### BIOLOGY (BIO)

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

#### Biology (BIO) Courses

**BIO 1033. Drugs and Society. (3-0) 3 Credit Hours. (TCCN = PHED 1346)**
An examination of licit and illicit drugs and their biosocial effects. Topics include pharmacology of alcohol, stimulants, hallucinogens, addiction, and abuse. May be applied toward the Core Curriculum requirement in Social and Behavioral Sciences. Same as NDRB 1033. Credit cannot be earned for both NDRB 1033 and BIO 1033. Generally offered: Fall, Spring. Course fees: LRC1 $12; LRS1 $46.20; DL01 $75; STSI $21.60.

**BIO 1053. Introductory Microbiology. (3-0) 3 Credit Hours. (TCCN = BIOL 2320)**
Prerequisite: BIO 1203 (formerly BIO 1404) or BIO 1233. A general study of microorganisms, their characteristics, isolation, growth, and importance in nature, industry, public health, and human disease. (Formerly AHS 1053. Same as MMI 1053. Credit can only be earned for one of the following courses: BIO 1053, AHS 1053, or MMI 1053. BIO 1053 cannot substitute for BIO 3713.) Generally offered: Fall, Spring. Course Fees: LRS1 $46.20; STSI $21.60.

**BIO 1061. Introductory Microbiology Laboratory. (0-3) 1 Credit Hour. (TCCN = BIOL 2120)**
Prerequisites: BIO 1233 or BIO 1203 (formerly BIO 1404), and completion of or concurrent enrollment in BIO 1053. Course provides basic microbiology lab skills and procedures, with emphasis on the growth, identification, and control of microbes of concern to health-care professionals. Immunodeficient and pregnant students must contact the Coordinator, Microbiology Teaching Labs, for additional instructions prior to the class start date. (Formerly AHS 1061 in previous catalogs and same as MMI 1061. Credit cannot be earned for more than one of BIO 1061, AHS 1061, or MMI 1061. BIO 1061 cannot substitute for BIO 3722.) Generally offered: Fall, Spring, Summer. Course Fees: IUS1 $15; L001 $30; LRS1 $15.40; STSI $7.20; DL01 $25.

**BIO 1173. Introduction to Computational Biology. (3-0) 3 Credit Hours.**
Prerequisite: MAT 1193. 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: IUS1 $15; L001 $30; LRS1 $15.40; STSI $7.20.

**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 $46.20; STSI $21.60.

**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: IUS1 $15; L001 $30; LRS1 $15.40; STSI $7.20.

**BIO 1223. Biosciences II for Science Majors. (3-0) 3 Credit Hours. (TCCN = BIOL 1307)**
Prerequisite: BIO 1203. Concurrent enrollment in 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 Fees: 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 2003. 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 in previous catalogs. Credit cannot be earned for both BIO 2003 and BIO 1023.) Generally offered: Spring. Course Fees: 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 Fees: LRS1 $46.20; STSI $21.60; DL01 $75.

BIO 2051. Human Anatomy and Physiology Laboratory I. (0-3) 1 Credit Hour. (TCCN = BIOL 2101)
Prerequisites: BIO 1203 or BIO 1233; previous or concurrent enrollment in BIO 2053 is required. 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
lab schedule that uses both dissections of representative organisms and laboratory experimentation to study human anatomical systems and physiological processes. (Same as BIO 3642. Credit cannot be earned for both BIO 2051 and BIO 3642. BIO 2051 cannot substitute for BIO 3422.) Generally offered: Fall, Spring, Summer. Course Fees: 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 required. 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, the integumentary, skeletal, muscular, and nervous systems. (Same as BIO 3643. Credit cannot be earned for both BIO 2053 and BIO 3643. BIO 2053 cannot substitute for BIO 3413.) Generally offered: Fall, Spring, Summer. Course Fees: LRS1 $46.20; STSI $21.60; DL01 $75.

BIO 2061. Human Anatomy and Physiology Laboratory II. (0-3) 1 Credit Hour. (TCCN = BIOL 2102)
Prerequisites: BIO 2051; previous or concurrent enrollment in BIO 2063 is required. 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
lab 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 Fees: 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 required. 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. (Same as BIO 3653. Credit cannot be earned for both BIO 2063 and BIO 3653. BIO 2063 cannot substitute for BIO 3413.) Generally offered: Fall, Spring, Summer. Course Fees: LRS1 $46.20; STSI $21.60; DL01 $75.

BIO 2073. Sophomore Research Experience. (1-4) 3 Credit Hours.
Prerequisite: BIO 1203, BIO 1201, BIO 1223, and BIO 1221 with a grade
of at least a 'C-'. 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
techniques, bioinformatics, experimental design, and interpretation of
results. Generally offered: Fall and Spring.

BIO 2313. Genetics. (3-0) 3 Credit Hours. (TCCN = BIOL 2316)
Prerequisites: BIO 1223 and completion or concurrent enrollment in one of the following: MAT 1093 (or higher) or STA 1053. Principles governing
transmission of hereditary factors in plants and animals, with emphasis on
molecular, biochemical, and population genetics. Generally offered: Fall,
Spring, Summer. Course Fees: LRS1 $46.20; STSI $21.60; DL01 $75.

BIO 2362. Molecular Genetics Laboratory. (1-4) 2 Credit Hours.
Prerequisites: BIO 1223, CHE 1103, and completion or concurrent
enrollment in MAT 1093 or higher. 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 Fees: 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 at least a 'C'.
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. Course Fees: LRS1 $30.80; STSI $14.40.

BIO 3013. Introduction to Clinical Medicine and Pathology. (3-0) 3 Credit Hours.
Prerequisites: 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
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 3503. Sophomore Research Experience. (1-4) 3 Credit Hours.
Prerequisite: BIO 1203, BIO 1201, BIO 1223, and BIO 1221 with a grade of at least a 'C-'. 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 techniques, bioinformatics, experimental design, and interpretation of results. Generally offered: Spring. Differential Tuition: $150.

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. (3-0) 3 Credit Hours.
Prerequisite: BIO 1203 and BIO 1223 with a grade of at least a 'C-'. Restricted to students who have completed 60 or more hours. The 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 Fees: IUS1 $15; STFB $40.

BIO 3123. Comparative Vertebrate Anatomy. (3-0) 3 Credit Hours.
Prerequisite: BIO 1203 and BIO 1223 with a grade of at least a 'C-'. 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: DLO $75.

BIO 3213. Animal Behavior. (3-0) 3 Credit Hours.
Prerequisite: BIO 1203 and BIO 1223 with a grade of at least a 'C-'. 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. (Same as NDRB 3213. Credit cannot be earned for both NDRB 3213 and BIO 3213.) Generally offered: Fall, Summer. Spring. Differential Tuition $150. Course fee: DLO $75.

BIO 3253. R Coding in Environmental Science and Ecology. (3-0) 3 Credit Hours.
Prerequisite: BIO 1173 or CS 1173 with a grade of at least a 'C'. 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. The Woody Plants. (2-3) 3 Credit Hours.
Prerequisites: BIO 1203 and BIO 1223 with a grade of at least a 'C-'. Restricted to students who have completed 60 or more hours. A study of the woody plants, emphasizing the characteristics of family, genus, and species. Includes identification of the common woody plants. Leaf, stem, and flower morphology, anatomy, and collecting techniques. Lecture, laboratory, and fieldwork will be included as part of the course. (Same as ES 3263. Credit cannot be earned for both BIO 3263 and ES 3263.) Generally offered: Fall. Differential Tuition: $150. Course Fee: STFB $40.

BIO 3273. Biology of Flowering Plants. (2-3) 3 Credit Hours.
Prerequisites: BIO 1203 and BIO 1223 with a grade of at least a 'C-'. Restricted to students who have completed 60 or more hours. A study of the wildflowers of Texas emphasizing identification of the more common wildflowers, as well as family characteristics. Flower anatomy, plant morphology, and plant-collecting techniques will be included. Lecture, laboratory, and fieldwork will be included as 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.

BIO 3283. Principles of Ecology. (3-0) 3 Credit Hours.
Prerequisite: BIO 1223. A study of the interaction of organisms with their environment, with focus on ecological principles, adaptations of organisms, environmental pollution, and principles of conservation. (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. Principles of Ecology Laboratory. (0-6) 2 Credit Hours.
Prerequisites: BIO 1223 and completion of or concurrent enrollment in BIO 3283. A 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 Fees: IUS1 $15; L001 $30; STFB $40.

BIO 3293. Mammalogy. (3-0) 3 Credit Hours.
Prerequisite: BIO 1203 and BIO 1223 with a grade of at least a 'C-'. Restricted to students who have completed 60 or more hours. 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 BIO 3293 and ES 3173.) Generally offered in Fall of odd years. Differential Tuition: $150. Course Fee: IUS1 $15.
BIO 3303. Entomology. (3-0) 3 Credit Hours.
Prerequisite: BIO 1203 and BIO 1223 with a grade of at least a 'C-'.
Restricted to students who have completed 60 or more hours. A course covering various aspects of the biology of insects, including 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 odd years. Field trips may be required. Differential Tuition: $150.

BIO 3323. Evolution. (3-0) 3 Credit Hours.
Prerequisites: BIO 1203, BIO 1223, and BIO 2313 with a grade of at least a 'C-'.
Restricted to students who have completed 60 or more hours. A discussion of theories and possible mechanisms for evolutionary changes at various levels of organization. (Same as MMI 3323. Credit cannot be earned for both BIO 3323 and MMI 3323.) Generally offered: Spring. Differential Tuition: $150. Course fee: DL01 $75.

BIO 3333. Plants and Society. (3-0) 3 Credit Hours.
Prerequisites: BIO 1203 and BIO 1223 with a grade of at least a 'C-'.
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.
Prerequisites: BIO 1203 and BIO 1223 with a grade of at least a 'C-'.
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. (3-0) 3 Credit Hours.
Prerequisite: BIO 1203 and BIO 1223 with a grade of at least a 'C-'.
Restricted to students who have completed 60 or more hours. A course covering various aspects of the biology of amphibians and reptiles, including anatomy, physiology, systematics, evolution, behavior, ecology, and biogeography. (Same as ES 3193. Credit cannot be earned for both BIO 3353 and ES 3193.) Field trips may be required. Differential Tuition: $150. Course Fee: IUS1 $15.

BIO 3362. Molecular Biochemistry Laboratory. (1-4) 2 Credit Hours.
Prerequisites: BIO 2362, CHE 1103, and completion or concurrent enrollment in MAT 1093 or higher. A study of the microscopic, biochemical and molecular techniques used to investigate biochemical reactions and the structure and function of proteins in cells and tissues. Techniques will include: protein extraction, protein characterization, enzyme kinetics, chromatography, western blotting, Immunofluorescence and bioinformatics. (Same as BIO 3522, BIO 3822, NDRB 3362, and BME 3114. Credit cannot be earned for both BIO 3362 and any of the following: BIO 3522, BIO 3822, NDRB 3362, or BME 3114.) Generally offered: Fall, Spring, Summer. Differential Tuition: $100. Course Fees: IUS1 $15; L001 $30; DL01 $50.

BIO 3382. Sophomore Research Initiative Peer Mentor. (0-0) 2 Credit Hours.
Prerequisites: BIO 3362, completion of the Sophomore Research Initiative, and instructor consent. 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. Cannot be repeated for credit. Differential Tuition: $100. Course Fees: IUS1 $15; L001 $30.

BIO 3413. Physiology. (3-0) 3 Credit Hours.
Prerequisites: BIO 1203 and BIO 1223 with a grade of at least a 'C-'.
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. Course fee: DL01 $75.

BIO 3422. Physiology Laboratory. (1-5) 2 Credit Hours.
Prerequisite: Completion 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 Fees: DL01 $50; IUS1 $15; L001 $30.

BIO 3433. Neurobiology. (3-0) 3 Credit Hours.
Prerequisite: BIO 1203 with a grade of at least a 'C-'.
Restricted to students who have completed 60 or more hours. Anatomy and physiology of nervous systems; the mechanisms of neuronal functions. Same as NDRB 3433. Credit cannot be earned for both BIO 3433 and NDRB 3433. Generally offered: Fall, Spring. Differential Tuition: $150. Course fee: DL01 $75.

BIO 3442. Neurobiology Laboratory. (0-4) 2 Credit Hours.
Prerequisites: BIO 1203 with a grade of at least a C, and completion of or concurrent enrollment in BIO 3433. Restricted to students who have completed 60 or more hours. A laboratory course emphasizing principles presented in BIO 3433. Same as NDRB 3442. Credit cannot be earned for both BIO 3442 and NDRB 3442. Generally offered: Fall, Spring. Differential Tuition: $100. Course Fees: IUS1 $15; L001 $30; DL01 $50.

BIO 3513. Biochemistry. (3-0) 3 Credit Hours.
Prerequisites: BIO 1203, BIO 1223, and CHE 3643 with a grade of at least a 'C-'.
Restricted to students who have completed 60 or more hours. Introduction to biochemistry: amino acids, protein structure, enzymes, lipids, metabolism, nucleic acid structure, bioenergetics, and carbohydrates. (Same as CHE 4303. Credit cannot be earned for both BIO 3513 and CHE 4303.) Generally offered: Fall, Spring, Summer. Differential Tuition: $150. Course fee: DL01 $75.

BIO 3523. Advanced Computational Biology. (3-0) 3 Credit Hours.
Prerequisite: BIO 1173 or CS 1173 with a grade of at least a 'C-'.
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 3623. Neuropsychopharmacology. (3-0) 3 Credit Hours.
Prerequisites: BIO 1203 and BIO 1223 with a grade of at least a 'C-'.
Restricted to students who have completed 60 or more hours. BIO 3433 is recommended. A study of the pharmacology of drugs that affect the function of the central nervous system. Topics include drug-receptor interactions, drugs of abuse, and drugs used to treat mental illness. (Same as NDRB 3623. Credit cannot be earned for both BIO 3623 and NDRB 3623.) Generally offered: Fall. Differential Tuition: $150. Course fee: DL01 $75.

BIO 3642. Clinical Anatomy Laboratory I. (0-6) 2 Credit Hours.
Prerequisite: BIO 2992 and BIO 3413 with a grade of at least a 'C-'.
Concurrent enrollment in 3643 required. 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. Same as BIO 2051. Credit cannot be earned for both BIO 2051 and BIO 3642. Generally offered: Fall. Differential Tuition: $100. Course Fees: IUS1 $15; L001 $30.

BIO 3643. Advanced Physiology I. (3-0) 3 Credit Hours.
Prerequisite: BIO 2992 and BIO 3413 with a grade of at least a 'C-'.
Concurrent enrollment in 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. Same as BIO 2053. Credit cannot be earned for BIO 2053 and BIO 3643. 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 at least a 'C-'.
Concurrent enrollment in BIO 3653 required. 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. Same as BIO 2051. Credit cannot be earned for both BIO 2051 and BIO 3652. Generally offered: Spring. Differential Tuition: $100. Course Fees: IUS1 $15; L001 $30.

BIO 3653. Advanced Physiology II. (3-0) 3 Credit Hours.
Prerequisite: BIO 3643 and BIO 3642 with a grade of at least a 'C-'.
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. Same as BIO 2063. Credit cannot be earned for BIO 2063 and BIO 3653. Generally offered: Spring. Differential Tuition: $150.

BIO 3663. Human Embryology. (3-0) 3 Credit Hours.
Prerequisites: BIO 1203, BIO 1223, and BIO 2313 with a grade of at least a 'C-'. Restricted to students who have completed 60 or more hours. Development of the human embryo from fertilization to the birth of the fetus. The origin of various tissues and organs will be followed during development. Environmental and genetic factors that can alter development will be discussed. Same as NDRB 3663. Credit cannot be earned for both BIO 3663 and NDRB 3663. Generally offered: Fall. Differential Tuition: $150.

BIO 3713. Microbiology. (3-0) 3 Credit Hours.
Prerequisite: BIO 1203 and BIO 1223; restricted to students who have completed 60 or more hours; concurrent enrollment in MMI 3722 is recommended for students intending to complete both courses. A comprehensive study of microorganisms, including their composition, morphology, growth, metabolism, classification, ecology, and significance in disease. BIO 1053 cannot substitute for BIO 3713. (Same as MMB 3713. Credit cannot be earned for both MMI 3713, BIO 3713, and ES 3103.) Generally offered: Fall, Spring, Summer. Differential Tuition: $150. Course fee: DL01 $75.

BIO 3722. Microbiology Laboratory. (0-6) 2 Credit Hours.
Prerequisites: BIO 1203 and BIO 1223 with at least a C-, and completion of or concurrent enrollment in BIO 3713. Restricted to students with 60 or more hours. Basic microbiology techniques with emphasis on microscopy; cell staining and characterization; species isolation techniques; bacterial cultivation, nutrition, and physical requirements; and the physical and chemical control of microbes. Immunodeficient and pregnant students must contact the Coordinator, Microbiology Teaching Labs, for additional instructions prior to the class start date. BIO 1061 cannot substitute for BIO 3722. Same as MMI 3722. Credit cannot be earned for both BIO 3722 and MMI 3722. Generally offered: Fall, Spring, Summer. Differential Tuition: $100. Course Fees: IUS1 $15; L001 $30; DL01 $50.

BIO 3743. Bacteriology. (3-0) 3 Credit Hours.
Prerequisite: BIO 2313 and BIO 3713 with a grade of at least a 'C-'. Restricted to students with at least 60 hours. A study of the phylogeny of prokaryotes; structure and function of prokaryotic cells; ecology and physiological diversity of prokaryotes; growth and control of microorganisms; genetics of bacteria and bacteriophages; bacteria as agents of disease; antibacterials and other chemotherapeutics; human applications of microbiology, microbial genomics, and principles of microbial biotechnology. Same as MMI 3743. Credit cannot be earned for both BIO 3743 and MMI 3743. Generally offered: Fall. Differential Tuition: $150. Course fee: DL01 $75.

BIO 3813. Cell Biology. (3-0) 3 Credit Hours.
Prerequisites: BIO 1203, BIO 1223, and BIO 2313 with a grade of at least a 'C-'. Restricted to students who have completed 60 or more hours. BIO 3513 is recommended. A study of cellular molecules and metabolic processes; synthesis and regulation of macromolecules; differential gene expression; membranes and organelles; cytoskeleton; cell cycle and growth of normal and neoplastic cells. (Same as BME 3114 and NDRB 3813. Credit cannot be earned for both BIO 3813 and BME 3114 or BIO 3813 and NDRB 3813.) Generally offered: Fall, Spring, Summer. Differential Tuition: $150. Course fee: DL01 $75.
BIO 3913. Molecular Biology. (3-0) 3 Credit Hours.
Prerequisites: BIO 1203, BIO 1223, and BIO 2313 with a grade of at least a 'C-'. Restricted to students who have completed 60 or more hours. BIO 3913 is recommended. A study of nucleotides, DNA, replication, recombination, RNA, transcription, genetic code, translation, genomes, and chromosomes. Same as NDRB 3913. Credit cannot be earned for both BIO 3913 and NDRB 3913. Generally offered: Fall, Spring. Differential Tuition: $150. Course fee: DL01 $75.

BIO 3933. Principles of Cancer Biology. (3-0) 3 Credit Hours.
Prerequisites: BIO 1203 and BIO 1223 with a grade of at least a 'C-'. Restricted to students who have completed 60 or more hours. BIO 3933 is recommended. A study of the underlying molecular and cellular biology involved in carcinogenesis, the roles of oncogenes and tumor suppressor genes in cancer development and progression, and modern technologies in cancer screening, diagnosis, treatments, and prevention. Upon completion of the class, students should have gained a basic understanding of the mechanisms by which tumors arise and progress to cancer, potential therapeutic targets in cancer treatments, and an individual's actions that are expected to decrease the chances of cancer development. Same as NDRB 3933. Credit cannot be earned for both BIO 3933 and NDRB 3933. Generally offered: Fall, Spring. Differential Tuition $150.

BIO 4033. Conservation Biology. (3-0) 3 Credit Hours.
Prerequisite: BIO 3283 with a grade of at least a 'C-'. The class topics will include studying the nature of the biosphere, threats to its integrity, and ecologically sound responses to these threats. Also included will be the origin and preservation of biotic diversity, how the rich variety of plant and animal life around us arose, how it has been maintained by natural processes, and how we can prevent its destruction. (Same as ES 4213. Credit cannot be earned for both BIO 4033 and ES 4213.) Generally offered: Fall. Differential Tuition: $150. Course fee: DL01 $75.

BIO 4043. Desert Biology. (2-3) 3 Credit Hours.
Prerequisites: BIO 1203 and BIO 1223 with a grade of at least a 'C-'. Restricted to students who have completed 60 or more hours, or consent of instructor. Concurrent enrollment in BIO 4043 and BIO 4241 required. A study of the deserts of the world with an emphasis on U.S. deserts. Adaptations of plants and animals and their responses to desert conditions, as well as examinations of desert climatic patterns, geology, and natural history. Lecture, laboratory, and fieldwork will be included. (Same as ES 4123. Credit cannot be earned for both BIO 4043 and ES 4213.) Generally offered: Summer. Differential Tuition $150. Course Fees: IUS1 $15; L001 $30.

BIO 4053. Wildlife Ecology. (3-0) 3 Credit Hours.
Prerequisite: BIO 3283 with a grade of at least a 'C-'. 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: Summer. Differential Tuition $150.

BIO 4063. Ornithology. (3-0) 3 Credit Hours.
Prerequisites: BIO 1203 and BIO 1223 with a grade of at least a 'C-'. Restricted to students who have completed 60 or more hours. A course covering various aspects of the biology of birds, including anatomy, physiology, systematics, evolution, behavior, ecology, and biogeography. Field trips will be included. (Same as ES 3163. Credit cannot be earned for both BIO 4063 and ES 3163.) Generally offered: Spring. Differential Tuition $150.

BIO 4143. Developmental Biology. (3-0) 3 Credit Hours.
Prerequisites: BIO 1203, BIO 1223, and BIO 2313 with a grade of at least a 'C-'. Restricted to students who have completed 60 or more hours. BIO 3913 is recommended. Overview of developmental biology focusing on the origins of classical concepts as well as modern molecular approaches. Emphasis will be placed on the mechanisms underlying developmental processes using both invertebrate and vertebrate examples. Subjects include axis formation, induction, morphogenesis, embryonic pattern formation, cell differentiation, and organogenesis. (Formerly listed as BIO 3143 in previous catalogs. Same as NDRB 4143. Credit cannot be earned for both BIO 4143 and BIO 3143 or BIO 4143 and NDRB 4143.) Generally offered: Fall. Differential Tuition: $150.

BIO 4233. Field Biology. (3-0) 3 Credit Hours.
Prerequisites: BIO 1203 and BIO 1223 with a grade of at least a 'C-'; restricted to students who have completed 60 or more hours, or consent of instructor. Corequisites: BIO 4241 and BIO 4033. A field-oriented course offering the opportunity for practical experience observing, collecting, and identifying Texas plants and animals. (Same as ES 4133. Credit cannot be earned for both BIO 4233 and ES 4133.) Generally offered: Summer. Differential Tuition $150. Course Fees: IUS1 $15; L001 $30.

BIO 4241. Field Biology Laboratory. (0-3) 1 Credit Hour.
Prerequisites: BIO 1203 and BIO 1223 with a grade of at least a 'C-'. Restricted to students who have completed 60 or more hours, or consent of instructor. Concurrent enrollment in BIO 4233 and BIO 4043 required. A field-oriented course offering the opportunity for practical experience observing, collecting, and identifying Texas plants and animals. (Same as ES 4111. Credit cannot be earned for both BIO 4241 and ES 4111.) Generally offered: Summer. Differential Tuition $50. Course Fees: IUS1 $15; L001 $30.

BIO 4263. River Ecosystems. (3-0) 3 Credit Hours.
Prerequisite: BIO 3283 with a grade of at least a 'C-'. This course examines the physical, chemical, and biological factors that determine biodiversity and the structure and function of aquatic and riparian ecosystems. Key ecological and hydrogeomorphology 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: BIO 3283 with a grade of at least a 'C-'. A study of the biotic and abiotic factors affecting the diversity and distribution of fishes, with a focus on North American freshwater fishes. This course will include (1) lectures and discussions covering patterns and processes in fish ecology; and (2) a collaborative research project covering computational techniques used in fish ecology. Same as ES 4273. Credit cannot be earned for both BIO 4273 and ES 4273. Generally offered: Fall of even years. Differential Tuition: $150.

BIO 4283. Plant-Soil-Microbe Interactions. (3-0) 3 Credit Hours.
Prerequisite: BIO 3283 with a grade of at least a 'C-'. This course focuses on the microbial groups which live in soils and among plant species and methodologies used to understand their interaction. Same as ES 4283. Credit cannot be earned for both BIO 4283 and ES 4283. Generally offered: Fall of even years. Differential Tuition: $150.
BIO 4303. Aquatic Ecology. (3-0) 3 Credit Hours.
Prerequisite: BIO 3283 with a grade of at least a 'C-'. Restricted to students who have completed 60 or more hours. Study of aquatic ecosystems including streams, wetlands, and lakes. Topics include watershed processes, biological communities, physical habitats, nutrient cycling, energy flow, and management issues. The course culminates with individual research projects focused on local watersheds. Field trips may be required. Same as ES 4023. Credit cannot be earned for both BIO 4303 and ES 4023. Generally offered: Spring. Differential Tuition: $150. Course Fee: STFB $40.

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.
Prerequisites: BIO 1203, BIO 1223, and BIO 2313 with a grade of at least a 'C'. Restricted to students who have completed 60 or more hours. Molecular, cellular, and physiological effects of hormones in health and disease. Topics include molecular mechanisms of hormone action in reproductive physiology, growth, and development, as well as defects in hormonal regulation underlying clinically important syndromes (e.g., diabetes, hypertension, osteoporosis, and cancer). Same as NDRB 4453. Credit cannot be earned for BIO 4453 and NDRB 4453. Generally offered: Fall. Differential Tuition: $150. Course Fee: DL01 $75.

BIO 4473. Advanced Clinical Medicine and Pathology. (3-0) 3 Credit Hours.
Prerequisite: BIO 3013 with a grade of at least a 'C-'. Advanced concepts in human disease, diagnosis, and underlying pathology. Same as MMI 4473. Credit cannot be earned for both BIO 4473 and MMI 4473. Generally offered: Spring. Differential Tuition $150.

BIO 4483. Medical Mycology. (3-0) 3 Credit Hours.
Prerequisites: BIO 3713 and BIO 3722 with a grade of at least a 'C'. Comprehensive study of causative agents, pathogenesis, and treatment of human fungal diseases. Same as MMI 4483. Credit cannot be earned for both BIO 4483 and MMI 4483. Generally offered: Spring. Differential Tuition $150. Course Fee: DL01 $75.

BIO 4583. Emergent Properties of Neural Circuits. (3-0) 3 Credit Hours.
Prerequisite: BIO 3433 with a grade of at least a 'C-'. Principles of cellular neurophysiology and neuroanatomy are used to explore the computational operations performed by neurons and networks of neurons. Same as NDRB 4583. Credit cannot be earned for both BIO 4583 and NDRB 4583. Generally offered: Spring. Differential Tuition: $150.

BIO 4643. Medicinal Plants. (3-0) 3 Credit Hours.
Prerequisites: BIO 1203 and BIO 1223 with a grade of at least a 'C'. Restricted to students who have completed 60 or more hours. BIO 3513 is recommended. Ethnobotanical, biochemical, and pharmacological aspects of some of our most important plant-derived drugs. Generally offered: Fall. Differential Tuition: $150.

BIO 4723. Virology. (3-0) 3 Credit Hours.
Prerequisite: BIO 2313 and BIO 3513 with a grade of at least a 'C'. Introduction to the molecular, genetic, and biological properties of viruses. Course will cover the basic concepts of virus structure, replication, virus/host interactions, pathogenesis, and evolution. Same as MMI 4723. Credit cannot be earned for both BIO 4723 and MMI 4723. Generally offered: Fall. Differential Tuition: $150.

BIO 4743. Immunology. (3-0) 3 Credit Hours.
Prerequisites: BIO 1203, BIO 1223, and BIO 2313 with a grade of at least a 'C'; restricted to students who have completed 60 or more hours; concurrent enrollment in BIO 4752 is recommended. A study of the properties of antigens and antibodies and current concepts of humoral and cell-mediated immunity and the cells involved. Same as MMI 4743. Credit cannot be earned for both BIO 4743 and MMI 4743. Generally offered: Fall, Spring, Summer. Differential Tuition: $150.

BIO 4752. Immunology Laboratory. (0-4) 2 Credit Hours.
Prerequisites: BIO 1203, BIO 1223, BIO 2313, BIO 2362 (or BIO 2322 in previous catalogs), and completion of or concurrent enrollment in BIO 4743, all with a grade of at least a 'C'. Restricted to students who have completed 60 or more hours. Laboratory applications of principles presented in BIO 4743. (Formerly listed as BIO 4751 in previous catalogs. Same as MMI 4752. Credit cannot be earned for both BIO 4752 and MMI 4752.) Generally offered: Fall, Spring, Summer. Differential Tuition: $100. Course Fees: IUS1 $15; L001 $30; DL01 $50.

BIO 4763. Parasitology. (3-0) 3 Credit Hours.
Prerequisites: BIO 1203, BIO 1223, and BIO 2313 with a grade of at least a 'C'. Restricted to students who have completed 60 or more hours. BIO 3713 is strongly recommended. This course is focused on eukaryotic parasites of medical or veterinary importance: their life cycles, epidemiology, control, and the diseases and pathology they cause. Evolutionary aspects of host-parasite interactions, the diversity of parasite biology, and the interrelationships between parasitology, vector biology, and public health will be emphasized. Same as MMI 4763. Credit cannot be earned for both BIO 4763 and MMI 4763. Generally offered: Spring. Differential Tuition $150. Course fee: DL01 $75.

BIO 4773. Microbial Ecology and Metagenomics. (3-0) 3 Credit Hours.
Prerequisites: BIO 1053 and BIO 2313. This course will provide an overview of microbial ecology principles and application of microbial ecological approaches to understand microbial structure and function across environments, including the soil, freshwater and marine environments. The course will focus its content on prokaryotes and fungi. An emphasis in this course will be on learning foundational concepts in microbiome science and applying concepts to laboratory and computational techniques through hands-on experiments. Same as MMI 4773. Credit cannot be earned for both BIO 4773 and MMI 4773. Generally offered: Fall, Spring. Differential Tuition: $150.

BIO 4783. Microbial Genomes and Virulence. (3-0) 3 Credit Hours.
Prerequisite: BIO 2313. MMI 3713 is recommended. This course is focused on microbial pathogens of medical importance. Insights into the genome makeup and virulence inventories of pathogens is essential for understanding their biology, epidemiology, human diseases they cause, and trajectories of pathogen evolution. Topics covered include the basic concepts of genome sequencing, pathogen-specific virulence traits, and the role of genetic exchange in genome evolution, speciation, fitness, and pathogenicity. Same as MMI 4783. Credit cannot be earned for both BIO 4783 and MMI 4783. Generally offered: Spring. Differential Tuition $150. Course fee: DL01 $75.
BIO 4813. Brain and Behavior. (3-0) 3 Credit Hours.
Prerequisites: BIO 1203 and BIO 1223 with a grade of at least a 'C'. Restricted to students who have completed 60 or more hours. This course explores the brain basis of behavior, with a focus on understanding the neurophysiological, neurochemical, and neuroanatomical underpinnings for a variety of simple and complex behaviors. Students will explore topics such as sensation and perception, pain, movement, sleep, biological rhythms, emotions, addiction, learning and memory, and neurodevelopment. The topics are grounded with examples of typical human behavior and disorders, such as Parkinson's disease, autism, schizophrenia, and psychopathology. Same as NDRB 4813. Credit cannot be earned for more than one of BIO 4813, PSY 4183, or NDRB 4813. Generally offered: Fall. Differential Tuition: $150. Course fee: DL01 $75.

BIO 4823. Cognitive Neuroscience. (3-0) 3 Credit Hours.
Prerequisite: BIO 3433 or BIO 4813 or PSY 4183, with a grade of at least a C, or consent of instructor. The biological basis of cognition, including perception, attention, learning, memory, emotion, language, and executive function. The course introduces students to the use of human neuroimaging experiments and clinical population, as well as research with other species, to study the brain basis of complex behavior and cognitive disorders, such as memory loss, language impairment, and developmental disorders. Same as NDRB 4823. Credit cannot be earned for both BIO 4823 and NDRB 4823. Generally offered: Spring. 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 credit 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 4981. Senior Seminar in Microbiology and Immunology. (1-0) 1 Credit Hour.
Prerequisite: Senior status, a minimum of 90 semester credit hours. This course is only open to seniors in the Microbiology and Immunology degree program. Students will learn how to interpret the scientific literature and to organize and present scientific research findings as reported in the current literature. May be repeated for credit. The grade report for the course is either "CR" (satisfactory performance) or "NC" (unsatisfactory performance). Generally offered: Fall, Spring. Differential Tuition: $50. Course fee: DL01 $25.
**BIO 4993. Honors Research. (0-0) 3 Credit Hours.**
Prerequisite: Students taking this course must have approval by the Honors College or College Honors Committee, must be a Biology major, must be either a member of the Honors College or pursuing College of Sciences Honors, and must be in the last two semesters of study. Supervised research and preparation of an Honors Thesis. 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.