO 1223, BIO 1413, BIO 1414, or ES 2013.) Generally offered: Fall, Spring, Summer. Course fees: LRC1 \$12; LRS1 \$46.20; STSI \$21.60.

### **BIO 1233. Contemporary Biology I. (3-0) 3 Credit Hours. (TCCN = BIOL 1308)**

This is the first course in a two-part introduction to the science of biology for non-majors. This course focuses on the chemical basis of life, principles of inheritance, principles of evolution, and biodiversity. May be applied toward the Core Curriculum requirement in Life and Physical Sciences. May not be applied to a B.S. degree in Biology or B.S. degree in Microbiology and Immunology. Generally offered: Fall, Spring. Course Fee: LRC1 \$12; LRS1 \$46.20; STSI \$21.60; DL01 \$75.

### **BIO 1243. Contemporary Biology II. (3-0) 3 Credit Hours. (TCCN = BIOL 1309)**

This is the second course in a two-part introduction to the science of biology for non-majors. This course focuses on evolution, animal and plant physiology, and ecology. May be applied toward the Core Curriculum requirement in Life and Physical Sciences. May not be applied to a B.S. degree in Biology or the B.S. degree in Microbiology and Immunology. Generally offered: Fall, Spring, Summer. Course Fees: DL01 \$75; LRC1 \$12; LRS1 \$46.20, STSI \$21.60.

### **BIO 2043. Nutrition. (3-0) 3 Credit Hours. (TCCN = BIOL 1322)**

Prerequisite: BIO 1233 or BIO 1203 (formerly BIO 1404). In-depth study of nutrient classes in foods: their ingestion, digestion, absorption, and utilization by the human body. Clinical consequences of nutrient deficiency or excess, and Medical Nutrition Therapy to complement management of disease. (Formerly AHS 2043 in previous catalogs. Same as NDT 2043. Credit cannot be earned for more than one of the following courses: AHS 2043, BIO 2043, or NDT 2043.) Generally offered: Fall, Spring, Summer. Course Fee: LRS1 \$46.20; STSI \$21.60; DL01 \$75.

### **BIO 2051. Human Anatomy and Physiology Laboratory I. (0-3) 1 Credit Hour. (TCCN = BIOL 2101)**

Prerequisite: BIO 1203 or BIO 1233; completion of or concurrent enrollment in BIO 2053 is recommended. This laboratory supplements the BIO 2053 lecture. Designed for pre-nursing and allied health students. Not recommended for pre-medical and pre-dental students. It is the first of a two-course laboratory sequence that uses both dissections of representative organisms and laboratory experimentation to study human anatomical systems and physiological processes. This course cannot count towards the BS Biology Degree. Generally offered: Fall, Spring, Summer. Course Fee: IUS1 \$15; L001 \$30; LRS1 \$15.40; STSI \$7.20; DL01 \$25.

**BIO 2053. Human Anatomy and Physiology I. (3-0) 3 Credit Hours. (TCCN = BIOL 2301)**

Prerequisite: BIO 1203 or BIO 1233; concurrent enrollment in BIO 2051 is recommended. Designed for pre-nursing and allied health students. Not recommended for pre-medical and pre-dental students. This is the first of a two-course sequence that provides an integrative study of the anatomy and physiology of the human body with an emphasis on the structure/function interrelationships between organ systems. Topics covered include cell and tissue biology and the integumentary, skeletal, muscular, and nervous systems. This course cannot count towards the BS Biology Degree. Generally offered: Fall, Spring, Summer. Course Fee: LRS1 \$46.20; STSI \$21.60; DL01 \$75.

**BIO 2061. Human Anatomy and Physiology Laboratory II. (0-3) 1 Credit Hour. (TCCN = BIOL 2102)**

Prerequisite: BIO 2051; completion of or concurrent enrollment in BIO 2063 is recommended. Designed for pre-nursing and allied health students. Not recommended for pre-medical and pre-dental students. This laboratory supplements the BIO 2063 lecture. It is the second of a two-course laboratory sequence that uses both dissections of representative organisms and laboratory experimentation to study human anatomical systems and physiological processes. (Same as BIO 3652. Credit cannot be earned for both BIO 2061 and BIO 3652. BIO 2061 cannot substitute for BIO 3422.) Generally offered: Fall, Spring, Summer. Course Fee: IUS1 \$15; L001 \$30; LRS1 \$15.40; STSI \$7.20; DL01 \$25.

**BIO 2063. Human Anatomy and Physiology II. (3-0) 3 Credit Hours. (TCCN = BIOL 2302)**

Prerequisite: BIO 2053; concurrent enrollment in BIO 2061 is recommended. Designed for pre-nursing and allied health students. Not recommended for pre-medical and pre-dental students. This is the second of a two-course sequence that provides an integrative study of the anatomy and physiology of the human body with an emphasis on the structure/function interrelationships between organ systems. Topics covered include the endocrine, digestive, respiratory, cardiovascular, lymphatic/immune, renal, and reproductive systems. Human growth and development will also be covered. (This course cannot count towards the BS Biology Degree.) Generally offered: Fall, Spring, Summer. Course Fee: LRS1 \$46.20; STSI \$21.60; DL01 \$75.

**BIO 2073. Sophomore Research Experience (CURE) I. (1-6) 3 Credit Hours.**

Prerequisite: BIO 1203, BIO 1201, BIO 1223, and BIO 1221 with a grade of "C-" or better. Restricted to students who have completed 30 or more hours. The organizing principles of biology (such as molecular and cellular functions, reproduction, development, homeostatic mechanisms, and organismal physiology and behavior) are used within a comparative and evolutionary framework to train students in modern laboratory or field techniques, bioinformatics, experimental design, and interpretation of results. This is the first semester of a year-long course-based research experience (CURE) in which students complete an original research project and present results to stakeholders outside of the classroom. (Same as ES 2003. Credit cannot be earned for both BIO 2073 and ES 2003.) Generally offered: Fall. Course Fee: LRS1 \$46.20; STSI \$21.60; DL01 \$75; L001 \$30.

**BIO 2313. Genetics. (3-0) 3 Credit Hours. (TCCN = BIOL 2316)**

Prerequisite: BIO 1203 and BIO 1223. Principles governing the transmission of hereditary factors in plants and animals, with emphasis on molecular, biochemical, and population genetics. Generally offered: Fall, Spring, Summer. Course Fee: LRS1 \$46.20; STSI \$21.60; DL01 \$75.

**BIO 2362. Molecular Genetics Laboratory. (0-6) 2 Credit Hours.**

Prerequisite: BIO 1203, BIO 1223, and CHE 1103. A study of techniques used to investigate the inheritance of genetic information at the molecular level. Students will gain an understanding of the structure, function and regulation of genes. Techniques will include; nucleic acid biochemistry, molecular cloning mutagenesis and bioinformatics. (Formerly BIO 2322. Credit cannot be earned for both BIO 2362 and BIO 2322.) Generally offered: Fall, Spring, Summer. Course Fee: L001 \$30; LRS1 \$30.80; STSI \$14.40; DL01 \$50.

**BIO 2953. Special Topics in Biology. (3-0) 3 Credit Hours.**

An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Topics may be repeated for credit when the topics vary, but not more than 6 semester credit hours will apply to a bachelor's degree, regardless of discipline. No more than 6 semester credit hours of BIO 2953, BIO 4951, or BIO 4953 can be applied to a Bachelor of Science degree in Biology or Microbiology and Immunology. Course Fees: LRS1 \$46.20; STSI \$21.60.

**BIO 2992. Medical Terminology. (2-0) 2 Credit Hours.**

Prerequisite: BIO 1203 and BIO 1223 with a grade of "C-" or better. This course covers the language of medicine that will be used as a foundation for understanding upper-division undergraduate and graduate-level courses to follow. It will include pronunciation, definition, usage, and origins of medical terms. Medical terms presented will be used to identify signs, symptoms, diagnoses, and treatment options for selected pathologies. With these skills the student will be able to effectively interpret and communicate in a healthcare setting. Generally offered: Fall and Spring. Course Fee: LRS1 \$30.80; STSI \$14.40.

**BIO 3002. Professional Development for Pre-Medical Sciences. (2-0) 2 Credit Hours.**

Prerequisite: BIO 1001 or consent of the instructor; restricted to Biology majors within the Pre-medical Science concentration with at least 60 semester credit hours. Career development intended to enhance career readiness and marketability of students preparing to apply to health professional schools or employment in the health professions. Topics include elements of successful applications and development of student portfolios. Differential Tuition: \$100. Course Fee: LRS1 \$30.80; STSI \$14.40.

**BIO 3013. Introduction to Clinical Medicine and Pathology. (3-0) 3 Credit Hours.**

Prerequisite: BIO 1203, BIO 1223, BIO 2313, and BIO 2992. Introduction to concepts of human disease, diagnosis, and underlying pathology. (Same as MMI 3013. Credit cannot be earned for both BIO 3013 and MMI 3013.) Generally offered: Fall. Differential Tuition: \$150.

**BIO 3043. UTeachSA Research Methods. (3-0) 3 Credit Hours.**

Prerequisite: This course is only open to students who are participating in the UTeachSA teacher preparation program. Students design and carry out independent inquiries, which they write up and present in the manner that is common in the scientific community. Inquiries incorporate mathematics and the various science disciplines to solve research problems. Only 6 semester credit hours of BIO 3043, BIO 4911-3, BIO 4923 and BIO 4993, in any combination, can be taken as BIO electives. Additional research hours of these courses (excluding Independent Study) may be taken as free electives, for a maximum of 12 research hours being applied to the bachelor's degree. (Same as UTE 3043. Credit cannot be earned for both BIO 3043 and UTE 3043.) Generally offered: Fall. Spring. Differential Tuition \$150.

**BIO 3053. Sophomore Research Experience (CURE) II. (1-6) 3 Credit Hours.**

Prerequisites: Completion of BIO 2073 with a grade of "C-" or better. The organizing principles of biology (such as molecular and cellular functions, reproduction, development, homeostatic mechanisms, and organismal physiology and behavior) are used within a comparative and evolutionary framework to train students in modern laboratory or field techniques, bioinformatics, experimental design, and interpretation of results. This is the second semester of a year-long course-based research experience (CURE) in which students complete an original research project and present results to stakeholders outside of the classroom. (Same as ES 3003. Credit cannot be earned for both BIO 3053 and ES 3003.) Generally offered: Spring. Differential Tuition: \$150. Course fees: LRS1 \$46.20; STSI \$21.60; L001 \$30.

**BIO 3073. Environmental Rhetoric and Technical Communication. (3-0) 3 Credit Hours.**

Prerequisite: ENG 2413; restricted to students who have completed 60 or more hours. This course focuses on rhetoric, ecology, and technical/scientific communication in order to develop interdisciplinary, team-based, and applied research projects. This advanced professional writing and rhetoric course will examine ecological communications as an archetypal example of specialized technical communication. (Same as ES 3073. Credit cannot be earned for both BIO 3073 and ES 3073.) Generally offered: Fall, Spring. Differential tuition: \$150.

**BIO 3113. Ichthyology. (2-3) 3 Credit Hours.**

Prerequisite: BIO 1203 and BIO 1223 with a grade of "C-" or better; restricted to students who have completed 60 or more hours. This course will focus on form and function, behavior, life history, ecology, and key taxonomic characteristics of most of the orders of fishes. Field trips may be required. (Same as ES 3113. Credit cannot be earned for both BIO 3113 and ES 3113.) Generally offered: Spring. Differential Tuition: \$150. Course Fee: STFE \$40; L001 \$15.

**BIO 3123. Comparative Vertebrate Anatomy. (3-0) 3 Credit Hours.**

Prerequisite: BIO 1203 and BIO 1223 with a grade of "C-" or better; restricted to students who have completed 60 or more hours. Not recommended for pre-medical and pre-dental students. A comparative analysis of developmental and adult anatomy of vertebrates (including humans). Emphasis is placed on phylogenetic relationships between form, function, and evolution. Generally offered: Spring. Differential Tuition: \$150. Course Fee: DL01 \$75.

**BIO 3183. Animal Nutrition. (3-0) 3 Credit Hours.**

Prerequisite: BIO 1203, BIO 1223, CHE 1103, and CHE 1113; restricted to students who have completed 60 or more hours. Comparative study of vertebrate nutrition with a focus on mammalian and avian species. The course will cover nutritional requirements and sources, nutrient metabolism, digestive physiology, and clinical consequences of nutrient deficiency and excess. Course Fee: LRS1 \$46.20; STSI \$21.60; DL01 \$75.

**BIO 3213. Animal Behavior. (3-0) 3 Credit Hours.**

Prerequisite: BIO 1203 and BIO 1223 with a grade of "C-" or better; restricted to students who have completed 60 or more hours. This course will introduce various approaches to the study of animals and their behavior in natural habitats. The course will examine basic principles derived from studying the evolution, ecology, and development of animals, and use these principles to explain how and why animals behave as they do in particular situations. Formerly NDRB 3213. Credit cannot be earned for both NDRB 3213 and BIO 3213. Generally offered: Spring, Summer. Differential Tuition \$150. Course Fee: DL01 \$75; STSI \$21.60; LRS1 \$46.20.

**BIO 3233. Survey of Insects. (3-0) 3 Credit Hours.**

Prerequisite: BIO 1203 and BIO 1223 with a grade of "C-" or better; restricted to students who have completed 60 or more hours. Course includes an introduction to basic insect biology, as well as in-depth coverage of insect systematics, including major orders and families. (Same as ES 3233. Credit cannot be earned for both BIO 3233 and ES 3233.) Generally offered: Spring even years. Differential Tuition: \$150.

**BIO 3253. R Coding in Environmental Science and Ecology. (3-0) 3 Credit Hours.**

Prerequisite: BIO 1173 or CS 1173 with a grade of "C-" or better. This course will teach the management of environmental and ecological data using Program R. The focus will be on the structure and linguistics of data in R and how to integrate R into a data science workflow. (Same as ES 3253. Credit cannot be earned for both BIO 3253 and ES 3253.) Generally offered: Fall. Differential tuition: \$150. Course Fee: IUS1 \$15.

**BIO 3263. Woody Plant Identification. (1-4) 3 Credit Hours.**

Prerequisite: Junior or senior status; a minimum of 60 semester credit hours. A study of the woody plants emphasizing identification of the more common woody plants of Texas. Family characteristics, flower anatomy, plant morphology, and plant-collecting techniques will be included. Lecture, laboratory, and fieldwork will be a part of the course. (Same as ES 3223. Credit cannot be earned for both BIO 3263 and ES 3223.) Generally offered: Fall. Differential Tuition: \$150. Course Fee: STFE \$40.

**BIO 3273. Wildflower Identification. (1-4) 3 Credit Hours.**

Prerequisite: Junior or senior status; a minimum of 60 semester credit hours. A study of the spring forbs emphasizing identification of the more common wildflowers of Texas. Family characteristics, flower anatomy, plant morphology, and plant-collecting techniques will be included. Lecture, laboratory, and fieldwork will be a part of the course. (Same as ES 3213. Credit cannot be earned for both BIO 3273 and ES 3213.) Generally offered: Spring. Differential Tuition: \$150. Course Fee: STFE \$40.

**BIO 3283. Ecology. (3-0) 3 Credit Hours.**

Prerequisite: BIO 1203 and BIO 1223, or equivalents. Examination of the interactions of biotic and abiotic systems, including interactions of plants, animals, and the environment. (Same as ES 3033. Credit cannot be earned for both BIO 3283 and ES 3033.) Generally offered: Fall, Spring, Summer. Differential Tuition: \$150.

**BIO 3292. Ecology Laboratory. (0-6) 2 Credit Hours.**

Prerequisite: BIO 1201 and BIO 1221, or equivalents, are required; concurrent enrollment in BIO 3283 is recommended. A laboratory and field-oriented course emphasizing modern ecological techniques, including examinations of plant and animal populations and measurement of selected chemical and physical parameters. (Same as ES 3042. Credit cannot be earned for both BIO 3292 and ES 3042.) Generally offered: Fall, Spring, Summer. Differential Tuition: \$100. Course Fee: IUS1 \$15; L001 \$30; STFB \$40.

**BIO 3293. Mammalogy. (2-3) 3 Credit Hours.**

Prerequisite: ES 1113 and ES 1123 with a grade of "C-" or better. A course covering various aspects of the biology of mammals, including anatomy, physiology, systematics, evolution, behavior, ecology, and biogeography. Field trips may be required. (Same as ES 3173. Credit cannot be earned for both ES 3173 and BIO 3293.) Generally offered: Fall of odd years. Differential Tuition: \$150. Course Fee: L001 \$10; STFE \$10.

**BIO 3303. Entomology. (2-3) 3 Credit Hours.**

Prerequisite: BIO 1203 and BIO 1223 with a grade of "C-" or better; restricted to students who have completed 60 or more hours. A course covering various aspects of the biology of insects, including systematics, anatomy, physiology, evolution, behavior, ecology, and biogeography. (Same as ES 3183. Credit cannot be earned for both BIO 3303 and ES 3183.) Generally offered: Spring even years. Field trips may be required. Differential Tuition: \$150. Course Fee: L001 \$10; STFE \$10.

**BIO 3323. Evolution. (3-0) 3 Credit Hours.**

Prerequisite: BIO 1203, BIO 1223, and BIO 2313 with a grade of "C-" or better. This course is an introduction to the theories and mechanisms of evolution, focusing on evolutionary change of molecular, developmental, morphological, and behavioral traits. Topics include molecular evolution, natural selection and microevolution, phylogenetics, systematics, speciation, macroevolution, biogeography, and the fossil record. This course includes a diverse taxonomic focus, from prokaryotes to plants to animals. Discussion of the importance of evolutionary theory for diverse biological fields (from medicine to conservation) is included. Differential Tuition: \$150. Course Fee: DL01 \$75.

**BIO 3333. Plants and Society. (3-0) 3 Credit Hours.**

Prerequisite: BIO 1203 and BIO 1223 with a grade of "C-" or better; restricted to students who have completed 60 or more hours. The importance of plants and plant-derived products to human health and wellbeing through the provision of food, pharmaceuticals, and other important natural products. (Formerly listed as BIO 2343 in previous catalogs. Credit cannot be earned for both BIO 3333 and BIO 2343.) Generally offered: Spring. Differential Tuition \$150.

**BIO 3343. Plant Cell Biology. (3-0) 3 Credit Hours.**

Prerequisite: BIO 1203 and BIO 1223 with a grade of "C-" or better; restricted to students who have completed 60 or more hours. A comprehensive study of the molecular structures and functions of plant cells and their integration into the whole plant system. (Formerly titled "Plant Sciences.") Generally offered: Spring. Differential Tuition \$150.

**BIO 3353. Herpetology. (2-3) 3 Credit Hours.**

Prerequisite: BIO 1203 and BIO 1223 with a grade of "C-" or better. A course covering various aspects of the biology of amphibians and reptiles, including anatomy, physiology, systematics, evolution, behavior, ecology, and biogeography. Field trips may be required. (Same as ES 3193. Credit cannot be earned for both ES 3193 and BIO 3353.) Generally offered: Fall of odd years. Differential Tuition: \$150. Course Fee: L001 \$10; STFE \$10.

**BIO 3382. Sophomore Research Initiative Peer Mentor. (0-6) 2 Credit Hours.**

Prerequisite: BIO 3053, completion of the Sophomore Research Initiative, and consent of instructor. Student will be a peer mentor for students in the Sophomore Research Initiative (SRI) in a laboratory in which they were previously enrolled, and which they completed with a grade of "A" or "B". Students will work under the guidance of a graduate teaching assistant or laboratory coordinator. Besides assisting in the laboratory, students will be expected to attend group meetings associated with the laboratory, help with setup of the laboratories and complete a written assignment at the end of the semester. Students will not have any student grading responsibility. Can be repeated once for credit. Differential Tuition: \$100. Course Fee: IUS1 \$15; L001 \$30.

**BIO 3413. Physiology. (3-0) 3 Credit Hours.**

Prerequisite: BIO 1203 and BIO 1223 with a grade of "C-" or better. Physiology of systems of higher animals and plants, including circulation, regulation of body fluids, nervous system, muscle, sensory systems, and photosynthesis. Generally offered: Fall, Spring, Summer. Differential Tuition: \$150.

**BIO 3422. Physiology Laboratory. (0-6) 2 Credit Hours.**

Prerequisite: Completion of or concurrent enrollment in BIO 3413. Basic understanding of the physiological processes in living systems, employing methods and instruments of biological research. Generally offered: Fall, Spring, Summer. Differential Tuition: \$100. Course Fee: IUS1 \$15; L001 \$30.

**BIO 3483. Biology of Human Reproduction. (3-0) 3 Credit Hours.**

An in-depth look at human reproductive anatomy, physiology, and behavior. Topics to be considered include anatomy, sex differentiation, neuroendocrine physiology, conception and development, birth control, and sexually transmitted diseases. (Formerly BIO 1023 and BIO 2003 in previous catalogs. Credit can only be earned for one of the following: BIO 2003, BIO 1023, or BIO 3483.) Generally offered: Spring. Course Fee: LRS1 \$46.20; STSI \$21.60.

**BIO 3523. Advanced Computational Biology. (3-0) 3 Credit Hours.**

Prerequisite: BIO 1173 or CS 1173 with a grade of "C-" or better. Development and application of computational approaches to biological questions, with focus on formulating interdisciplinary problems as computational problems and then solving these problems using algorithmic techniques. Generally offered: Spring. Differential tuition: \$150. Course Fee: IUS1 \$15.

**BIO 3642. Clinical Anatomy Laboratory I. (0-6) 2 Credit Hours.**

Prerequisite: BIO 2992 and BIO 3413 with a grade of "C-" or better; completion of or concurrent enrollment in BIO 3643. Designed for pre-medical and pre-dental students. Not recommended for pre-nursing and allied health students. This is the first laboratory course in a two part series that teaches the structure of the human body at a level required for clinical medicine. Generally offered: Fall. Differential Tuition: \$100. Course Fee: IUS1 \$15; L001 \$30.

**BIO 3643. Advanced Physiology I. (3-0) 3 Credit Hours.**

Prerequisite: BIO 2992 and BIO 3413 with a grade of "C-" or better; completion of or concurrent enrollment in BIO 3642. This is the first lecture course in a two part series that teaches the structure and functions of the human body at a level required for clinical medicine. The course covers normal physiology, as well as selected diseases. This course will cover foundational basics on the cell, body fluids, the autonomic nervous system, and endocrine system. The ultimate goal is for students to develop an understanding of the integrated functions of the normal body and "problem solving" and "critical thinking" skills in evaluating clinical situations. Generally offered: Fall. Differential Tuition: \$150.

**BIO 3652. Clinical Anatomy Laboratory II. (0-6) 2 Credit Hours.**

Prerequisite: BIO 3643 and BIO 3642 with a grade of "C-" or better; completion of or concurrent enrollment in BIO 3653. Designed for pre-medical and pre-dental students. Not recommended for pre-nursing and allied health students. This is the second laboratory course in a two part series that teaches the structure of the human body at a level required for clinical medicine. Generally offered: Spring. Differential Tuition: \$100. Course Fee: IUS1 \$15; L001 \$30.

**BIO 3653. Advanced Physiology II. (3-0) 3 Credit Hours.**

Prerequisite: BIO 3643 and BIO 3642 with a grade of "C-" or better; completion of or concurrent enrollment in BIO 3652. Designed for pre-medical and pre-dental students. Not recommended for pre-nursing and allied health students. This is the second lecture course in a two part series that teaches the structure and functions of the human body at a level required for clinical medicine. The course covers cardiovascular, respiratory, renal, and gastrointestinal; with a final integration section which applies the physiological principles learned to special situations. The ultimate goal is for students to develop an understanding of the integrated functions of the normal body and "problem solving" and "critical thinking" skills in evaluating clinical situations. Generally offered: Spring. Differential Tuition: \$150.

**BIO 4002. Professional Development for Biology Careers. (2-0) 2 Credit Hours.**

Prerequisite: Restricted to Biology majors with at least 90 credit hours. A semester-long professional development seminar aimed at enhancing students' academic training, career readiness, and marketability for biology careers. Differential Tuition: \$100.

**BIO 4033. Conservation Biology. (3-0) 3 Credit Hours.**

Prerequisite: BIO 3283 or ES 3033 or equivalents. Class topics will include identifying and/or explaining biological and ecological principles central to conservation biology; critically evaluating reasons for conserving ecosystems and ecosystem services; explaining how the human dimension (human behavior, economics, land use, and others) affects the conservation of species; evaluating strategies and tools used to conserve species or habitat at risk of extinction or destruction; demonstrating skills in science communication: articulate and communicate a breadth of knowledge of conservation biology, conservation challenges, policies, and programs. (Same as BIO 4033. Credit cannot be earned for both ES 4213 and BIO 4033.) Generally offered: Spring. Differential Tuition: \$150.

**BIO 4043. Desert Biology. (2-3) 3 Credit Hours.**

Prerequisite: A minimum of 60 semester credit hours or consent of instructor. Corequisites: BIO 4233 and BIO 4241. A multi-week, off-campus, field-oriented course focused on the study of the deserts of the world, emphasizing the deserts of the American Southwest. Adaptations of plants and animals and their responses to desert conditions, as well as examinations of desert climatic patterns, geology, and natural history. (Same as ES 4123. Credit cannot be earned for both BIO 4043 and ES 4123.) Special fee to cover transportation and campsite costs. Generally offered: Summer. Differential Tuition \$150. Course Fee: IUS1 \$15.

**BIO 4053. Wildlife Biology. (3-0) 3 Credit Hours.**

Prerequisite: BIO 3283 with a grade of "C-" or better. Major environmental factors affecting wildlife, structure and behavior of wildlife populations, regional wildlife communities and their conservation. Field studies will allow students to observe and apply classroom topics. (Same as ES 4243. Credit cannot be earned for both BIO 4053 and ES 4243.) Generally offered: Fall. Differential Tuition: \$150.

**BIO 4063. Ornithology. (2-3) 3 Credit Hours.**

Prerequisite: BIO 1203 and BIO 1223 with a grade of "C-" or better. A course covering various aspects of the biology of birds, including anatomy, physiology, systematics, evolution, behavior, ecology, and biogeography. Field trips may be required. (Same as ES 3163. Credit cannot be earned for both ES 3163 and BIO 4063.) Generally offered: Spring of even years. Differential Tuition: \$150. Course Fee: L001 \$10; STFE \$10.

**BIO 4103. Social Science Research Methods. (3-0) 3 Credit Hours.**

Prerequisite: A minimum of 60 semester credit hours, or consent of the instructor. The objective of this course is to introduce social science research methods which are: (a) commonly used in biological research (e.g., human dimensions research, public lands management, medical research) and (b) essential for research directly engaging stakeholders and the public (e.g., citizen science or community-based research). The course engages ethical and legal obligations related to human-subjects research. It introduces 5 different data collection methods: surveys, interviews, focus groups, ethnographic and community-based research methods, and audiovisual/textual artifact analysis (e.g., photographs, etc.). Assignments emphasize writing skills specific to these methods and provide opportunities to actively engage different data collection methods (e.g., via field observations). Differential Tuition: \$150.

**BIO 4123. Internship in the Biological Sciences. (0-0) 3 Credit Hours.**

Prerequisite: Junior or senior status, in Academic Good Standing, and approval from the employer, the instructor, the Department Chair, and the Associate Dean for Undergraduate Studies; form available on the College of Sciences website. The opportunity for a semester-long work experience in a private business or public agency in a position related to the student's field of study. Generally offered: Fall, Spring, Summer. Differential Tuition: \$150.

**BIO 4233. Field Biology. (3-0) 3 Credit Hours.**

Prerequisite: A minimum of 60 semester credit hours or consent of instructor. Corequisites: BIO 4241 and BIO 4043. A multi-week, off-campus, field-oriented course offering the opportunity for practical experience observing, collecting, and identifying plants and animals of the American Southwest. (Same as ES 4113. Credit cannot be earned for both BIO 4233 and ES 4113.) Special fee to cover transportation and campsite costs. Generally offered: Summer. Differential Tuition \$150. Course Fee: IUS1 \$15; L001 \$30.

**BIO 4241. Field Biology Laboratory. (0-3) 1 Credit Hour.**

Prerequisite: A minimum of 60 semester credit hours, or consent of instructor. Corequisites: BIO 4233 and BIO 4043. A multi-week, off-campus, field-oriented course offering the opportunity for practical experience observing, collecting, and identifying plants and animals of the American Southwest. (Same as ES 4111. Credit cannot be earned for both BIO 4241 and ES 4111.) Special fee to cover transportation and campsite costs. Generally offered: Summer. Differential Tuition \$50. Course Fee: IUS1 \$15; L001 \$30.

**BIO 4263. River Ecosystems. (3-0) 3 Credit Hours.**

Prerequisite: BIO 3283 or ES 3033 with a grade of "C-" or better, and ES 3143. This course examines the physical, chemical, and biological factors that determine biodiversity and the structure and function of aquatic and riparian ecosystems. Key ecological, hydrological, and physicochemical concepts and their application to environmental concerns are covered. (Same as ES 4263. Credit cannot be earned for both BIO 4263 and ES 4263.) Generally offered: Spring of even years. Differential Tuition: \$150.

**BIO 4273. Fish Ecology. (3-0) 3 Credit Hours.**

Prerequisite: ES 2013, ES 2021, ES 2023, ES 2031, or equivalents. A study of the biotic and abiotic factors affecting the diversity and distribution of fishes, with a focus on North American and Texas freshwater fishes. This course is split into lecture-style classes focusing on the aforementioned topics and field trip classes during which students will learn how to implement basic survey methods, identify common freshwater fishes, and collect and analyze data. Field trips may be required. (Same as ES 4273. Credit cannot be earned for both BIO 4273 and ES 4273.) Generally offered: Fall even years. Differential Tuition: \$150. Course Fee: IUS1 \$15.

**BIO 4283. Plant-Soil-Microbe Interactions. (3-0) 3 Credit Hours.**

Prerequisite: ES 3123 with a grade of "C-" or better; restricted to students who have completed 60 or more hours. This course focuses on the microbial groups which live in soils and among plant species and the methodologies used to understand their interaction. (Same as ES 4283. Credit cannot be earned for both BIO 4283 and ES 4283.) Generally offered: Spring of odd years. Differential Tuition: \$150.

**BIO 4303. Aquatic Ecology. (3-0) 3 Credit Hours.**

This course focuses on the physical, chemical, and biological processes in groundwater, wetlands, streams, rivers, lakes, and reservoirs. Anthropogenic impacts will be discussed and evaluated. Students need to have a basic knowledge of ecology and chemistry. Students will learn about the physical and chemical aspects of aquatic systems and the life cycles and adaptations of aquatic organisms. After completion of the course, students will have a basic understanding of aquatic systems and the impacts of human activities on aquatic ecosystems. Differential Tuition: \$150.

**BIO 4313. Plant Physiological Ecology. (3-0) 3 Credit Hours.**

Prerequisite: BIO 3283 with a grade of "C-" or better. Survey of physiological approaches to understanding plant-environment interactions from the functional perspective. (Same as ES 4033. Credit cannot be earned for both BIO 4313 and ES 4033.) Generally offered: Fall of odd years. Differential Tuition: \$150.

**BIO 4323. Restoration Ecology. (3-0) 3 Credit Hours.**

Prerequisite: ES 3033 or BIO 3283, or equivalents. Applies ecological principles to the restoration of disturbed terrestrial, wetland, and aquatic ecosystems. Includes the restoration of soils and waterways, of flora and fauna, and of natural ecological processes such as plant succession and nutrient cycling. (Same as ES 4233. Credit cannot be offered for both BIO 4323 and ES 4233.) Generally offered: Spring. Differential Tuition: \$150.

**BIO 4453. Endocrinology. (3-0) 3 Credit Hours.**

Prerequisite: BIO 1203 or BIO 1233 with a grade of "C-" or better; restricted to students who have completed 60 or more hours. Topics include molecular mechanisms of hormone action in reproductive physiology, growth, development, and defects in hormonal regulation underlying clinically important syndromes (e.g., diabetes, hypertension, osteoporosis, and cancer). Differential Tuition: \$150.

**BIO 4643. Medicinal Plants. (3-0) 3 Credit Hours.**

Prerequisite: BIO 1203 and BIO 1223 with a grade of "C-" or better; restricted to students who have completed 60 or more hours; a course in biochemistry is recommended. Ethnobotanical, biochemical, and pharmacological aspects of some of our most important plant-derived drugs. Generally offered: Fall. Differential Tuition: \$150.

**BIO 4911. Independent Study. (0-0) 1 Credit Hour.**

Prerequisite: Permission in writing (form available) from the instructor, an undergraduate academic advisor, the Department Chair, and the Dean of the College in which the course is offered. Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but no more than 6 semester credit hours, regardless of discipline, will apply to a bachelor's degree. Only 6 semester credit hours of BIO 3043, BIO 4911-3, BIO 4923, and BIO 4993, in any combination, can be taken as BIO electives. Additional research hours of these courses (excluding Independent Study) may be taken as free electives, for a maximum of 12 research hours being applied to the bachelor's degree. Generally offered: Fall, Spring, Summer. Differential Tuition: \$50.

**BIO 4912. Independent Study. (0-0) 2 Credit Hours.**

Prerequisite: Permission in writing (form available) from the instructor, an undergraduate academic advisor, the Department Chair, and the Dean of the College in which the course is offered. Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but no more than 6 semester credit hours, regardless of discipline, will apply to a bachelor's degree. Only 6 semester credit hours of BIO 3043, BIO 4911-3, BIO 4923, and BIO 4993, in any combination, can be taken as BIO electives. Additional research hours of these courses (excluding Independent Study) may be taken as free electives, for a maximum of 12 research hours being applied to the bachelor's degree. Generally offered: Fall, Spring, Summer. Differential Tuition: \$100.

**BIO 4913. Independent Study. (0-0) 3 Credit Hours.**

Prerequisite: Permission in writing (form available) from the instructor, an undergraduate academic advisor, the Department Chair, and the Dean of the College in which the course is offered. Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but no more than 6 semester credit hours, regardless of discipline, will apply to a bachelor's degree. Only 6 semester credit hours of BIO 3043, BIO 4911-3, BIO 4923, and BIO 4993, in any combination, can be taken as BIO electives. Additional research hours of these courses (excluding Independent Study) may be taken as free electives, for a maximum of 12 research hours being applied to the bachelor's degree. Generally offered: Fall, Spring, Summer. Differential Tuition: \$150.

**BIO 4923. Laboratory Research: Biology Concentrations. (0-0) 3 Credit Hours.**

Prerequisite: Permission in writing (form available in the Biology Department Office) from the faculty mentor, the student's advisor, the Department Chair, and the Dean of the College. Supervised laboratory research mentored by a faculty member engaged in active research within the student's designated area of concentration. May be repeated for credit, but no more than 6 semester credit hours will apply to a bachelor's degree. Only 6 semester credit hours of BIO 3043, BIO 4911-3, BIO 4923, and BIO 4993, in any combination, can be taken as BIO electives. Additional research hours of these courses (excluding Independent Study) may be taken as free electives, for a maximum of 12 research hours being applied to the bachelor's degree. Generally offered: Fall, Spring, Summer. Differential Tuition: \$150.

**BIO 4951. Special Studies in Biology. (1-0) 1 Credit Hour.**

An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies may be repeated for credit when the topics vary, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor's degree. No more than 6 semester credit hours of BIO 2953, BIO 4951, or BIO 4953 can be applied to a B.S. degree in Biology or Microbiology and Immunology. Differential Tuition: \$50.

**BIO 4953. Special Studies in Biology. (3-0) 3 Credit Hours.**

An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies may be repeated for credit when the topics vary, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor's degree. No more than 6 semester hours of BIO 2953, BIO 4951, or BIO 4953 can be applied to a B.S. degree in Biology or Microbiology and Immunology. Generally offered: Fall, Spring, Summer. Differential Tuition: \$150. Course fee: DL01 \$75.

**BIO 4993. Directed Research. (0-0) 3 Credit Hours.**

Prerequisite: Approval from the instructor, the Department Chair, and the Associate Dean of Undergraduate Studies in the College for which this course is offered; form available on the College of Sciences website.

Supervised research mentored by a faculty member engaged in active research within the student's designated area of concentration. Students may produce a thesis in addition to active research. This course can also be used for students pursuing the COS Undergraduate Thesis Option.

May be repeated for credit with approval, but no more than 6 semester credit hours, regardless of discipline, will apply to a bachelor's degree.

Only 6 semester credit hours of BIO 4911-3, BIO 4923, and BIO 4993, in any combination, can be taken as BIO electives. Additional research hours of these courses (excluding Independent Study) may be taken as free electives, for a maximum of 12 research hours being applied to the bachelor's degree. Generally offered: Fall, Spring. Differential Tuition: \$150.