

## Biological Sciences

Dr. Max Sanderford, Department Head  
 Department of Biological Sciences  
 Science Building, Room 203 C  
 Box T-0100  
 Stephenville, Texas 76402  
 (254) 968-9162  
 sanderford@tarleton.edu  
 www.tarleton.edu/biology (<http://www.tarleton.edu/biology/>)

The Department of Biological Sciences offers three distinct four-year curricula that lead to the baccalaureate degree. These are the Bachelor of Science in Biology, the Bachelor of Science in Biomedical Science, and the Bachelor of Science in Biotechnology (Fall 2022 pending THECB approval). In addition, Pre-Health professional programs are offered which include Pre-Medicine, Pre-Dentistry, Pre-Physical Therapy, Pre-Pharmacy, and Pre-Veterinary Medicine. The curricula are designed to maximize career opportunities and to prepare students for various graduate and professional school programs. The Department of Biological Sciences provides a broad range of courses and learning opportunities designed to prepare students for diverse careers. Particular attention is given to maintaining updated curricula to keep pace with the rapidly changing field of biology. Whenever possible we emphasize hands-on experience with the biological techniques and instrumentation used by biologists world-wide and encourage students to become involved in faculty initiated research experiences.

A Master of Science degree is also offered. For further information, see the graduate section (<http://catalog.tarleton.edu/grad/sciencetechnology/biologicalsciences/>) of this catalog.

### Bachelor of Science in Biology

#### The Bachelor of Science Degree in Biology

##### Required Courses

General Education Requirements ( <a href="http://catalog.tarleton.edu/academicaffairs/">http://catalog.tarleton.edu/academicaffairs/</a> ) <sup>1</sup>		43
BIOL 1406	Biology for Science Majors	4
BIOL 1407	Biology for Science Majors II	4
BIOL 2300	Cell Biology	3
BIOL 3407	Microbiology	4
BIOL 3303	Genetics	3
BIOL 3103	Genetic Techniques	1
BIOL 3353	Ecology and Evolution	3
or BIOL 3363	Study Abroad: Ecology and Evolution	
BIOL 4398 [WI ( <a href="http://catalog.tarleton.edu/academicaffairs/">http://catalog.tarleton.edu/academicaffairs/</a> )]	Current Topics in the Life Sciences	3
CHEM 1311 & CHEM 1111 [shared]	College Chemistry I (Lecture and College Chemistry I (Laboratory) <sup>2</sup>	
CHEM 1312 & CHEM 1112 [shared]	College Chemistry II (Lecture and College Chemistry II (Laboratory) <sup>2</sup>	
PHYS 1401	College Physics I	4
CHEM 2323 & CHEM 2123	Organic Chemistry I and Organic Chemistry I Laboratory	4
PHYS 1402	College Physics II	4
ENGL 1301 [shared] [WI ( <a href="http://catalog.tarleton.edu/academicaffairs/">http://catalog.tarleton.edu/academicaffairs/</a> )]	Composition I	
ENGL 1302 [shared] [WI ( <a href="http://catalog.tarleton.edu/academicaffairs/">http://catalog.tarleton.edu/academicaffairs/</a> )]	Composition II	
ENGL 3309 [WI ( <a href="http://catalog.tarleton.edu/academicaffairs/">http://catalog.tarleton.edu/academicaffairs/</a> )]	Technical Writing and Document Design	3
MATH 2412 [shared]	Precalculus Math (shared)	
<b>Total Hours</b>		<b>83</b>

##### Additional Required Courses for Concentrations

###### General Without Certification

Advanced BIOL Electives		18
MATH 3450	Principles of Bio-Statistics	4
Electives (6 Hours Advanced)		15
<b>Total Hours</b>		<b>37</b>

###### Aquatic Ecology

BIOL 3449	Animal Diversity	4
BIOL 4401	Ecology	4
BIOL 4462	Ichthyology	4
BIOL 4441	Freshwater Biology	4
BIOL 3340	Introduction to Marine Biology	3
EASC 3350	Environmental Science	3
GEOL 1403	Physical Geology	4
MATH 3450	Principles of Bio-Statistics	4
EASC 3340	Oceanography	3
BIOL 3430	Phycology	4
<b>Total Hours</b>		<b>37</b>

**Environmental**

BIOL 3415	Plant Taxonomy	4
BIOL 3436	Plant Physiology	4
BIOL 3449	Animal Diversity	4
BIOL 4401	Ecology	4
BIOL 4441	Freshwater Biology	4
or BIOL 4462	Ichthyology	
BIOL 3340	Introduction to Marine Biology	3
EASC 3350	Environmental Science	3
GEOL 1403	Physical Geology	4
MATH 3450	Principles of Bio-Statistics	4
Electives		3
<b>Total Hours</b>		<b>37</b>

**Molecular**

BIOL 3413	Molecular Biology	4
BIOL 3485	Immunology	4
BIOL 3395	Pathogenic Microbiology	3
BIOL 4374	Biochemistry I	3
BIOL 4375	Biochemistry II	3
BIOL 4378	Biochemistry Lab	3
CHEM 2325 & CHEM 2125	Organic Chemistry II and Organic Chemistry II Laboratory	4
MATH 3450	Principles of Bio-Statistics	4
Electives (4 Hours Advanced)		9
<b>Total Hours</b>		<b>37</b>

**Wildlife**

BIOL 3415	Plant Taxonomy	4
BIOL 3449	Animal Diversity	4
or BIOL 3436	Plant Physiology	
BIOL 4401	Ecology	4
BIOL 4420	Terrestrial Field Ecology	4
Select any 3 of the following courses:		12
BIOL 4430	Ornithology	
BIOL 4440	Herpetology	
BIOL 4451	Mammalogy	
BIOL 4462	Ichthyology	
MATH 3450	Principles of Bio-Statistics	4
WSES 2322	Principles of Wildlife Conservation and Management	3
Elective		2
<b>Total Hours</b>		<b>37</b>

**Zoology**

BIOL 3406	Comparative Vertebrate Anatomy	4
BIOL 3449	Animal Diversity	4
MATH 3450	Principles of Bio-Statistics	4
BIOL 4340	Developmental Biology	3
Select 22 hours from the following:		22
BIOL 4320	Behavioral Ecology	
BIOL 4430	Ornithology	
BIOL 4440	Herpetology	
BIOL 4445	Parasitology	
BIOL 4451	Mammalogy	
BIOL 4462	Ichthyology	
BIOL 4460	Animal Physiology	
<b>Total Hours</b>		<b>37</b>

**Terrestrial Ecology**

BIOL 3449	Animal Diversity	4
BIOL 4401	Ecology	4
BIOL 4320	Behavioral Ecology	3
BIOL 4420	Terrestrial Field Ecology	4
MATH 3450	Principles of Bio-Statistics	4
WSES 4309 [WI ( <a href="http://catalog.tarleton.edu/academicaffairs/">http://catalog.tarleton.edu/academicaffairs/</a> )]	Plant-Animal Interactions	3
WSES 4311	Fire Ecology	3
One of the Following Courses:		4

BIOL 4445	Parasitology	
BIOL 3436	Plant Physiology	
One of the Following Courses:		4
BIOL 4430	Ornithology	
BIOL 4440	Herpetology	
BIOL 4451	Mammalogy	
Advanced Elective		4
<b>Total Hours</b>		<b>37</b>

### Botany

MATH 3450	Principles of Bio-Statistics	4
BIOL 3415	Plant Taxonomy	4
BIOL 3420	Plant Pathology	4
BIOL 3449	Animal Diversity	4
BIOL 3430	Phycology	4
BIOL 4401	Ecology	4
BIOL 3436	Plant Physiology	4
BIOL 4086	Biology Problems (Herbarium Techniques Botanical Research Institute of Texas)	3
Biology Elective		3
WSES 4309 [WI ( <a href="http://catalog.tarleton.edu/academicaffairs/">http://catalog.tarleton.edu/academicaffairs/</a> )]	Plant-Animal Interactions	3
<b>Total Hours</b>		<b>37</b>

1

Please see Academic Information section.

2

Course may be counted toward general education requirement.

## Bachelor of Science in Biomedical Science

### The Bachelor of Science Degree in Biomedical Science

#### Required Courses

General Education Requirements ( <a href="http://catalog.tarleton.edu/academicaffairs/">http://catalog.tarleton.edu/academicaffairs/</a> ) <sup>1</sup>		43
BIOL 1406	Biology for Science Majors	4
BIOL 1407	Biology for Science Majors II	4
BIOL 2300	Cell Biology	3
BIOL 3406	Comparative Vertebrate Anatomy	4
BIOL 3303	Genetics	3
BIOL 3103	Genetic Techniques	1
BIOL 3407	Microbiology	4
BIOL 3353	Ecology and Evolution	3
or BIOL 3363	Study Abroad: Ecology and Evolution	
BIOL 4460	Animal Physiology	4
BIOL 4374	Biochemistry I	3
BIOL 4398 [WI ( <a href="http://catalog.tarleton.edu/academicaffairs/">http://catalog.tarleton.edu/academicaffairs/</a> )]	Current Topics in the Life Sciences	3
CHEM 1311 & CHEM 1111 [shared]	College Chemistry I (Lecture) and College Chemistry I (Laboratory) <sup>2</sup>	
BIOL 1185	Career Pathways in Biomedical Science	1
CHEM 1312 & CHEM 1112 [shared]	College Chemistry II (Lecture) and College Chemistry II (Laboratory) <sup>2</sup>	
PHYS 1401	College Physics I	4
or PHYS 2425	University Physics I	
CHEM 2123	Organic Chemistry I Laboratory	1
CHEM 2323	Organic Chemistry I	3
PHYS 1402	College Physics II	4
or PHYS 2426	University Physics II	
<b>Placement into MATH 2413 is based upon the score obtained on the college level MATH placement exam</b>		
MATH 2412 [shared]	Precalculus Math	
or MATH 2413	Calculus I	
MATH 3450	Principles of Bio-Statistics	4
ENGL 1301 [shared] [WI ( <a href="http://catalog.tarleton.edu/academicaffairs/">http://catalog.tarleton.edu/academicaffairs/</a> )]	Composition I	
ENGL 1302 [shared] [WI ( <a href="http://catalog.tarleton.edu/academicaffairs/">http://catalog.tarleton.edu/academicaffairs/</a> )]	Composition II	
ENGL 3309 [WI ( <a href="http://catalog.tarleton.edu/academicaffairs/">http://catalog.tarleton.edu/academicaffairs/</a> )]	Technical Writing and Document Design	3
<b>Total Hours</b>		<b>99</b>

**Additional Required Courses for Concentrations****General Without Certification**

Select two of the following:		6-8
BIOL 3380	Introduction to Virology	
BIOL 3395	Pathogenic Microbiology	
BIOL 3402	Histology	
BIOL 3413	Molecular Biology	
BIOL 3485	Immunology	
BIOL 4340	Developmental Biology	
BIOL 4350	Vaccines	
BIOL 4445	Parasitology	
BIOL 4375	Biochemistry II	
BIOL 4378	Biochemistry Lab	
Electives (7 Hours Advanced)		15
<b>Total Hours</b>		<b>21</b>

**Pre-Medical/Pre-Dental**

PSYC 2301 [shared]	General Psychology	
BIOL 3485	Immunology	4
Select one of the following:		3-4
BIOL 3380	Introduction to Virology	
BIOL 3395	Pathogenic Microbiology	
BIOL 3402	Histology	
BIOL 3413	Molecular Biology	
BIOL 4340	Developmental Biology	
BIOL 4350	Vaccines	
BIOL 4445	Parasitology	
BIOL 4375	Biochemistry II	
BIOL 4378	Biochemistry Lab	
Electives (6 Hours Advanced)		10
CHEM 2325	Organic Chemistry II	3
CHEM 2125	Organic Chemistry II Laboratory	1
<b>Total Hours</b>		<b>21</b>

**Pre-Physical Therapy**

Select two of the following:		6-8
BIOL 3380	Introduction to Virology	
BIOL 3395	Pathogenic Microbiology	
BIOL 3402	Histology	
BIOL 3413	Molecular Biology	
BIOL 3485	Immunology	
BIOL 4340	Developmental Biology	
BIOL 4350	Vaccines	
BIOL 4445	Parasitology	
BIOL 4375	Biochemistry II	
BIOL 4378	Biochemistry Lab	
PSYC 2301 [shared]	General Psychology <sup>2</sup>	
PSYC 3307	The Human Lifespan	3
SOCI 1301	Introductory Sociology	3
Advanced Electives		4
Electives		5
<b>Total Hours</b>		<b>21</b>

**Pre-Veterinary**

COMM 1315 [shared] or COMM 2302	Public Speaking Business and Professional Speaking	
PSYC 2301 [shared]	General Psychology	
BIOL 4375	Biochemistry II	3
Select one of the following:		3-4
BIOL 3380	Introduction to Virology	
BIOL 3395	Pathogenic Microbiology	
BIOL 3402	Histology	
BIOL 3413	Molecular Biology	
BIOL 3485	Immunology	
BIOL 4340	Developmental Biology	
BIOL 4350	Vaccines	
BIOL 4445	Parasitology	

BIOL 4378	Biochemistry Lab	
AGRI 1419	General Animal Science	4
CHEM 2125	Organic Chemistry II Laboratory	1
CHEM 2325	Organic Chemistry II	3
ANSC 3409	Feeds and Feeding <sup>4</sup>	4
or ANSC 3308	Principles of Animal Nutrition	
Advanced Electives <sup>4</sup>		3-4
<b>Total Hours</b>		<b>21</b>

### Pre-Pharmacy

Select 2 of the following:		6-8
BIOL 3380	Introduction to Virology	
BIOL 3395	Pathogenic Microbiology	
BIOL 3402	Histology	
BIOL 3413	Molecular Biology	
BIOL 3485	Immunology	
BIOL 4340	Developmental Biology	
BIOL 4350	Vaccines	
BIOL 4445	Parasitology	
BIOL 4375	Biochemistry II	
BIOL 4378	Biochemistry Lab	
MATH 2413	Calculus I <sup>3</sup>	4
CHEM 2125	Organic Chemistry II Laboratory	1
CHEM 2325	Organic Chemistry II	3
ECON 2301 [shared]	Principles of Macroeconomics <sup>2</sup>	
PHIL 1301 [shared]	Introduction to Philosophy <sup>2</sup>	
Advanced Electives		7
<b>Total Hours</b>		<b>21</b>

1

Please see Academic Information section.

2

Course may be counted toward general education requirement.

3

A student who counts MATH 2413 towards general education requirements must complete an additional 4 hours, in this concentration, of coursework in order to meet the 120 hour requirement.

4

Students choosing to complete ANSC 3308 to meet this requirement, must complete 1 additional advanced credit hour to meet the 120 hour program requirement and 45 advanced hours requirement.

## Bachelor of Science in Biotechnology

### Bachelor of Science Degree in Biotechnology

#### Required Courses

General Education Requirements ( <a href="http://catalog.tarleton.edu/academicaffairs/">http://catalog.tarleton.edu/academicaffairs/</a> )		43
ENGL 1301 [shared] [WI ( <a href="http://catalog.tarleton.edu/academicaffairs/">http://catalog.tarleton.edu/academicaffairs/</a> )]	Composition I	
ENGL 1302 [shared] [WI ( <a href="http://catalog.tarleton.edu/academicaffairs/">http://catalog.tarleton.edu/academicaffairs/</a> )]	Composition II	
GOVT 2305 [shared]	Federal Government (Federal Constitution and Topics)	
GOVT 2306 [shared]	Texas Government (Texas Constitution and Topics)	
BTEC 1185	Biotechnology Seminar	1
BIOL 1406 [shared]	Biology for Science Majors	
BIOL 1407 [shared]	Biology for Science Majors II	
MATH 2412 [shared]	Precalculus Math	
BIOL 2300	Cell Biology	3
BIOL 3407	Microbiology	4
BIOL 3413	Molecular Biology	4
BTEC 3340	Biotechnology Research Techniques	3
BTEC 3350	Computational Biology	3
BTEC 4380 [WI ( <a href="http://catalog.tarleton.edu/academicaffairs/">http://catalog.tarleton.edu/academicaffairs/</a> )]	Capstone in Biotechnology	3
CHEM 1311 & CHEM 1111	College Chemistry I (Lecture) and College Chemistry I (Laboratory)	4
CHEM 1312 & CHEM 1112	College Chemistry II (Lecture) and College Chemistry II (Laboratory)	4
CHEM 2323	Organic Chemistry I	3
CHEM 2123	Organic Chemistry I Laboratory	1
PHYS 1401	College Physics I	4

MATH 2413	Calculus I	4
MATH 3450	Principles of Bio-Statistics	4
ENGL 3309 [WI ( <a href="http://catalog.tarleton.edu/academicaffairs/">http://catalog.tarleton.edu/academicaffairs/</a> )]	Technical Writing and Document Design	3

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**Total Hours** **91**

### Additional Required Courses for Concentrations

#### Molecular Biotechnology

BIOL 3303	Genetics	3
BIOL 3103	Genetic Techniques	1
BTEC 3360	Biotechnology Compliance	3
BIOL 4374	Biochemistry I	3
BIOL 4378	Biochemistry Lab	3

Choose 10 hours from the following course list: 10

BIOL 3353	Ecology and Evolution	
BIOL 3380	Introduction to Virology	
BIOL 3395	Pathogenic Microbiology	
BIOL 3402	Histology	
BIOL 3420	Plant Pathology	
BIOL 3436	Plant Physiology	
BIOL 3485	Immunology	
BIOL 4340	Developmental Biology	
BIOL 4350	Vaccines	
BIOL 4375	Biochemistry II	
BIOL 4445	Parasitology	

Electives 6

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**Total Hours** **29**

#### Bioinformatics

BIOL 3303	Genetics	3
BIOL 3103	Genetic Techniques	1
BTEC 3360	Biotechnology Compliance	3
COSC 1310	Procedural Programming	3
COSC 2341	Data Structures	3
COSC 3360	Python Programming for Data Science	3
COSC 4401	Database Theory and Practice	4
COSC 3443	Computer Architecture	3-4
or COSC 3380	Operating Systems	
COSC 4360	Machine Learning	3

Advanced Electives 3

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**Total Hours** **29**

#### Plant and Animal Biotechnology

AGRI 3409	Genetics	4
or BIOL 3303 & BIOL 3103	Genetics and Genetic Techniques	
BIOL 4374	Biochemistry I	3
ANSC 4319	Biotechnology in Agriculture	3
ANSC 3323	Ethical Issues in Agriculture and the Natural Resources	3
or WSES 3323	Ethical Issues in Agriculture and the Natural Resources	

Choose 12 hours from the following list of courses (9 hours Advanced) 12

AGRI 1307 & AGRI 1107	Agronomy and Agronomy Laboratory	
BIOL 3420	Plant Pathology	
BIOL 3436	Plant Physiology	
BIOL 4378	Biochemistry Lab	
ENTO 3312	General Entomology	
ENTO 3380	Ecological Pest Management	
HORT 2320	Fundamentals of Market Gardening	
HORT 3300	Plant Propagation	
WSES 3308	Analysis of Natural Resource Data	
WSES 3315	Sustainability	
ANSC 4084	Internship	
or WSES 4084 or WSES 4088	Internship in the Natural Resource Sciences Undergraduate Research in the Natural Resource Sciences	

Electives 4

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**Total Hours** **29**

## Important Information Regarding Health Professions Programs

The Pre-Medical/Pre-Dental, Pre-Physical Therapy, Pre-Pharmacy, and Pre-Veterinary Support Areas in Biomedical Science are designed to meet or exceed the entrance requirements for medical, dental, physical therapy, pharmacy, and veterinary medicine programs in Texas. Other health professions programs including, but not limited to Physician Assistant, Optometry, Chiropractic, Occupational Therapy, Podiatry, Radiology Technician, and Dental Hygiene can vary considerably in terms of entrance requirements. Students interested in such programs are encouraged to earn a BS in Biomedical Science by following the General Biomedical Science Support Area. By allowing greater flexibility in elective courses, the General Biomedical Science Support Area can be easily adjusted to meet the entrance requirements of these health professions programs.

A program in Pre-Veterinary Medicine is also offered through the Department of Animal Science and the Department of Wildlife and Natural Resources. Although the Pre-Veterinary programs offered through these departments and the Department of Biological Sciences each meet all the requirements for admission to the Texas colleges of veterinary medicine, a student is typically best suited for one program or the other. It is important that a student discuss with an advisor which program is best suited to his or her interests, skills, and goals.

It is important to know that health profession programs may change entrance requirements without notice. Therefore, it is the responsibility of the student to check these requirements and work closely with an advisor to ensure that all requirements are met. If all of the entrance requirements for a professional program have been met, it is sometimes possible for a student to matriculate to the professional program prior to completing a degree at Tarleton. In this case, a student might meet the requirements of a Bachelor of Science degree at Tarleton by

1. fulfilling the "Degree Requirements" as stated in the Academic Information section of the catalog and
2. transferring the necessary hours from an approved professional school to Tarleton for a minimum total of 120 hours.

## Academic Advising Guides

Academic Advising Guides area available at the following website:

<https://web.tarleton.edu/majorinfo/>

### Professors

- Calahan, John Dr.
- Sudman, Philip Dr.
- Nelson, Allan Dr.
- Sanderford, Max Dr.
- Pfau, Russell Dr.

### Associate professors

- Rathburn, Harold Dr.
- Speshock, Janice Dr.
- Herrmann, Kristin Dr.
- Meik, Jesse Dr.
- Edwards, Dustin Dr.
- Murray, Karen Dr.

### Assistant professors

- Brock, Chad Dr.
- Chraibi, Victoria Dr.

### Instructor

- Johnson, Terry Mr.
- Price, Callie Ms.
- Scoggins, Brian Mr.

## Biology Courses

### **BIOL 1100. Transitioning to University Studies in Biology/Biomedical Sciences. 1 Credit Hour (Lecture: 1 Hour, Lab: 1 Hour).**

Practical study designed to prepare the student for university life, aid in the development of skills for academic success, promote personal growth and responsibility, and encourage active involvement in the learning process from an individual college perspective. These skill sets are presented in the context of biology and biomedical disciplines.

### **BIOL 1185. Career Pathways in Biomedical Science. 1 Credit Hour (Lecture: 1 Hour, Lab: 0 Hours).**

Exploration of opportunities in the health professions, biomedical research, biomedical industry, and related fields. Course is open to all majors interested in life science careers related to health and disease.

### **BIOL 1406. Biology for Science Majors. 4 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).**

Fundamental principles of living organisms will be studied, including physical and chemical properties of life, organization, function, evolutionary adaptation, and classification. Concepts of cytology, reproduction, genetics, and scientific reasoning are included. 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. Lab fee: \$2.

### **BIOL 1407. Biology for Science Majors II. 4 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).**

The diversity and classification of life will be studied, including animals, plants, protists, fungi, and prokaryotes. Special emphasis will be given to anatomy, physiology, ecology, and evolution of plants and animals. 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. Lab fee: \$2.

### **BIOL 2020. Biology Connect 2020. 0 Credit Hours (Lecture: 0 Hours, Lab: 0 Hours).**

### **BIOL 2300. Cell Biology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

An introduction to the study of cells, including structure and function of cellular components, bioenergetics, cellular transport and communication, and the cell cycle. Prerequisites: BIOL 1406.

### **BIOL 2310. Essential Elements of Biology. 3 Credit Hours (Lecture: 2 Hours, Lab: 3 Hours).**

The study of morphology, anatomy, growth, life cycles, ecology, behavior, classification, and uses of organisms. Human systems and tissues and mechanisms of heredity and metabolism will be introduced. The laboratory will give experience in the use of the microscope, dissecting procedures, and problem solving. Enrollment in this course is restricted to Interdisciplinary Studies Majors. Prerequisite: 3 hours of CHEM, PHYS, or GEOL Lab fee: \$2.

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

Basic physiological principles and their applications in the study of the skeletal, muscular, and nervous systems are emphasized. Substantial microscopic observation required. Lab fee: \$2.

**BIOL 2402. Anatomy & Physiology II. 4 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).**

Integrated study of human anatomy and physiology. Includes study of the structure and function of the human body including the following systems: endocrine, cardiovascular, immune, lymphatic, respiratory, digestive (including nutrition), urinary (including fluid and electrolyte balance), and reproductive (including human development and genetics). Emphasis is on interrelationships among systems and regulation of physiological functions involved in maintaining homeostasis. The lab provides a hands-on learning experience for exploration of human system components and basic physiology. Lab fee: \$2.

**BIOL 2420. Microbiology for Non-Science Majors. 4 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).**

A survey of the microorganisms, their environments, and their interactions with multicellular organisms, particularly man. The course concentrates on the microorganisms which are pathogenic to man, human diseases, treatments for the diseases, and their prevention. Microorganisms need time to grow and therefore there will be several laboratory assignments throughout the course of the semester where students will be required to return the next day for about 15-45 minutes for culture analysis. Course is appropriate for pre-nursing majors. Prerequisites: 8 hours of BIOL or CHEM Lab fee: \$2.

**BIOL 3103. Genetic Techniques. 1 Credit Hour (Lecture: 0 Hours, Lab: 3 Hours).**

Application of modern genetic techniques to generate, analyze, and interpret data. Emphasis will be placed on the development of practical laboratory skills. Prerequisites: BIOL 3303 or concurrent enrollment. Lab fee: \$2.

**BIOL 3303. Genetics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

An introduction to the study of genetics including the nature of genetic material, mechanisms of gene expression and inheritance, population genetics and evolution, and application of modern DNA technology. Prerequisites: 8 hours of BIOL with a grade of C or higher and CHEM 1311 and 1111 or higher.

**BIOL 3340. Introduction to Marine Biology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

General considerations of the marine environment including habitats, biota, zoogeography, and humans' impact. Prerequisites: BIOL 1406, 1407.

**BIOL 3353. Ecology and Evolution. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

The objective of this course is to convey a basic understanding of how life evolves, how organisms interact with their environments, and how evolutionary and ecological principles can be applied to a wide range of questions. Prerequisites: BIOL 1406, 1407 and 3303.

**BIOL 3363. Study Abroad: Ecology and Evolution. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

This course is intended to convey a basic understanding of how life evolves, how organisms interact with their environments, and how evolutionary and ecological principles can be applied to a wide range of questions. Emphasis will be placed on the writing process. This course will be an Applied Learning Experience. Prerequisite: BIOL 1406, BIOL 1407, BIOL 3303.

**BIOL 3380. Introduction to Virology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

This course covers the basic principles in the study of viruses. It will provide a foundation to understanding virus architecture and nomenclature, virus replication cycles, mechanisms of viral entry and spread of infection, host responses to viral infections, laboratory research and diagnostics of viral diseases, and epidemiology of viral infections. Prerequisites: BIOL 3407.

**BIOL 3395. Pathogenic Microbiology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

A study of the disease-producing capacities of various microorganisms with emphasis on the diagnostic procedure of isolation and identification. Prerequisites: BIOL 3407 with minimum grade of "C" or approval by the department head.

**BIOL 3402. Histology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**

Introduction to cellular ultrastructure. Study of vertebrate tissues and their arrangement in various organs. Prerequisite: 8 hours of BIOL Lab fee: \$2.

**BIOL 3406. Comparative Vertebrate Anatomy. 4 Credit Hours (Lecture: 3 Hours, Lab: 4 Hours).**

The morphology, physiology, and phylogeny of the organ systems of vertebrates. Laboratory study of representative vertebrates. Prerequisite: 8 hours of biology. Lab fee: \$2.

**BIOL 3407. Microbiology. 4 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).**

Study of microorganisms; characteristics, physiology, genetics, and their interrelations with humans. Substantial microscopic observation required. Microorganisms need time to grow and therefore there will be several laboratory assignments throughout the course of the semester where students will be required to return the next day for about 15-45 minutes for culture analysis. Prerequisites: 2 semesters of BIOL and 1 semester of CHEM, or 1 semester of BIOL and 2 semesters of CHEM, or approval by the department head. Lab fee \$2.

**BIOL 3413. Molecular Biology. 4 Credit Hours (Lecture: 3 Hours, Lab: 4 Hours).**

Fundamentals of gene expression, gene regulation, DNA metabolism and nucleic acid structure, recombinant DNA techniques and protein structure. Prerequisites: BIOL 3303 and 3103, and either CHEM 2423 or both CHEM 2323 and CHEM 2123.

**BIOL 3415. Plant Taxonomy. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**

Principles of plant taxonomy. Field and laboratory studies of common Texas wild flowers and trees with emphasis on identification, collection, and preparation of herbarium specimens. Prerequisites: 8 hours of BIOL with a grade of C or better, junior classification, or department head approval. Lab fee \$2.

**BIOL 3420. Plant Pathology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**

Study of the various types of plant diseases and specific examples of each type. Emphasis upon identification, host-parasite interactions, pathogen dissemination, and control methods. Prerequisite: BIOL 1406, 3407 or approval by department head. Lab fee: \$2.

**BIOL 3430. Phycology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**

Hands-on training in the taxonomy, ecology, and ecophysiology of algae. Discussion of current uses of algae for water quality, biofuel, food production, forensic science, and nanotechnology. Prerequisites: BIOL 1406 and BIOL 1407 Lab fee: \$2.

**BIOL 3436. Plant Physiology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**

A study of physiology of green plants with emphasis on nitrogen metabolism, respiration, mineral nutrition, photosynthesis, and growth. Prerequisite: BIOL 1406 or BIOL 1407 Lab fee: \$2.

**BIOL 3449. Animal Diversity. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**

The study of the morphology, taxonomy, biology, and phylogeny of the invertebrate animals. In lecture, students concentrate on basic concepts of structures, function and evolutionary development of major invertebrate groups. In lab, students are exposed to a large collection of invertebrates, learning about systematics, ecology, structure and phylogenetic relationships. Prerequisite: 12 hours of BIOL or approval by the department head. Lab fee: \$2.

**BIOL 3485. Immunology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**

Emphasis on the basic concepts of humoral and cell-mediated immunity. Laboratory: current techniques in experimental immunology and serology. Prerequisites: BIOL 2300, BIOL 3407 and one year of CHEM or approval by the department head. Lab fee: \$2.

**BIOL 4010. Independent Research. 0 Credit Hours (Lecture: 0 Hours, Lab: 0 Hours).****BIOL 4086. Biology Problems. 1-6 Credit Hours (Lecture: 0 Hours, Lab: 1-6 Hours).**

A course open by invitation to capable juniors and seniors wishing to pursue a biological problem. Students are permitted and encouraged to work independently under the guidance of an instructor. May be repeated for credit, subject to the approval by the department head. Prerequisite: 14 hours of BIOL Lab fee: \$2.

**BIOL 4090. Special Topics. 1-3 Credit Hours (Lecture: 1-3 Hours, Lab: 3-9 Hours).**

Deals with selected topics in biology. May be repeated for credit when topics vary. Prerequisite: approval of department head.



**BIOL 4185. Seminar. 1-3 Credit Hours (Lecture: 1-3 Hours, Lab: 0 Hours).**

Survey of biological literature, biological instrumentation, history of biology, and current trends in biological sciences. Grading in this course is satisfactory/unsatisfactory. Prerequisite: 12 hours BIOL or approval of department head.

**BIOL 4320. Behavioral Ecology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

The aim of this course is to understand variation in behavior among species and among individuals within a species. The course will focus on how behavior affects an animal's ability to survive and reproduce. Prerequisites: 12 hours of biology or approval by department head.

**BIOL 4325. Conservation Biology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Principles of conservation biology and the major issues that define the discipline. Study of value, threats to, and conservation of biodiversity. Conservation issues at the population and species levels, policy, and practical applications of the science will be included. Prerequisite: Course in Ecology, or department head approval.

**BIOL 4340. Developmental Biology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Introduction to basic principles of developmental biology. The course will include sections on classical embryology, the molecular basis of development, and evolution of development. In addition, students will read/discuss relevant articles from the primary literature. Prerequisites: BIOL 3303 or BIOL 3403.

**BIOL 4350. Vaccines. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

This course will cover the basic principles in the study of vaccines by providing a foundation to the understanding of the immune response to vaccinations, development of vaccinations, and the significance of individual human and animal vaccines. Prerequisites: BIOL 3407.

**BIOL 4370. Organisms and Ecosystems of Texas. 3 Credit Hours (Lecture: 2 Hours, Lab: 4 Hours).**

A comparison of the organisms and ecosystems of Texas. The comparative study of the morphology, anatomy, metabolism, reproduction, and the phylogenetic and ecological relationships of organisms in Texas. Prerequisites: BIOL 1406, BIOL 1407, and CHEM 1311 and 1111, or approval of department head. Lab fee: \$2.

**BIOL 4374. Biochemistry I. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Introduction to the basic principles of biological chemistry and to fundamental processes of plants, animals and microorganisms. Credit for both BIOL 4374 and CHEM 4374 will not be awarded. Prerequisites: BIOL 3407 with "C" or better, and either CHEM 2423 or both CHEM 2323 and 2123 with "C" or better.

**BIOL 4375. Biochemistry II. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

A detailed survey of intermediary metabolism. The metabolism of carbohydrates, lipids, proteins and nucleic acids, and the regulation of metabolism are emphasized. Credit for both BIOL 4375 and CHEM 4375 will not be awarded. Prerequisites: BIOL/CHEM 4374, or approval of department head.

**BIOL 4378. Biochemistry Lab. 3 Credit Hours (Lecture: 1 Hour, Lab: 5 Hours).**

Principles and applications of basic methodology for the isolation, purification, characterization, and quantitative determination of biologically important compounds. Credit for both BIOL 4378 and CHEM 4378 will not be awarded. Prerequisite: BIOL 4374 or CHEM 4374 Lab fee: \$2.

**BIOL 4398. Current Topics in the Life Sciences. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours). [WI (<http://catalog.tarleton.edu/academicaffairs/>)]**

Students will apply knowledge and skills learned in previous courses to address biological issues through writing, oral presentations, and other assessments. All majors must complete this course to graduate with a BS in Biology or BS in Biomedical Science. Prerequisites: Major in Biology or Biomedical Science and at least 80 hours of coursework completed, including BIOL 1406, BIOL 1407, BIOL 2300, BIOL 3103 and BIOL 3303, BIOL 3353, and BIOL 3407, or Department Head Approval.

**BIOL 4401. Ecology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**

The scientific study of the biotic and abiotic interactions that determine the distribution and abundance of organisms. Prerequisites: BIOL 1406, BIOL 1407, and 4 hours of chemistry Lab fee: \$2.

**BIOL 4420. Terrestrial Field Ecology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**

A study of the structure and functioning of terrestrial communities with an emphasis on plants. Laboratories will be conducted over three weekends. Prerequisite: Plant Taxonomy (BIOL 3415) or department head approval Lab fee: \$2.

**BIOL 4430. Ornithology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**

A study of the basic biology of birds, including origins, systematics, ecology, biogeography, physiology, anatomy, and reproductive biology. Laboratory emphasizes identification of regional avifauna and includes multiple field trips. Prerequisite: BIOL 1406 and BIOL 1407. Lab fee \$2.

**BIOL 4440. Herpetology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**

A survey of the biology of amphibians and reptiles, with emphasis on phylogenetics, ecology, physiology, morphology, zoogeography, conservation, and taxonomy. Laboratory and field work will provide students with practical experience in collecting, identifying, and preparing specimens of regional species, as well as observing populations in natural settings. Prerequisites: BIOL 1406 and BIOL 1407. Lab fee: \$2.

**BIOL 4441. Freshwater Biology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**

The study of aquatic communities and the biogeochemical factors affecting the productivity of ponds, reservoirs, and streams (Limnology). Labs focus on field collections and student-driven experimental research. Prerequisites: 1 year of CHEM and 12 hours of BIOL, including BIOL 1406 and 1407 (or department head approval). Lab fee: \$2.

**BIOL 4445. Parasitology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**

A survey of the various invertebrate parasites of medical importance with particular reference to epidemiology and the host-parasite relationship. Prerequisites: 12 hours of BIOL or approval by the department head. Lab fee \$10.

**BIOL 4451. Mammalogy. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**

A study of the evolution, anatomy, behavior, ecology, systematics, and basic biology of mammals. Laboratory work includes identification of regional mammals as well as techniques for the collection and preparation of mammalian specimens. Prerequisite: BIOL 1406 and BIOL 1407. Lab fee \$2.

**BIOL 4460. Animal Physiology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**

An advanced course in the fundamentals of vertebrate physiology emphasizing physiologic mechanisms from a basic molecular/cellular level up to the level of organ systems, which include the nervous, endocrine, muscular, cardiovascular, respiratory, digestive and urinary systems. The basic physiologic mechanisms are presented in the context of human physiology, however, how selected animals are adapted to particular environments is addressed. Laboratory exercises involve the use of electronic instrumentation to measure physiologic responses non-invasively in human volunteers or in surgically prepared animals. Prerequisite: 12 hours of BIOL and one semester of organic chemistry with laboratory. Lab fee: \$2.

**BIOL 4462. Ichthyology. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**

A study of the anatomy, behavior, ecology, evolution, taxonomy, and zoogeography of fishes. Field and laboratory work provide students with practical experience in collecting, identifying, and studying fishes. Emphasis will be placed on local fauna. Prerequisite: BIOL 1406 and BIOL 1407. Lab fee \$2.

## Biotechnology Courses

**BTEC 1185. Biotechnology Seminar. 1 Credit Hour (Lecture: 1 Hour, Lab: 0 Hours).**

Exploration of opportunities in the biotechnology research, biotechnology industry, and related fields. Students will have the opportunity to learn the academic and co-curricular expectations necessary to be successful applicants to professional school, graduate school or entry-level industry positions.

**BTEC 3340. Biotechnology Research Techniques. 3 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).**

Students will learn tissue culture techniques, how to introduce foreign DNA into cells, how to select for desired cells, and biochemical assays. Prerequisite: BIOL 2300 Lab fee: \$2.

**BTEC 3350. Computational Biology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Introduction to computational tools and programming languages for biotechnology. Prerequisites: BIOL 2300 and MATH 3450.

**BTEC 3360. Biotechnology Compliance. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Role of regulatory agencies during the discovery, development, and manufacture of biotechnological products. Prerequisites: GOVT 2305 and GOVT 2306 (or Government Core Complete [core 070]) and BTEC 3340.

**BTEC 4086. Biotechnology Problems. 1-6 Credit Hours (Lecture: 0 Hours, Lab: 1-6 Hours).**

A course open by invitation to capable students wishing to pursue a biotechnology problem. Students are permitted and encouraged to work independently under the guidance of an instructor. May be repeated for credit, subject to the approval by the department head.

**BTEC 4090. Special Topics. 1-3 Credit Hours (Lecture: 1-3 Hours, Lab: 3-9 Hours).**

Focuses on selected topics in Biotechnology. May be repeated for credit when topics vary.

**BTEC 4380. Capstone in Biotechnology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours). [WI (<http://catalog.tarleton.edu/academicaffairs/>)]**

Students will apply knowledge and skills learned in previous courses to address biotechnology issues through writing, oral presentations, and other assessments. All majors must complete this course to graduate with a BS in Biotechnology. Prerequisites: Major in Biology, Biotechnology, or Biomedical Science and at least 80 hours of coursework completed, including BIOL 1406, BIOL 1407, BIOL 2300, BIOL 3103 and BIOL 3303, BTEC 3340, BTEC 3350 and BIOL 3407, or Department Head Approval.