The Department of Biology offers a Bachelor of Science (B.S.) degree in Biology and a B.S. degree in Microbiology and Immunology, as well as a Minor in Biology. The Department also offers Grades 7–12 Biology Teacher Certification in collaboration with UTeachSA, and the Certificate in Pathogenic Outbreak Investigations in collaboration with the Department of Computer Science and the Department of Information Systems and Cyber Security in the College of Business.

The B.S. degree in Biology is designed to prepare students for professional careers in the biological sciences, medical and health service fields, research, industry, and education. The program of study is structured around a comprehensive core curriculum that includes genetics, physiology, cell biology, chemistry, physics, computer science, and mathematics. At the upper-division level, students wanting to specialize can choose one of five area concentrations: Cell and Molecular Biology, Integrative Biology, Neurobiology, Plant Biology, or Grades 7–12 Biology Teacher Certification.

The B.S. degree in Microbiology and Immunology is designed to prepare students for professional careers in the medical and health service fields, research, industry, education and as specialists in industrial quality testing and control, and as regulatory workers in government agencies and public health laboratories. The program of study is structured around a comprehensive core curriculum that is similar to the Biology degree but upper-division level coursework is designed to achieve a deeper education in several specialized areas of microbiology.

Due to extensive curriculum overlap, students cannot receive a double major in Biology and Microbiology and Immunology. Students must choose between a B.S. in Biology or a B.S. in Microbiology and Immunology.

The UTSA Department of Biology offers two accelerated degree programs in conjunction with UTHealth San Antonio. The DEAP program allows students to earn both the Bachelor of Science (B.S.) degree in Biology from UTSA and their Doctor of Dental Surgery (D.D.S.) degree at the UTHealth San Antonio Dental School within a seven-year period. For eligibility requirements and application visit the DEAP website (http://utsa.edu/healthprofessions/deap.html). The FAME program allows students to earn both the Bachelor of Science (B.S.) degree in Biology from UTSA and their Doctor of Medicine (M.D.) degree at the UTHealth San Antonio Medical School within a seven-year period. For eligibility requirements and application visit the FAME Web site (http://utsa.edu/healthprofessions/fame.html).

**Admission Policy for the B.S. Degree in Biology and the B.S. Degree in Microbiology and Immunology**

The goal of the Department of Biology is to provide undergraduate students a program of study with the highest possible standards. To achieve this goal, the admission policy of the Department of Biology is designed to identify those students most likely to succeed in their undergraduate biology education. All applicants for admission to the Department of Biology will be admitted to the Department as prebiology (PBI) or pre-microbiology and immunology (PMI) students. In order to declare a major in Biology or a major in Microbiology and Immunology, a student’s academic performance will be evaluated after the five courses listed below have been completed. To declare either major, PBI or PMI, a student must have:

- a grade point average of at least 2.0 for all UTSA coursework
- a grade point average of at least 2.25 for all Biology coursework (UTSA and/or transfer credit). Transfer students, in addition, must have a grade point average of at least 2.0 for all UTSA Department of Biology coursework
- successfully satisfied all three sections (mathematics, reading, and writing) of the Texas Success Initiative (TSI)
- successfully completed the following or equivalent courses with a grade of “C-“ or better:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 1404</td>
<td>Biosciences I</td>
<td>4</td>
</tr>
<tr>
<td>BIO 1414</td>
<td>Biosciences II</td>
<td>4</td>
</tr>
<tr>
<td>CHE 1103</td>
<td>General Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>MAT 1193</td>
<td>Calculus for the Biosciences</td>
<td>3</td>
</tr>
<tr>
<td>PHY 1943</td>
<td>Physics for Scientists and Engineers</td>
<td>3</td>
</tr>
<tr>
<td>or PHY 1603</td>
<td>Algebra-based Physics I</td>
<td>3</td>
</tr>
</tbody>
</table>

PBI and PMI students are restricted from registering for upper-division (3000- and 4000-level) Biology courses without the consent of an undergraduate academic advisor in Life and Health Sciences Advising. A student who does not meet all the above requirements after completing 60 hours of credit will no longer be considered a PBI or PMI student and their major will be changed from PBI/PMI to undeclared (UND) in the University student record system. The student must choose a major other than Biology or Microbiology and Immunology. A biology minor is, however, available to all UTSA students who seek to complement a different academic major with a strong foundation in biology. Students can be reinstated as a Biology major or Microbiology and Immunology major, but only after successfully completing all the PBI/PMI requirements, and upon approval of the Biology department.

**Academic Standing Policy for the B.S. Degree in Biology and the B.S. Degree in Microbiology and Immunology**

All majors in Biology or Microbiology and Immunology must maintain:

- a minimum overall UTSA grade point average of 2.0
- a minimum overall grade point average of 2.25 in all Biology courses (UTSA and transfer credit). Transfer students, in addition, must have a grade point average of at least 2.0 for all UTSA Department of Biology coursework.

Students who do not meet these requirements are placed on Department of Biology academic probation. Students on Department of Biology academic probation must achieve the minimum required grade point averages by the end of the next enrolled long semester at UTSA (Fall or Spring) that follows the semester in which the student falls below the required grade point averages. Students who do not meet the minimum requirements by the end of the next subsequent-enrolled long semester will be dismissed from the B.S. degree in Biology or the B.S. degree in Microbiology and Immunology and classified as undeclared (UND) in the University student record system. The student must choose a major other than Biology or Microbiology and Immunology. A biology minor is, however, available to all UTSA students who seek to complement a different academic major with a strong foundation in biology. Dismissed students may appeal one time for reinstatement to
either B.S. degree program: such appeals will be granted only under extraordinary circumstances. See Life and Health Sciences Advising for required forms. All Biology majors and Microbiology and Immunology majors must have the required minimum grade point averages in order to receive the Bachelor of Science degree.

- B.S. degree in Biology (p. 2)
- B.S. degree in Microbiology and Immunology (p. 6)

**Bachelor of Science Degree in Biology**

The minimum number of semester credit hours required for the Bachelor of Science (B.S.) degree in Biology, including the Core Curriculum requirements, is 120. To complete the concentration in Biology Teaching Certification requires a minimum of 126 semester credit hours. Thirty-nine of the total semester credit hours required for the degree must be at the upper-division level. All major and support work courses and the required prerequisites must be completed with a grade of “C-” or better, in addition, students must meet the grade point average requirements under the Academic Standing Policy.

For students wishing to add focus and expertise to their degree, the Department of Biology also offers the B.S. degree with a concentration in one of five areas: Cell and Molecular Biology, Integrative Biology, Neurobiology, Plant Biology, and Grades 7–12 Biology Teacher Certification. Specific grade point average requirements and courses required for each concentration are listed following the general degree requirements.

Due to extensive curriculum overlap, students cannot receive a double major in Biology and Microbiology and Immunology. Students must choose between a B.S. in Biology or a B.S. in Microbiology and Immunology.

All candidates for this degree must fulfill the Core Curriculum requirements and the degree requirements, which are listed below.

**Core Curriculum Requirements (42 semester credit hours)**

Students seeking the B.S. degree in Biology must fulfill University Core Curriculum requirements in the same manner as other students. The courses listed below satisfy both degree requirements and Core Curriculum requirements; however, if these courses are taken to satisfy both requirements, then students may need to take additional courses in order to meet the minimum number of semester credit hours required for this degree.

MAT 1193 may be used to satisfy the core requirement in Mathematics as well as a major requirement. (Students in the teaching concentration can substitute STA 1053 for MAT 1193.) Two of the following courses may be used to satisfy the core requirement in Life and Physical Sciences, as well as major requirements: BIO 1404, BIO 1414, PHY 1943 or PHY 1963. CS 1173 may be used to satisfy the core requirement in Component Area Option as well as a major requirement.

**Core Curriculum Component Area Requirements** ([catalog.utsa.edu/undergraduate/bachelorsdegree/regulations/degreerequirements/corecurriculumcomponentarequirements](catalog.utsa.edu/undergraduate/bachelorsdegree/regulations/degreerequirements/corecurriculumcomponentarequirements))

| First Year Experience Requirement | 3 |
| Communication | 6 |
| Mathematics | 3 |
| Life and Physical Sciences | 6 |

**Degree Requirements**

**A. Required courses in the major**

1. Biology requirements:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 1404</td>
<td>Biosciences I</td>
<td>4</td>
</tr>
<tr>
<td>BIO 1414</td>
<td>Biosciences II</td>
<td>4</td>
</tr>
<tr>
<td>BIO 2313</td>
<td>Genetics</td>
<td>5</td>
</tr>
<tr>
<td>BIO 3422</td>
<td>Immunology</td>
<td>5</td>
</tr>
<tr>
<td>BIO 3413</td>
<td>Advanced Physiology</td>
<td>5</td>
</tr>
<tr>
<td>BIO 3513</td>
<td>Biochemistry</td>
<td>5</td>
</tr>
<tr>
<td>BIO 3522</td>
<td>Biochemistry Laboratory</td>
<td>5</td>
</tr>
<tr>
<td>BIO 3813</td>
<td>Cell Biology</td>
<td>5</td>
</tr>
<tr>
<td>BIO 3822</td>
<td>Cell Biology Laboratory</td>
<td>5</td>
</tr>
</tbody>
</table>

2. Select one of the following sequences:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 3283</td>
<td>Principles of Ecology</td>
<td>5</td>
</tr>
<tr>
<td>BIO 3292</td>
<td>Principles of Ecology Laboratory</td>
<td>5</td>
</tr>
<tr>
<td>BIO 3423</td>
<td>Neurobiology</td>
<td>5</td>
</tr>
<tr>
<td>BIO 3442</td>
<td>Neurobiology Laboratory</td>
<td>5</td>
</tr>
<tr>
<td>BIO 3713</td>
<td>Microbiology</td>
<td>5</td>
</tr>
<tr>
<td>BIO 3722</td>
<td>Microbiology Laboratory</td>
<td>5</td>
</tr>
</tbody>
</table>

Note: A laboratory section adds a valuable dimension to the understanding of the material presented in a lecture. In general, students are encouraged to add the appropriate laboratory section to any lecture beyond the minimum 5-semester-credit-hour requirement.

3. Biology electives:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 3832</td>
<td>Advanced Physiology</td>
<td>3</td>
</tr>
<tr>
<td>BIO 3842</td>
<td>Advanced Physiology Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>BIO 3852</td>
<td>Advanced Physiology Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>BIO 3862</td>
<td>Advanced Physiology Laboratory</td>
<td>3</td>
</tr>
</tbody>
</table>

**B. Support work**

The support courses listed below are mandatory prerequisites for various biology courses starting in a student’s sophomore year. Students need to complete their support work as soon as possible, in their freshman and sophomore years, to be eligible to register for upper-division biology core courses and electives. Failure to complete the support courses listed below in a timely fashion will significantly delay a student’s progress toward graduation.

1. Required chemistry courses:
CHE 1103 and General Chemistry I Laboratory 4

& CHE 1121

CHE 1113 General Chemistry II and General Chemistry II Laboratory 4

& CHE 1131

CHE 2603 Organic Chemistry I and Organic Chemistry I Laboratory 5

& CHE 2612

CHE 3673 Organic Chemistry II with Biological Applications or CHE 3643 Organic Chemistry II 3

Students pursuing the Grades 7–12 Teacher Certification concentration can substitute STA 1053 for both MAT 1193 and STA 1403.

2. Required mathematics and statistics courses:

MAT 1193 Calculus for the Biosciences 3

STA 1403 Probability and Statistics for the Biosciences 3

Select two of the following:

PHY 1603 Algebra-based Physics I and Algebra-based Physics I Laboratory *

& PHY 1611

PHY 1623 Algebra-based Physics II and Algebra-based Physics II Laboratory *

& PHY 1631

Option 2

PHY 1943 Physics for Scientists and Engineers I and Physics for Scientists and Engineers I Laboratory *

& PHY 1951

PHY 1963 Physics for Scientists and Engineers II and Physics for Scientists and Engineers II Laboratory *

& PHY 1971

4. Computer-based data visualization and analysis:

CS 1173 Data Analysis and Visualization 3

C. Free electives

Select 9 semester credit hours of free electives, at least 4 hours of which must be at the upper-division level to reach the minimum requirement of 39 upper-division semester credit hours.

Students pursuing the Grades 7–12 Teacher Certification concentration should take required courses for teacher certification in lieu of free electives (see concentration requirements below).

*Note: Students in the 7–12 Teaching Certification Concentration have a defined program of study outlined below. Laboratories noted by an asterisk (*) are not required for the teaching certification concentration.

Total Credit Hours 87

Concentrations

For students interested in research or graduate programs, the Department of Biology offers five areas of concentration. To declare a concentration or obtain advice, students should consult an undergraduate advisor in Life and Health Sciences Advising. If a student takes any of the courses listed below that satisfy both the Biology degree and concentration requirements, then the student may need to take additional upper-division Biology courses in order to meet the minimum number of semester credit hours required for the Biology degree.

Concentration in Cell and Molecular Biology

The coursework within the Cell and Molecular Biology concentration must be completed with a minimum cumulative grade point average of 3.0 or better. Students are also encouraged to enroll in BIO 4923 Laboratory Research: Biology Concentrations as part of their program of study.

All candidates for the Concentration in Cell and Molecular Biology must complete the following:

BIO 3913 Molecular Biology 3

Select three of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 3933</td>
<td>Principles of Cancer Biology</td>
</tr>
<tr>
<td>BIO 4143</td>
<td>Developmental Biology</td>
</tr>
<tr>
<td>BIO 4453</td>
<td>Endocrinology</td>
</tr>
<tr>
<td>BIO 4723</td>
<td>Virology</td>
</tr>
<tr>
<td>BIO 4743</td>
<td>Immunology</td>
</tr>
<tr>
<td>BIO 4923</td>
<td>Laboratory Research: Biology Concentrations (Research must be in a laboratory engaged in molecular biology research.)</td>
</tr>
</tbody>
</table>

Total Credit Hours 12

Concentration in Integrative Biology

The coursework within the Integrative Biology concentration must be completed with a minimum cumulative grade point average of 3.0 or better. Students are also encouraged to enroll in BIO 4923 Laboratory Research: Biology Concentrations as part of their program of study.

All candidates for the Concentration in Integrative Biology must complete the following:

BIO 3283 Principles of Ecology 5

& BIO 3292 and Principles of Ecology Laboratory

Select two of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 3213</td>
<td>Animal Behavior</td>
</tr>
<tr>
<td>BIO 3323</td>
<td>Evolution</td>
</tr>
<tr>
<td>BIO 4033</td>
<td>Conservation Biology</td>
</tr>
<tr>
<td>BIO 4053</td>
<td>Wildlife Biology</td>
</tr>
<tr>
<td>BIO 4063</td>
<td>Ornithology</td>
</tr>
<tr>
<td>BIO 4233</td>
<td>Field Biology</td>
</tr>
<tr>
<td>BIO 4923</td>
<td>Laboratory Research: Biology Concentrations (Research must be in a laboratory engaged in integrative biology research.)</td>
</tr>
</tbody>
</table>

Total Credit Hours 11

Concentration in Neurobiology

The coursework within the Neurobiology concentration must be completed with a minimum cumulative grade point average of 3.0 or better. Students are also encouraged to enroll in BIO 4923 Laboratory Research: Biology Concentrations as part of their program of study.

All candidates for the Concentration in Neurobiology must complete the following:

BIO 3433 Neurobiology 5

& BIO 3442 and Neurobiology Laboratory

Select two of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 3213</td>
<td>Animal Behavior</td>
</tr>
<tr>
<td>BIO 3623</td>
<td>Neuropsychopharmacology</td>
</tr>
<tr>
<td>BIO 4583</td>
<td>The Computational Brain</td>
</tr>
<tr>
<td>BIO 4813</td>
<td>Brain and Behavior</td>
</tr>
<tr>
<td>BIO 4823</td>
<td>Cognitive Neuroscience</td>
</tr>
</tbody>
</table>

Total Credit Hours 6
Concentration in Plant Biology

The coursework within the Plant Biology concentration must be completed with a minimum cumulative grade point average of 3.0 or better. Students are also encouraged to enroll in BIO 4923 Laboratory Research: Biology Concentrations as part of their program of study.

All candidates for the Concentration in Plant Biology must complete the following:

- BIO 3343 Plant Cell Biology: 3 credit hours
- Select three of the following: 9 credit hours
  - BIO 3263 The Woody Plants
  - BIO 3273 Biology of Flowering Plants
  - BIO 3333 Plants and Society
  - BIO 4643 Medicinal Plants
  - BIO 4923 Laboratory Research: Biology Concentrations (Research must be in a laboratory engaged in plant-based research.)

Total Credit Hours: 12

Concentration in Grades 7–12 Biology Teacher Certification

The B.S. degree in Biology with Teacher Certification is designed to prepare students for professional careers in teaching Biology at the level of secondary education. The program of study is structured around a comprehensive Biology core curriculum and state requirements for grades 7–12 life science teaching certification. Students cannot receive a comprehensive Biology core curriculum and state requirements for a B.S. degree in Microbiology and Immunology in order to receive a degree in Biology. Undergraduates seeking elementary teacher certification must transfer to the B.S. degree in Biology or the B.S. degree in Microbiology and Immunology in order to receive a degree in Biology. Undergraduates seeking elementary teacher certification must complete the Interdisciplinary Studies degree.

The minimum number of semester credit hours required for the Bachelor of Science degree in Biology with Teacher Certification, including the Core Curriculum requirements, is 126. Thirty-nine of the total semester credit hours required for the degree must be at the upper-division level. The coursework within the Biology Teacher concentration must be completed with a minimum cumulative grade point average of 2.5 or better.

All candidates for the Concentration in Grades 7–12 Biology Teacher Certification must complete the following:

- BIO 3043 UTeachSA Research Methods: 3 credit hours
- BIO 3283 Principles of Ecology: 3 credit hours
- BIO 3323 Evolution: 3 credit hours
- BIO 3713 Microbiology: 3 credit hours
- BIO 4813 Brain and Behavior: 3 credit hours
- ESL 3063 Second Language Teaching and Learning for Grades 4–8 and 7–12: 3 credit hours
- LTED 3773 Reading and Writing Across the Disciplines: Grades 7–12: 3 credit hours

Total Credit Hours: 14

Course Sequence Guide for B.S. Degree in Biology

This course sequence guide is designed to assist students in completing their UTSA undergraduate Biology degree requirements. This is merely a guide and students must satisfy other requirements of this catalog and meet with their academic advisor for individualized degree plans.

Progress within this guide depends upon such factors as course availability, individual student academic preparation, student time management, work obligations, and individual financial considerations. Students may choose to take courses during Summer terms to reduce course loads during long semesters.

B.S. in Biology – Recommended Four-Year Academic Plan

**First Year**

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>AIS 1203</td>
<td>Academic Inquiry and Scholarship (core)</td>
<td>3</td>
</tr>
<tr>
<td>Fall</td>
<td>BIO 1404</td>
<td>Biosciences I (core and major) ¹</td>
<td>4</td>
</tr>
<tr>
<td>Fall</td>
<td>CHE 1103</td>
<td>General Chemistry I ¹</td>
<td>3</td>
</tr>
<tr>
<td>Fall</td>
<td>CHE 1121</td>
<td>General Chemistry I Laboratory ²</td>
<td>1</td>
</tr>
<tr>
<td>Fall</td>
<td>WRC 1013</td>
<td>Freshman Composition I (Q) (core)</td>
<td>3</td>
</tr>
<tr>
<td>Spring</td>
<td>BIO 1414</td>
<td>Biosciences II (core and major) ¹</td>
<td>4</td>
</tr>
<tr>
<td>Spring</td>
<td>CHE 1113</td>
<td>General Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>Spring</td>
<td>CHE 1131</td>
<td>General Chemistry II Laboratory ²</td>
<td>1</td>
</tr>
<tr>
<td>Spring</td>
<td>CS 1173</td>
<td>Data Analysis and Visualization (core and major)</td>
<td>3</td>
</tr>
<tr>
<td>Spring</td>
<td>MAT 1193</td>
<td>Calculus for the Biosciences (core and major) ¹</td>
<td>3</td>
</tr>
<tr>
<td>Spring</td>
<td>WRC 1023</td>
<td>Freshman Composition II (Q) (core)</td>
<td>3</td>
</tr>
</tbody>
</table>

**Second Year**

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>CHE 2603</td>
<td>Organic Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>Fall</td>
<td>CHE 2612</td>
<td>Organic Chemistry I Laboratory ²</td>
<td>2</td>
</tr>
<tr>
<td>Fall</td>
<td>American History core</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Fall</td>
<td>Select one of the following:</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Fall</td>
<td>PHY 1603 &amp; PHY 1611</td>
<td>Algebra-based Physics I ¹</td>
<td></td>
</tr>
<tr>
<td>Fall</td>
<td>PHY 1943 &amp; PHY 1951</td>
<td>Physics for Scientists and Engineers I</td>
<td></td>
</tr>
<tr>
<td>Spring</td>
<td>BIO 2313</td>
<td>Genetics</td>
<td>3</td>
</tr>
<tr>
<td>Spring</td>
<td>BIO 2322</td>
<td>Genetics Laboratory</td>
<td>2</td>
</tr>
</tbody>
</table>
Department of Biology

CHE 3673 or 3643  Organic Chemistry II with Biological Applications  3
STA 1403  Probability and Statistics for the Biosciences  3

Select one of the following:  4
PHY 1623  Algebra-based Physics II & PHY 1631
PHY 1963  Physics for Scientists and Engineers II

Third Year

Fall
BIO 3413  Advanced Physiology  3
BIO 3422  Advanced Physiology Laboratory  2
BIO 3513  Biochemistry  3
BIO 3522  Biochemistry Laboratory  2
Language, Philosophy & Culture core  3
Social & Behavioral Sciences core  3

Spring
BIO 3813  Cell Biology  3
BIO 3822  Cell Biology Laboratory  2
Free elective  3
Upper-division BIO lab (BIO 3XX2)  2
Upper-division BIO lecture (BIO 3XX3)  3
Creative Arts core  3

Fourth Year

Fall
Upper-division BIO elective  3
Upper-division BIO elective  3
Upper-division BIO elective  3
American History core  3
Government-Political Science core  3

Spring
Upper-division BIO elective  3
Upper-division free elective  3
Upper-division free elective  3
Government-Political Science core  3
Free elective (to meet 120 hour minimum)  3

Total Credit Hours:  120.0

1  In order to declare Biology as a major, a student’s academic performance will be evaluated after these five courses have been completed. Students must see their academic advisor to declare a Biology major.

2  These laboratory courses include a lecture component as indicated on the University Schedule of Classes.

Note: Some courses are only offered once a year; Fall or Spring. Check with the Department of Biology for scheduling of courses.

B.S. in Biology with Teaching Certification – Recommended Four-Year Academic Plan

First Year
Fall  Credit Hours
AIS 1203  Academic Inquiry and Scholarship (core)  3

Fall
BIO 1404  Biosciences I (core and major)  4
CHE 1103  General Chemistry I  3
CHE 1121  General Chemistry I Laboratory  2
WRC 1013  Freshman Composition I (Q) (core)  3
UTE 1111  Introduction to STEM Teaching Step 1

Spring
BIO 1414  Biosciences II (core and major)  4
CHE 1113  General Chemistry II  3
CHE 1131  General Chemistry II Laboratory  2
WRC 1023  Freshman Composition II (Q) (core)  3
UTE 1122  Introduction to STEM Teaching Step 2

Select one of the following:  3
MAT 1193  Calculus for the Biosciences (core)
STA 1053  Basic Statistics (core)

Second Year

Fall
BIO 2313  Genetics  3
BIO 2322  Genetics Laboratory  2
CHE 2603  Organic Chemistry I  3
CHE 2612  Organic Chemistry I Laboratory  2
UTE 3203  Knowing and Learning in Mathematics and Science  3

Select one of the following:  3
PHY 1603  Algebra-based Physics I  1
PHY 1943  Physics for Scientists and Engineers I

Spring
CS 1173  Data Analysis and Visualization (core and major)  3
UTE 3023  Perspectives on Science and Mathematics  3

Social & Behavioral Sciences core  3
Select one of the following:  3
CHE 3673  Organic Chemistry II with Biological Applications
CHE 3643  Organic Chemistry II

Select one of the following:  3
PHY 1623  Algebra-based Physics II
PHY 1963  Physics for Scientists and Engineers II

Summer
American History core  3
Government-Political Science core  3
Creative Arts core  3

Third Year

Fall
BIO 3283  Principles of Ecology  3
BIO 3513  Biochemistry 3
BIO 3522  Biochemistry Laboratory 2
BIO 3713  Microbiology 3
LTED 3773  Reading and Writing Across the Disciplines-Grades 7–12 3

Spring
BIO 3043  UTeachSA Research Methods 3
BIO 3413  Advanced Physiology 3
BIO 3422  Advanced Physiology Laboratory 2
BIO 4813  Brain and Behavior 3
UTE 3213  Classroom Interactions 3

Fourth Year
Fall
BIO 3323  Evolution 3
BIO 3813  Cell Biology 3
ESL 3063  Second Language Teaching and Learning for Grades 4–8 and 7–12 3
UTE 4203  Project-Based Instruction 3

Spring
UTE 4646  Clinical Teaching 6

Total Credit Hours: 126.0

1 In order to declare Biology as a major, a student’s academic performance will be evaluated after these five courses have been completed. Students must see their academic advisor to declare a Biology major.

2 These laboratory courses include a lecture component as indicated on the University Schedule of Classes.

Note: Some courses are only offered once a year; Fall or Spring. Check with the Department of Biology for scheduling of courses.

Bachelor of Science Degree in Microbiology and Immunology

The minimum number of semester credit hours required for the Bachelor of Science (B.S.) degree in Microbiology and Immunology, including the Core Curriculum requirements, is 120. Thirty-nine of the total semester credit hours required for the degree must be at the upper-division level. All major and support work courses and the required prerequisites must be completed with a grade of “C-” or better, in addition, students must meet the grade point average requirements under the Academic Standing Policy. Students seeking teacher certification should contact the Teacher Advising and Certification Center in the College of Education and Human Development for information. Undergraduates seeking elementary teacher certification must complete the Interdisciplinary Studies degree.

Due to extensive curriculum overlap, students cannot receive a double major in Biology and Microbiology and Immunology. Students must choose between a B.S. in Biology or a B.S. in Microbiology and Immunology.

All candidates for this degree must fulfill the Core Curriculum requirements and the degree requirements, which are listed below.

Core Curriculum Requirements (42 semester credit hours)

Students seeking the B.S. degree in Microbiology and Immunology must fulfill University Core Curriculum requirements in the same manner as other students. The courses listed below satisfy both degree requirements and Core Curriculum requirements; however, if these courses are taken to satisfy both requirements, then students may need to take additional courses in order to meet the minimum number of semester credit hours required for this degree.

MAT 1193 may be used to satisfy the core requirement in Mathematics as well as a major requirement. Two of the following courses may be used to satisfy the core requirement in Life and Physical Sciences, as well as major requirements: BIO 1404, BIO 1414, PHY 1943 or PHY 1963.

Core Curriculum Component Area Requirements (http://catalog.utsa.edu/undergraduate/bachelorsdegreceregulations/degreerequirements/corecurriculumcomponentarearequirements)

First Year Experience Requirement 3
Communication 6
Mathematics 3
Life and Physical Sciences 6
Language, Philosophy and Culture 3
Creative Arts 3
American History 6
Government-Political Science 6
Social and Behavioral Sciences 3
Component Area Option 3
Total Credit Hours 42

Gateway Courses

Students pursuing the B.S. degree in Microbiology and Immunology must successfully complete each of the following Gateway Courses with a grade of “C-” or better in no more than two attempts. A student who is unable to successfully complete these courses within two attempts, including dropping a course with a grade of “W” or taking an equivalent course at another institution, will be required to change his or her major.

BIO 1404  Biosciences I
BIO 1414  Biosciences II
BIO 2313  Genetics

Degree Requirements

A. Required courses in the major, 34 of which must be at the upper-division level

1. Required biology courses:
   BIO 1404  Biosciences I 4
   BIO 1414  Biosciences II 4
   BIO 2313  Genetics 5
   & BIO 3222  and Genetics Laboratory 5
   BIO 3413  Advanced Physiology 3
   BIO 3513  Biochemistry 5
   & BIO 3522  and Biochemistry Laboratory 5
   BIO 3713  Microbiology 5
   & BIO 3722  and Microbiology Laboratory 5
Course Sequence Guide for B.S. Degree in Microbiology and Immunology

This course sequence guide is designed to assist students in completing their UTSA undergraduate Microbiology and Immunology degree requirements. This is merely a guide and students must satisfy other requirements of this catalog and meet with their academic advisor for individualized degree plans. Progress within this guide depends upon such factors as course availability, individual student academic preparation, student time management, work obligations, and individual financial considerations. Students may choose to take courses during Summer terms to reduce course loads during long semesters.

B.S. in Microbiology and Immunology – Recommended Four-Year Academic Plan

<table>
<thead>
<tr>
<th>First Year</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td></td>
</tr>
<tr>
<td>AIS 1203</td>
<td>Academic Inquiry and Scholarship (core)</td>
</tr>
<tr>
<td>BIO 1404</td>
<td>Biosciences I (core and major)</td>
</tr>
<tr>
<td>CHE 1103</td>
<td>General Chemistry I</td>
</tr>
<tr>
<td>CHE 1121</td>
<td>General Chemistry I Laboratory</td>
</tr>
<tr>
<td>WRC 1013</td>
<td>Freshman Composition I (Q) (core)</td>
</tr>
<tr>
<td>Spring</td>
<td></td>
</tr>
<tr>
<td>BIO 1414</td>
<td>Biosciences II (core and major)</td>
</tr>
<tr>
<td>CHE 1113</td>
<td>General Chemistry II</td>
</tr>
<tr>
<td>CHE 1131</td>
<td>General Chemistry II Laboratory</td>
</tr>
<tr>
<td>MAT 1193</td>
<td>Calculus for the Biosciences (core and major)</td>
</tr>
<tr>
<td>WRC 1023</td>
<td>Freshman Composition II (Q) (core)</td>
</tr>
<tr>
<td>Free elective</td>
<td></td>
</tr>
<tr>
<td>Second Year</td>
<td></td>
</tr>
<tr>
<td>Fall</td>
<td></td>
</tr>
<tr>
<td>CHE 2603</td>
<td>Organic Chemistry I</td>
</tr>
<tr>
<td>CHE 2612</td>
<td>Organic Chemistry I Laboratory</td>
</tr>
<tr>
<td>STA 1403</td>
<td>Probability and Statistics for the Biosciences</td>
</tr>
<tr>
<td>Select one of the following:</td>
<td>4</td>
</tr>
<tr>
<td>PHY 1603</td>
<td>Algebra-based Physics I (core)</td>
</tr>
<tr>
<td>&amp; PHY 1611</td>
<td></td>
</tr>
<tr>
<td>PHY 1943</td>
<td>Physics for Scientists and Engineers</td>
</tr>
<tr>
<td>&amp; PHY 1951</td>
<td></td>
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<tr>
<td>PHY 1963</td>
<td>Physics for Scientists and Engineers II</td>
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<tr>
<td>&amp; PHY 1971</td>
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<tr>
<td>Spring</td>
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<tr>
<td>BIO 2313</td>
<td>Genetics</td>
</tr>
<tr>
<td>BIO 2322</td>
<td>Genetics Laboratory</td>
</tr>
<tr>
<td>CHE 3673 or 3643</td>
<td>Organic Chemistry II with Biological Applications</td>
</tr>
<tr>
<td>CHE 3652</td>
<td>Organic Chemistry II Laboratory</td>
</tr>
<tr>
<td>Select one of the following:</td>
<td>4</td>
</tr>
<tr>
<td>PHY 1623</td>
<td>Algebra-based Physics II</td>
</tr>
<tr>
<td>&amp; PHY 1631</td>
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<tr>
<td>PHY 1963</td>
<td>Physics for Scientists and Engineers II</td>
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<td>&amp; PHY 1971</td>
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<tr>
<td>Third Year</td>
<td></td>
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<tr>
<td>Fall</td>
<td></td>
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</tbody>
</table>

Total Credit Hours: 87
**Minor in Biology**

The Minor in Biology is open to all majors in the University. To declare a Minor in Biology or obtain advice, students should consult with their academic advisor. All students pursuing the minor must complete a minimum of 20 semester credit hours of Biology courses. It should be noted that students seeking a minor must also complete applicable support coursework in chemistry, computer science, physics, mathematics and statistics, as needed to fulfill the normal prerequisites for any course listed below. All Biology courses and their prerequisites must be completed with a grade of “C-” or better, and students must achieve a grade point average of at least 2.0 on all work used to satisfy the requirements of the minor.

### A. Required courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 1404</td>
<td>Biosciences I</td>
<td>4</td>
</tr>
<tr>
<td>BIO 1414</td>
<td>Biosciences II</td>
<td>4</td>
</tr>
</tbody>
</table>

### B. 3000- or 4000-level organized biology courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO 3513</td>
<td>Genetics</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Total Credit Hours

<table>
<thead>
<tr>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>9</td>
</tr>
</tbody>
</table>

- Three upper-division biology courses. Excludes laboratory, independent study, research and seminar courses. Substitutions are not allowed without approval of the Biology department.

### Certificate in Pathogenic Outbreak Investigations

This interdisciplinary certificate program is designed for students in biology, information systems and cyber security, computer science and computer engineering disciplines to investigate biological and digital pathogen identification, propagation prediction, and mitigation. The required capstone project reinforces the cross-disciplinary learning fostered by the program and provides real-world practice.

This certificate is open only to biology, information systems and cyber security, computer science, and computer engineering majors. To apply for the Pathogenic Outbreak Investigations certificate, students should consult with the Director of the Office of Undergraduate Research for specific information about certificate requirements and consult with their academic advisors to verify that they have met all University requirements. All courses used to satisfy the requirements of this undergraduate certificate program must be college-level courses taken at UTSA. Students must fulfill all prerequisite requirements for elective courses.

Students pursuing the Certificate in Pathogenic Outbreak Investigations must complete a minimum of 15 semester credit hours:

#### A. Courses required by all majors:

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<tr>
<th>Course Code</th>
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<th>Credit Hours</th>
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<tbody>
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<td>Advanced Physiology</td>
<td>3</td>
</tr>
<tr>
<td>BIO 4783</td>
<td>Microbial Genetics and Physiology</td>
<td>3</td>
</tr>
<tr>
<td>American History core</td>
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<td>3</td>
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<td>Government-Political Science core</td>
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2. These laboratory courses include a lecture component as indicated on the University Schedule of Classes.

**Note:** Some courses are only offered once a year; Fall or Spring. Check with the Department of Biology for scheduling of courses.

### Minor in Biology

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2. These laboratory courses include a lecture component as indicated on the University Schedule of Classes.

**Note:** Some courses are only offered once a year; Fall or Spring. Check with the Department of Biology for scheduling of courses.
BIOL 1203. 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. Generally offered: Fall, Spring.

BIOL 1205. Introductory Microbiology. (3-0) 3 Credit Hours. (TCCN = BIOL 2320)
Prerequisite: BIOL 1233 or BIOL 1404. A general study of microorganisms, their characteristics, isolation, growth, and importance in nature, industry, public health, and human disease. (Formerly AHS 1053. Credit cannot be earned for both BIOL 1053 and AHS 1053. BIOL 1053 cannot substitute for AHS 3713.) Generally offered: Fall, Spring.

BIOL 1206. Introductory Microbiology Laboratory. (0-3) 1 Credit Hour. (TCCN = BIOL 2120)
Prerequisites: BIOL 1233 or BIOL 1404, and completion of or concurrent enrollment in BIOL 1205. 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. Credit cannot be earned for both AHS 1061 and BIOL 1061. BIOL 1061 cannot substitute for BIOL 3722.) Generally offered: Fall, Spring, Summer.

BIOL 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.

BIOL 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.

BIOL 1404. Biosciences I. (3-4) 4 Credit Hours. (TCCN = BIOL 1406)
Prerequisite: Completion of or concurrent enrollment in one of the following: STA 1053, MAT 1023, MAT 1033, MAT 1073, or higher. 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. The course includes 3 hours of lecture and a mandatory 3.5-hour laboratory per week. May be applied toward the Core Curriculum requirement in Life and Physical Sciences. (Formerly BIOL 1113 and BIOL 1203. Credit cannot be earned for both BIOL 1404 and BIOL 1113 or BIOL 1203.) Generally offered: Fall, Spring, Summer.

BIOL 1414. Biosciences II. (3-4) 4 Credit Hours. (TCCN = BIOL 1407)
Prerequisite: BIOL 1404. 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. The course includes 3 hours of lecture and a mandatory 3.5-hour laboratory per week. May be applied toward the Core Curriculum requirement in Life and Physical Sciences. (Formerly BIOL 1143, BIOL 1223 and BIOL 1413. Credit cannot be earned for more than one of the following: BIOL 1143, BIOL 1223, BIOL 1413, BIOL 1414, or ES 2013).

BIOL 1511. Biomedical Research as a Career. (1-0) 1 Credit Hour.
Intended for science majors of any discipline, this course is designed to introduce students to career options in the biosciences, particularly biomedical research. Students will explore the opportunities available in research and learn what they can do now to successfully launch a future career as a scientist.

BIOL 1951. Special Studies in Biosciences. (0-3) 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.

BIOL 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 BIOL 1023. Credit cannot be earned for both BIOL 2003 and BIOL 1023.) Generally offered: Spring.

BIOL 2043. Nutrition. (3-0) 3 Credit Hours. (TCCN = BIOL 1322)
Prerequisite: BIOL 1233 or BIOL 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. Credit cannot be earned for both BIOL 2043 and AHS 2043.) Generally offered: Fall, Spring, Summer.
BIO 2051. Human Anatomy and Physiology Laboratory I. (0-3) 1 Credit Hour. (TCCN = BIOL 2101)
Prerequisite: BIO 1233 or BIO 1404. Concurrent enrollment in BIO 2053 is recommended. This laboratory supplements the BIO 2053 lecture. It is the first of a two-course laboratory sequence that uses both dissections of representative organisms and laboratory experimentation to study human anatomical systems and physiological processes. (Credit cannot be earned for both BIO 2051 and BIO 2091. BIO 2051 cannot substitute for BIO 3422).

BIO 2053. Human Anatomy and Physiology I. (3-0) 3 Credit Hours.
(TCCN = BIOL 2301)
Prerequisite: BIO 1233 or BIO 1404. Concurrent enrollment in BIO 2051 is recommended. 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. (Credit cannot be earned for both BIO 2053 and BIO 2083. BIO 2053 cannot substitute for BIO 3413).

BIO 2061. Human Anatomy and Physiology Laboratory II. (0-3) 1 Credit Hour. (TCCN = BIOL 2102)
Prerequisite: BIO 2051. Concurrent enrollment in BIO 2063 is recommended. This laboratory supplements the BIO 2063 lecture. It is the second of a two-course laboratory sequence that uses both dissections of representative organisms and laboratory experimentation to study human anatomical systems and physiological processes. (Credit cannot be earned for both BIO 2061 and BIO 2111. BIO 2061 cannot substitute for BIO 3422).

BIO 2063. Human Anatomy and Physiology II. (3-0) 3 Credit Hours.
(TCCN = BIOL 2302)
Prerequisite: BIO 2053. Concurrent enrollment in BIO 2061 is recommended. 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. (Credit cannot be earned for both BIO 2063 and BIO 2103. BIO 2063 cannot substitute for BIO 3413).

BIO 2313. Genetics. (3-0) 3 Credit Hours. (TCCN = BIOL 2316)
Prerequisites: BIO 1414 and completion or concurrent enrollment in one of the following: MAT 1093 (or higher) or STA 1053. Concurrent enrollment in BIO 2322 is recommended. Principles governing transmission of hereditary factors in plants and animals, with emphasis on molecular, biochemical, and population genetics. Generally offered: Fall, Spring, Summer.

BIO 2322. Genetics Laboratory. (1-4) 2 Credit Hours.
Prerequisites: BIO 1414 and completion or concurrent enrollment in BIO 2313, and in one of the following: MAT 1093 (or higher) or STA 1053. A practical introduction to genetic problem solving that focuses on experiments with model organisms using classic, biochemical and molecular biological techniques. This laboratory includes a lecture component. Generally offered: Fall, Spring, Summer.

BIO 3013. Introduction to Clinical Medicine and Pathology. (3-0) 3 Credit Hours.
Prerequisite: BIO 1404. Introduction to concepts of human disease, diagnosis, and underlying pathology. (Formerly titled “Introductory Pathology”).

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 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).

BIO 3123. Comparative Vertebrate Anatomy. (3-0) 3 Credit Hours.
Prerequisite: BIO 1414. A comparative analysis of developmental and adult anatomy of vertebrates (including human). Emphasis is placed on phylogenetic relationships between form, function and evolution. (Formerly BIO 2123. Credit cannot be earned for both BIO 2123 and BIO 3123.) Generally offered: Spring.

BIO 3213. Animal Behavior. (3-0) 3 Credit Hours.
Prerequisite: BIO 1414 or consent of instructor. A detailed study of animal behaviors and their biological determinants. Generally offered: Fall, Summer.

BIO 3263. The Woody Plants. (2-3) 3 Credit Hours.
Prerequisite: Junior or senior status: a minimum of 60 semester credit 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 3223. Credit cannot be earned for both BIO 3263 and ES 3223.) Generally offered: Fall.

BIO 3273. Biology of Flowering Plants. (2-3) 3 Credit Hours.
Prerequisite: Junior or senior status: a minimum of 60 semester credit 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.

BIO 3283. Principles of Ecology. (3-0) 3 Credit Hours.
Prerequisite: BIO 1414. Concurrent enrollment in BIO 3292 is recommended for biology majors. A study of the interaction of organisms with their environment, with focus on ecological principles, adaptations of organisms, environmental pollution, and principles of conservation. (Credit cannot be earned for both BIO 3283 and ES 3033.) Generally offered: Fall, Spring, Summer.

BIO 3292. Principles of Ecology Laboratory. (0-6) 2 Credit Hours.
Prerequisites: BIO 1414 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. (Credit cannot be earned for both BIO 3292 and ES 3042.) Generally offered: Fall, Spring, Summer.

BIO 3323. Evolution. (3-0) 3 Credit Hours.
Prerequisite: BIO 2313. A discussion of theories and possible mechanisms for evolutionary changes at various levels of organization.
BIO 3333. Plants and Society. (3-0) 3 Credit Hours.
Prerequisite: BIO 2313. 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 BIO 2343. Credit cannot be earned for both BIO 3333 and BIO 2343.) Generally offered: Spring.

BIO 3343. Plant Cell Biology. (3-0) 3 Credit Hours.
Prerequisite: BIO 2313. 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.

BIO 3413. Advanced Physiology. (3-0) 3 Credit Hours.
Prerequisites: BIO 2313 and MAT 1193. Concurrent enrollment in BIO 3422 is also recommended. This course is designed to develop the skills and competencies needed by students to understand the dynamic physiological processes underlying the maintenance of homeostatic balance in animals. Topics to be covered include endocrine, neural, muscular, cardiopulmonary and renal physiology. (BIO 2103 or BIO 3153 cannot substitute for BIO 3413.) Generally offered: Fall, Spring, Summer.

BIO 3422. Advanced Physiology Laboratory. (0-5) 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. (BIO 2111 cannot substitute for BIO 3422.) Generally offered: Fall, Spring, Summer.

BIO 3433. Neurobiology. (3-0) 3 Credit Hours.
Prerequisite: BIO 1414. Concurrent enrollment in BIO 3442 is recommended. Anatomy and physiology of nervous systems; the mechanisms of neuronal functions. Generally offered: Fall, Spring.

BIO 3442. Neurobiology Laboratory. (0-4) 2 Credit Hours.
Prerequisite: Completion of or concurrent enrollment in BIO 3433. A laboratory course emphasizing principles presented in BIO 3433. Generally offered: Fall, Spring.

BIO 3513. Biochemistry. (3-0) 3 Credit Hours.
Prerequisites: CHE 2612 and CHE 3643; BIO 2313 and CHE 3673 are highly recommended. Concurrent enrollment in BIO 3522 is recommended. Introduction to biochemistry: amino acids, protein structure, enzymes, lipids, metabolism, nucleic acid structure, bioenergetics, and carbohydrates. (Credit cannot be earned for both BIO 3513 and CHE 4303.) Generally offered: Fall, Spring, Summer.

BIO 3522. Biochemistry Laboratory. (1-4) 2 Credit Hours.
Prerequisites: CHE 2603 and CHE 2612, and completion of or concurrent enrollment in BIO 3513. Basic biochemical laboratory techniques: Protein assay, centrifugation, protein purification, chromatography, electrophoresis, western blotting, and enzyme kinetics. This laboratory includes a lecture component. Generally offered: Fall, Spring, Summer.

BIO 3533. FAME-Biophysics. (3-0) 3 Credit Hours.
This course is only open to students who are participating in the FAME Program. Biophysics is an algebra-based introduction to the science of physics with an emphasis on the life sciences and the practice of medicine. Topics include mechanics, fluids, sounds, and electromagnetism and their biomedical applications.

BIO 3543. FAME-Behavioral Health. (3-0) 3 Credit Hours.
This course is only open to students who are participating in the FAME Program. This course is designed to introduce students to the challenges and opportunities of treating patients with mental illness. Students will learn key ethical principles, differential diagnosis, and pharmacological and psychotherapeutic interventions for managing serious mental illnesses including schizophrenia, bipolar disorder, depression, and anxiety disorders. Students will also learn how to conduct a psychiatric interview and prepare a new patient intake including patient history, mental status exam, assessment, and plan.

BIO 3553. FAME-Geriatrics. (3-0) 3 Credit Hours.
This course is only open to students who are participating in the FAME Program. Using interdisciplinary perspectives, students will learn about medical and psychosocial aspects of aging including physiological, societal, social, physical, and psychological changes as they relate to the aging process, geriatric health care, palliative care and end of life care. Hands-on educational experiences will involve interaction with healthy elders, clinical rotations at hospital consult services, long term care communities and hospice care. All activities will be case-based, interactive and will have an online learning component.

BIO 3563. FAME-Cardiovascular Disease/Diabetes. (3-0) 3 Credit Hours.
This course is only open to students who are participating in the FAME Program. This course is designed to provide an overview and historical perspective in the evolution of maternal health and pediatrics as fields of practice in medicine. Topics discussed will include public health and policy, representations of the field in the arts, literature and media, and the development of careers in pediatric medicine. Opportunities for interactive community and clinically based experiences will be incorporated in the coursework.

BIO 3573. FAME-Obesity/Nutrition. (3-0) 3 Credit Hours.
This course is only open to students who are participating in the FAME Program. Students will explore the physiological, socio-behavioral, public health and philosophical implications of obesity and nutrition through acute and preventive medicine perspectives.

BIO 3583. FAME-Cardiovascular Disease/Diabetes. (3-0) 3 Credit Hours.
This course is only open to students who are participating in the FAME Program. Students will explore the genetic, biologic, physiologic, cultural, and economic implications of cardiovascular disease through didactic sessions, group projects, self-study and direct patient contact.

BIO 3593. FAME-Cancer. (3-0) 3 Credit Hours.
This course is only open to students who are participating in the FAME Program. Students will explore the historical, genetic, biologic, social, ethical, legal and economic implications of cancer, its predisposing factors and treatments. This will be accomplished through readings, didactic sessions, group projects, self-study, and clinical contact with patients and cancer center health care providers.

BIO 3613. The Biology of Aging. (3-0) 3 Credit Hours.
Prerequisite: BIO 2313. The biological principles of human life and health; changes that occur with aging and their implications for the lives of students and their families.

BIO 3623. Neuropsychopharmacology. (3-0) 3 Credit Hours.
Prerequisite: BIO 1414; 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. Generally offered: Fall.
BIO 3663. Human Embryology. (3-0) 3 Credit Hours.  
Prerequisite: BIO 2313. 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. Generally offered: Fall.

BIO 3713. Microbiology. (3-0) 3 Credit Hours.  
Prerequisite: BIO 1414. Concurrent enrollment in BIO 2313 and BIO 3722 is recommended. A comprehensive study of microorganisms, including their composition, morphology, growth, metabolism, classification, ecology, and significance in disease. (BIO 1053 cannot substitute for BIO 3713. Credit cannot be earned for both BIO 3713 and ES 3103.) Generally offered: Fall, Spring, Summer.

BIO 3722. Microbiology Laboratory. (0-6) 2 Credit Hours.  
Prerequisites: BIO 1414, and completion of or concurrent enrollment in BIO 3713. 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. Credit cannot be earned for both BIO 3722 and ES 3112.) Generally offered: Fall, Spring, Summer.

BIO 3743. Bacteriology. (3-0) 3 Credit Hours.  
Prerequisite: BIO 3713; BIO 3722 is recommended. 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. Generally offered: Fall.

BIO 3813. Cell Biology. (3-0) 3 Credit Hours.  
Prerequisite: BIO 2313; BIO 3513 is recommended. Concurrent enrollment in BIO 3822 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. Generally offered: Fall, Spring, Summer.

BIO 3822. Cell Biology Laboratory. (1-4) 2 Credit Hours.  
Prerequisites: BIO 2313 and either BIO 2322 or CHE 1131, and completion of or concurrent enrollment in BIO 3813. A study of the microscopic, biochemical and molecular approaches used to investigate cellular structure and function, including the principles involved in the techniques, their practical application, and analysis of the data generated. This laboratory includes a lecture component. Generally offered: Fall, Spring, Summer.

BIO 3913. Molecular Biology. (3-0) 3 Credit Hours.  
Prerequisite: BIO 2313; BIO 3513 is recommended. A study of nucleotides, DNA, replication, recombination, RNA, transcription, genetic code, translation, genomes, and chromosomas. Generally offered: Spring.

BIO 3933. Principles of Cancer Biology. (3-0) 3 Credit Hours.  
Prerequisite: BIO 1414; BIO 3813 is recommended. A comprehensive study of the molecular mechanisms responsible for cellular and organismal function including: nucleic acid structure, replication, repair and recombination of DNA, transcription (RNA), RNA processing, translation (proteins), regulation of gene expression, organization of genomes and chromosomes, epigenetics, and related scientific methods and approaches.

BIO 4033. Conservation Biology. (3-0) 3 Credit Hours.  
Prerequisite: BIO 3283. 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).

BIO 4043. Desert Biology. (2-3) 3 Credit Hours.  
Prerequisite: Junior or senior status: a minimum of 60 semester credit hours, or consent of instructor. 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.

BIO 4053. Wildlife Biology. (3-0) 3 Credit Hours.  
Prerequisite: BIO 3283. An introduction to wildlife biology and management including ecological principles dealing with ecosystems, natural communities, and populations. The importance of animal behavior, the availability of food, cover, wildlife diseases, predators, hunting, and trapping will be included. 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).

BIO 4063. Ornithology. (2-3) 3 Credit Hours.  
Prerequisite: BIO 1404. 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.

BIO 4143. Developmental Biology. (3-0) 3 Credit Hours.  
Prerequisite: BIO 2313. 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 BIO 3143. Credit cannot be earned for both BIO 4143 and BIO 3143).

BIO 4233. Field Biology. (3-0) 3 Credit Hours.  
Prerequisite: Junior or senior status: a minimum of 60 semester credit hours, or consent of instructor. Concurrent enrollment in BIO 4241 is recommended. A study of the natural history of plants and animals in their native environment. Techniques for the identification of birds, mammals, reptiles, amphibians, insects, and the dominant flowering plants will be discussed. (Same as ES 4113. Credit cannot be earned for both BIO 4233 and ES 4113.).

BIO 4241. Field Biology Laboratory. (0-3) 1 Credit Hour.  
Prerequisite: Junior or senior status: a minimum of 60 semester credit hours, or consent of instructor. Concurrent enrollment in BIO 4233 is recommended. 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).
BIO 4453. Endocrinology. (3-0) 3 Credit Hours.
Prerequisite: BIO 1414. 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). Generally offered: Fall.

BIO 4473. Advanced Clinical Medicine and Pathology. (3-0) 3 Credit Hours.

BIO 4483. Medical Mycology. (3-0) 3 Credit Hours.

BIO 4583. The Computational Brain. (3-0) 3 Credit Hours.
Prerequisite: BIO 3433. Principles of cellular neurophysiology and neuroanatomy are used to explore the computational operations performed by neurons and networks of neurons. Generally offered: Spring.

BIO 4643. Medicinal Plants. (3-0) 3 Credit Hours.
Prerequisite: BIO 2313; BIO 3513 is recommended. Ethnobotanical, biochemical and pharmacological aspects of some of our most important plant-derived drugs. Generally offered: Fall.

BIO 4723. Virology. (3-0) 3 Credit Hours.
Prerequisites: BIO 2313 and BIO 3513. 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. Generally offered: Fall.

BIO 4743. Immunology. (3-0) 3 Credit Hours.
Prerequisites: BIO 2313 and BIO 3713. 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. Generally offered: Fall, Spring, Summer.

BIO 4752. Immunology Laboratory. (0-4) 2 Credit Hours.
Prerequisites: BIO 3713 and BIO 3722, and completion or concurrent enrollment in BIO 4743. Laboratory applications of principles presented in BIO 4743. (Formerly BIO 4751. Credit cannot be earned for both BIO 4751 and BIO 4752).

BIO 4763. Parasitology. (3-0) 3 Credit Hours.
Prerequisite: BIO 2313. 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. Generally offered: Spring.

BIO 4783. Microbial Genetics and Physiology. (3-0) 3 Credit Hours.
Prerequisite: BIO 2313 and BIO 3713. A study of the genetic, physiological and molecular processes that influence gene transfer, pathogenesis, and drug resistance related to bacteria, fungi, and viruses.

BIO 4813. Brain and Behavior. (3-0) 3 Credit Hours.
Prerequisite: BIO 1414. Basic physiological functions of the brain and how they relate to behavior. Generally offered: Fall.

BIO 4823. Cognitive Neuroscience. (3-0) 3 Credit Hours.
Prerequisite: Junior or senior status: a minimum of 60 semester credit hours; BIO 3433 (or PSY 3103) is recommended. The biological foundations of mental phenomena, including perception, attention, learning, memory, language, motor control, and executive function, as well as functional specialization, development and plasticity, through various methodologies. Generally offered: Spring.

BIO 4831. Undergraduate Teaching Assistant. (0-0) 1 Credit Hour.
Prerequisite: Junior or senior status and consent of laboratory coordinator. Students can obtain teaching experience by assisting with instruction in a Biology undergraduate laboratory that they previously completed with a grade of "B-" or better. Students will work under the guidance of a graduate teaching assistant or laboratory coordinator. Besides instructing in the classroom, students will be expected to attend teaching assistant meetings, help set up laboratories and complete a written report at the end of the semester. Students will not have any grading responsibility. May be repeated for credit, but no more than 3 semester credit hours will apply to the bachelor's degree.

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 may be taken as free electives, for a maximum of 12 research hours being applied to the bachelor's degree.

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 may be taken as free electives, for a maximum of 12 research hours being applied to the bachelor's degree.

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 may be taken as free electives, for a maximum of 12 research hours being applied to the bachelor's degree.
BIO 4923. Laboratory Research: Biology Concentrations. (0-0) 3 Credit Hours.
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 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.

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.

BIO 4952. Special Studies in Biology. (2-0) 2 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.

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. Generally offered: Fall, Spring, Summer.

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).

BIO 4993. Honors Research. (0-0) 3 Credit Hours.
Enrollment limited to biology majors who are members of the Honors College or who are pursuing College of Sciences Honors, and who are in their last two semesters of study. Approval by the Honors College or College Honors Committee is required. 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 may be taken as free electives, for a maximum of 12 research hours being applied to the bachelor’s degree. Generally offered: Fall, Spring.