BIOLOGY

Programs Offered

- Bachelor of Science in Biology
- Bachelor of Science in Biology with an Emphasis in Biotechnology
- Bachelor of Science in Biology with an Emphasis in Cell and Molecular Biology
- Bachelor of Science in Biology with an Emphasis in Clinical Laboratory Science
- Bachelor of Science in Biology with an Emphasis in Ecology, Evolution and Organismal Biology
- Bachelor of Science in Biology with an Emphasis in Medical Imaging
- Bachelor of Arts in Biology with an Emphasis in Ecology, Evolution and Organismal Biology
- Bachelor of Arts in Biology with an Emphasis in General Biology
- Bachelor of Arts in Biology with an Emphasis in Pre-Professional Studies
- Bachelor of Arts in Biology with an Emphasis in Subject Matter Preparation in Teaching Biology (Pending CCTC approval)
- Master of Science in Biotechnology and Bioinformatics
- Master of Science in Biotechnology and Master of Business Administration (Dual Degree)
- Minor in Biology
- Certificate in Biotechnology
- Honors in Biology

Program Description

Biology is the study of life, its origins, diversity and intricacies. It emphasizes the relationship between structure and function in living systems and the processes, by which organisms grow, reproduce and interact with each other and their environment. The discipline is dynamic and rapidly advancing, particularly in the areas of biotechnology and information technology. The Biology Program provides its undergraduate and graduate students with a strong theoretical foundation in biology, combined with extensive hands-on laboratory experiences using state-of-the-art technology. Students take a series of core courses augmented by electives selected from areas of special interest.

Careers

The Bachelor of Science in Biology is designed for students who wish to enter medical, dental or other health professional or graduate schools, or to seek careers in business, industry or government.

The Bachelor of Science in Biology with an Emphasis in Biotechnology enables students to make a smooth transition from academia to biotechnology industry by understanding the concepts of basic and applied biotechnology. This program allows students to have numerous career avenues and the groundwork for graduate study.

The Bachelor of Science in Biology with an Emphasis in Cell and Molecular Biology offers students an opportunity to study the exciting developments in genetics, molecular biology, cloning, biotechnology and bioinformatics. This program leads to careers in medical sciences, biotechnology, pharmaceuticals, research and development, intellectual property and patent law.

Bachelor of Science in Biology with an Emphasis in Clinical Laboratory Science prepares students for further clinical training and California License Exam in Clinical Laboratory Science or for training and certification in Public Health Microbiology.

The Bachelor of Science in Biology with an Emphasis in Ecology, Evolution and Organismal Biology allows students to explore biodiversity at multiple levels of organization, from molecules to the biosphere. Students will gain an understanding of the complex interactions among organisms and between organisms and their physical environments. The emphasis prepares students for environmental studies conservation, research, or education. It also provides preparation for graduate study in biology.

The Bachelor of Science in Biology with an Emphasis in Medical Imaging prepares students for graduate or professional study in the medical sciences (medical imaging, medical physics, health physics, dosimetry, nuclear medicine, radiotherapy, oncology, biomedical engineering), or for entry into professional positions in the clinical environment and in medical imaging research and development.

The Bachelor of Arts degree is designed to obtain a general background in both the concepts and the technical skills of modern biology. Students completing the Bachelor of Arts major will find that their strong general background will allow them flexibility in both completing minor fields of study and career choices. The degree prepares graduates for careers in medical and other health professions (Emphasis in Pre-Professional Studies), science education (Emphasis in Subject Matter Preparation in Teaching Biology), industry or government (Emphasis in General Biology).

Biology as a discipline has been rapidly advancing in the last decade. With the information derived from the sequencing of the genomes of many organisms, it will have far-reaching impacts on the environment, public health, and on local, regional, and global economies. The Biology Minor allows students in majors other than biology to gain an understanding of these exciting developments. It will provide a solid background in biology and the opportunity to explore selected area(s) at a greater depth. Equipped with a minor in biology, students with a major in other disciplines will have a greater understanding and knowledge of the latest advances in many areas of biology and will therefore be more versatile in their career paths. The requirement for a Minor in Biology is 21 units.

The Certificate in Biotechnology will provide students with advanced knowledge and skills in modern biotechnology that will lead to careers in biotechnology as well as pharmaceutical industries.

Program Learning Outcomes

Students graduating from the Biology program will be able to:

- Explain the basic structures and fundamental processes of life at molecular, cellular and organismal levels;
- Identify the evolutionary processes that lead to adaptation and biological diversity;
- Describe the relationship between life forms and their environment and ecosystems;
- Collect, organize, analyze, interpret and present quantitative and qualitative data and incorporate them into the broader context of biological knowledge;
- Effectively apply current technology and scientific methodologies for problem solving;
- Find, select and evaluate various types of scientific information including primary research articles, mass media sources and world-wide web information; and
- Communicate effectively in written and oral forms.

Requirements for Honors in Biology

Candidacy for honors in biology is voluntary. To be eligible, a student must fulfill the following requirements:

1. Achieve a minimum grade point average of 3.5 for all courses satisfying the requirements for the major as defined above;
2. Take at least seven courses in the major at this university;
3. Satisfactorily complete a Service Learning course from BIOL 492, 494 or 497;
4. Satisfactorily complete a Senior Capstone course.

Application for candidacy must be made at the beginning of the senior year. Approval of candidacy and of the Service Learning project and project advisor rests with the Biology Program. The project advisor will have the sole responsibility for acceptance of the completed project.

The Biology Program may grant honors to exceptional students who have not met the above requirements, but who have in the judgment of the Program brought distinction upon themselves and the Program in some other significant and appropriate manner.

Faculty

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For graduation roadmaps for the B.S. and B.A. programs in Biology, please visit: http://biology.csuci.edu.

Requirements for the Bachelor of Science Degree in Biology (120 units)

Common Lower Division Requirements for All Emphases of the Bachelor of Science Degree in Biology (8 units)

BIOL	200*	Principles of Organismal and Population Biology, GE-B2 (4)
BIOL	201	Principles of Cell & Molecular Biology (4)

For Bachelor of Science in Biology

Upper Division Requirements in the Major (39 units)

1. Required Biology Courses (25 units)

BIOL	300	Cell Biology (4)
BIOL	302	Genetics (4)
BIOL	303	Evolutionary Biology (3)
BIOL	304	Comparative Animal Physiology (3)
BIOL	400	Molecular Biology (4)
BIOL	433*	Ecology and the Environment, GE- B2, UDID (4)
BIOL	499	Senior Capstone in Biology (3)

2. Electives in Biology (14 units)

Select a minimum of 14 units of biology courses from 300 and 400 levels, one of which must be a lab course. (Biology courses numbered from 326 to 345 are counted toward GE credits only and they are not counted towards the 14 units of electives).

No more than 2 units taken from the following can be counted towards the 14 units of electives:

BIOL	492	Internship (2-3)
BIOL	494	Independent Research (1-3)
BIOL	497	Directed Study (1-3)

Required Supporting and Other GE Courses (73 units)

1. Chemistry (16 units)

CHEM 121* General Chemistry I, GE-B1 (4)
CHEM 122 General Chemistry II, GE-B1 (4)
CHEM 311 Organic Chemistry I (3)
CHEM 312 Organic Chemistry I Laboratory (1)
CHEM 314 Organic Chemistry II (3)
CHEM 315 Organic Chemistry II Laboratory (1)

A year-long organic chemistry sequence with laboratory taken at a community college may be accepted for the Biology major in lieu of CHEM 311, 312, 314, 315

2. Physics (8 units)

Select one of the following combinations:

PHYS 100 Introduction to Physics I, GE-B1 (4)
PHYS 101 Introduction to Physics II, GE-B1 (4)
or
PHYS 200 General Physics I, GE-B1 (4)
PHYS 201 General Physics II, GE-B1 (4)

3. Statistics and Mathematics (7 units)

BIOL 203* Quantitative Methods for Biology, GE-B3, B4 (3)
MATH 150* Calculus I, GE-B3 (4)

4. Other Required GE Courses in Categories A-E (36 units)

Category A . . . . . 9 units
(For A3, recommend MATH 230 Mathematical Reasoning)
Category C . . . . . 12 units
Category D . . . . . 12 units
Category E . . . . . 3 units

5. American Institutions Requirement (6 units)

*Courses with * are double-counted toward GE credits.*

For Emphasis in Biotechnology

Upper Division Requirements in the Major (49 units)

1. Required Biology Courses (37 units)

BIOL 300 Cell Biology (4)
BIOL 301 Microbiology (4)
BIOL 302 Genetics (4)
BIOL 400 Molecular Biology (4)
BIOL 401 Biotechnology and Recombinant DNA Techniques (5)
BIOL 404 Plant and Animal Tissue Culture (3)
BIOL 405 Biochemical Engineering (4)
BIOL 420 Cellular & Molecular Immunology (4)
BIOL 492 Internship (2-3)
BIOL 499 Senior Capstone in Biology (3)

2. Electives in Biology and Physics (12 units)

Select from the following list of courses:

BIOL 315 Introduction to Biophysics (PHYS) (4)
BIOL 403 Foundations of Structural Biology (4)
BIOL 408 Nanobiotechnology (3)
BIOL 421 Virology (3)
BIOL 422 Molecular Plant Physiology (4)
BIOL 423 Cellular & Molecular Neurobiology (3)
BIOL 424 Human Physiology (3)
BIOL 425 Human Genetics (3)
BIOL 426 Hematology (4)
BIOL 428 Biology of Cancer (3)
BIOL 431* Bioinformatics, GE-B2, B4, UDID (4)
MGT 471 Project Management (3)
BIOL 503 Biotechnology Law and Regulation (3)

Required Supporting and Other GE Courses (63 units)

1. Chemistry (14 units)

CHEM 121* General Chemistry I, GE-B1 (4)
CHEM 122 General Chemistry II, GE-B1 (4)
CHEM 311 Organic Chemistry I (3)
CHEM 318 Biological Chemistry (3)

An organic chemistry taken at a community college may be accepted for the Biology major in lieu of CHEM 311

2. Statistics, Mathematics and Computer Applications (7 units)

BIOL 203* Quantitative Methods for Biology, GE- B3, B4 (3)
MATH 150* Calculus I, GE-B3 (4)

3. Other Required GE Courses in Categories A-E (36 units)

Category A . . . . . 9 units
(For A3, recommend MATH 230 Mathematical Reasoning)
Category C . . . . . 12 units
Category D . . . . . 12 units
Category E . . . . . 3 units

4. American Institutions Requirement (6 units)

*Courses with * are double-counted toward GE credits.*

For Emphasis in Cell and Molecular Biology

Upper Division Requirements in the Major (40 units)

1. Required Biology Courses (31 units)

BIOL 300 Cell Biology (4)
BIOL 301 Microbiology (4)
BIOL 302 Genetics (4)
BIOL 303 Evolutionary Biology (3)
BIOL 400 Molecular Biology (4)
BIOL 401 Biotechnology and Recombinant DNA Techniques (5)
BIOL 431* Bioinformatics, GE-B2, B4, UDID (4)
BIOL 499 Senior Capstone in Biology (3)

2. Electives in Biology (9 units)

Select from the following list of courses:

BIOL 402 Toxicology (3)
BIOL 403 Foundations of Structural Biology (4)
BIOL 404 Plant and Animal Tissue Culture (3)
BIOL 405 Biochemical Engineering (4)
BIOL 408 Nanobiotechnology (3)
BIOL 416 Radiobiology and Radionuclides (PHYS) (3)
BIOL 420 Cellular & Molecular Immunology (4)
BIOL 421 Virology (3)
BIOL 422 Molecular Plant Physiology (4)
BIOL 423 Cellular & Molecular Neurobiology (3)
BIOL 424 Human Physiology (3)
BIOL 425 Human Genetics (3)
BIOL 426 Hematology (4)
BIOL 427 Developmental Biology (4)
BIOL 428 Biology of Cancer (3)
BIOL 432* Principles of Epidemiology and Environmental Health, GE-B2, D, UDID (3)
BIOL 433* Ecology and the Environment, GE-B2, UDID (4)

No more than 2 units taken from the following can be counted towards the 9 units of electives:

BIOL 492 Internship (2-3)
BIOL 494 Independent Research (1-3)
BIOL 497 Directed Study (1-3)

Required Supporting and Other GE Courses (72 units)

1. Chemistry (minimum 15 units)

CHEM 121* General Chemistry I, GE-B1 (4)
CHEM 122 General Chemistry II GE-B1 (4)
CHEM 311 Organic Chemistry I (3)
CHEM 312 Organic Chemistry I Laboratory (1)

Select either:

CHEM 318 Biological Chemistry (3)
or
CHEM 314 Organic Chemistry II (3) ***and***
CHEM 315 Organic Chemistry II Laboratory (1)

A year-long organic chemistry sequence with laboratory taken at a community college may be accepted for the Biology major in lieu of CHEM 311, 312, 314, 315

2. Physics (8 units)

Select one of the following combinations:

PHYS 100 Introduction to Physics I, GE-B1 (4)
PHYS 101 Introduction to Physics II, GE-B1 (4)
or
PHYS 200 General Physics I, GE-B1 (4)
PHYS 201 General Physics II, GE-B1 (4)

3. Statistics and Mathematics (7 units)

BIOL 203* Quantitative Methods for Biology, GE-B3, B4 (3)
MATH 150* Calculus I, GE-B3 (4)

4. Other Required GE Courses in Categories A-E (36 units)

Category A . . . . . 9 units
(For A3, recommend MATH 230 Mathematical Reasoning)
Category C . . . . . 12 units
Category D . . . . . 12 units
Category E . . . . . 3 units

5. American Institutions Requirement (6 units)

*Courses with * are double-counted toward GE credits.*

For Emphasis in Clinical Laboratory Science

Additional Requirements in the Major (41 - 43 units)

1. Required Biology Courses (37 units)

BIOL 217 Medical Microbiology (4)
BIOL 300 Cell Biology (4)
BIOL 302 Genetics (4)
BIOL 303 Evolutionary Biology (3)
BIOL 317 Parasitology (4)
BIOL 318 Medical Mycology (4)
BIOL 420 Cellular and Molecular Immunology (4)
BIOL 421 Virology (3)
BIOL 426 Hematology (4)
BIOL 432* Principles of Epidemiology and Environmental Health, GE-B2, D, UDID (3)

2. Other Required Courses in Biology (4-6 units)

If one chooses to complete CHEM 318 and BIOL 203, one needs to complete a minimum of 6 units from the following courses. Otherwise, one needs to complete minimum of 4 units from the following courses:

BIOL 400 Molecular Biology (4)
BIOL 424 Human Physiology (3)
BIOL 425 Human Genetics (3)

Required Supporting and Other GE Courses (69-71 units)

1. Chemistry (19-20 units)

CHEM 121* General Chemistry I, GE-B1 (4)
CHEM 122 General Chemistry II GE-B1 (4)
CHEM 250 Quantitative Analysis (2)
CHEM 251 Quantitative Analysis Laboratory (2)
CHEM 311 Organic Chemistry I (3)
CHEM 312 Organic Chemistry I Laboratory (1)
and
CHEM 318 Biological Chemistry (3)
or
CHEM 460 Biochemistry I (4)

An Organic Chemistry course with laboratory taken at a community college may be accepted for the Biology major in lieu of CHEM 311 and 312.

2. Physics (8 units)

PHYS	100	Introduction to Physics I, GE-B1 (4)
PHYS	101	Introduction to Physics II, GE-B1 (4)

3. Statistics and Mathematics (3-4 units)

Select one of the following combinations:

BIOL	203*	Quantitative Methods for Biology, GE-B3, B4 (3)
MATH	150*	Calculus I, GE-B3 (4)

4. Other Required GE Courses in Categories A-E (33 units)

Category A . . . . . 9 units
(For A3, recommend MATH 230 Logic and Mathematical Reasoning)
Category C . . . . . 12 units
Category D . . . . . 9 units
Category E . . . . . 3 units

5. American Institutions Requirement (6 units)

*Courses with * are double-counted toward GE credits.*

For Emphasis in Ecology, Evolution and Organismal Biology

Upper Division Requirements in the Major (42-44 units)

1. Required Core Courses (26 units)

BIOL	301	Microbiology (4)
BIOL	302	Genetics (4)
BIOL	303	Evolutionary Biology (3)
BIOL	311	Plant Biology and Ecology (4)
BIOL	433*	Ecology and the Environment, GE- B2, UDID (4)
BIOL	499	Senior Capstone in Biology (3)

Select one of the following courses:

BIOL	310	Vertebrate Biology (4)
BIOL	316	Invertebrate Zoology (4)

2. Ecology/Evolution (6-7 units)

Select two courses from the following list:

BIOL	313	Conservation Biology (ESRM) (4)
ESRM	352	Theory and Practice of Ecological Restoration (3)
BIOL	406	Evolutionary Biogeography (3)
BIOL	407	Behavioral Ecology (3)

3. Organismal Biology (4 units)

Select one course from the following list:

BIOL	310	Vertebrate Biology (4) (if not taken as part of core)
BIOL	312	Marine Biology (4)
BIOL	316	Invertebrate Zoology (4) (if not taken as part of core)
BIOL	317	Parasitology (4)
BIOL	450	Ichthyology: The Biology of Fishes (4)
BIOL	451	Ornithology (4)

4. Physiology/Developmental/Molecular Biology (3-4 units)

Select one course from the following list:

BIOL	300	Cell Biology (4)
BIOL	304	Comparative Animal Physiology (3)
BIOL	400	Molecular Biology (4)
BIOL	422	Molecular Plant Physiology (4)
BIOL	427	Developmental Biology (4)

5. Cross-Disciplinary (3-4 units)

Select one course from the following list:

CHEM	301	Environmental Chemistry (3)
GEOL	321	Environmental Geology, GE-B1 (4)
ESRM	328	Introduction to Geographic Information Systems (3)

Required Supporting and Other GE Courses (63 units)

1. Required Supporting Courses (21 units)

CHEM	121*	General Chemistry I, GE-B1 (4)
CHEM	122	General Chemistry II, GE-B1 (4)
CHEM	311	Organic Chemistry I (3)
GEOL	122*	Historical Geology, GE-B1 (3)
BIOL	203*	Quantitative Methods for Biology, GE- B3, B4 (3)
MATH	150*	Calculus I, GE-B3 (4)

An organic chemistry taken at a community college may be accepted for the Biology major in lieu of CHEM 311

2. Other Required GE Courses in Categories A-E (36 units)

Category A . . . . . 9 units
(For A3, recommend MATH 230 Logic and Mathematical Reasoning)
Category C . . . . . 12 units
Category D . . . . . 12 units
Category E . . . . . 3 units

3. American Institutions Requirement (6 units)

Electives in Any Discipline (4-7 units)

One must choose enough elective units to reach the required 120 units for the degree.

*Courses with * are double-counted toward GE credits.*

For Emphasis in Medical Imaging

Additional Lower Division Requirements in the Major (8 units)

BIOL	210	Human Anatomy and Physiology I (4)
BIOL	211	Human Anatomy and Physiology II (4)

Upper Division Requirements in the Major (38 units)

1. Required Biology and Physics Courses (30 units)

BIOL	300	Cell Biology (4)
BIOL	301	Microbiology (4)
BIOL	302	Genetics (4)
BIOL	400	Molecular Biology (4)
BIOL	416	Radiobiology and Radionuclides (PHYS) (3)
BIOL	434*	Introduction to Biomedical Imaging, (HLTH/PHYS) GE-B1, E, UDID (4)
BIOL	464	Biomedical Instrumentation (PHYS) (4)
BIOL	499	Senior Capstone in Biology (3)

2. Electives in Biology and Physics (8 units)

Select from the following list of courses:

BIOL	315	Introduction to Biophysics (PHYS) (4)
BIOL	401	Biotechnology and Recombinant DNA Techniques (5)
BIOL	420	Cellular & Immunology (4)
BIOL	421	Virology (3)
BIOL	423	Cellular & Molecular Neurobiology (3)
BIOL	424	Human Physiology (3)
BIOL	425	Human Genetics (3)
BIOL	427	Developmental Biology (4)
BIOL	428	Biology of Cancer (3)
BIOL	431*	Bioinformatics, GE-B2, B4, UDID (4)
BIOL	432*	Principles of Epidemiology and Environmental Health, GE-B2, D, UDID (3)
BIOL	433*	Ecology and the Environment, GE-B2, UDID (4)
PHYS	445*	Image Analysis and Pattern Recognition, (COMP/MATH) GE-B1, B4, UDID (3

No more than 2 units taken from the following can be counted towards the 8 units of electives:

PHYS	492	Physics Internship (3)
BIOL	494	Independent Research (1-3)
or		
PHYS	494	Independent Research (1-3)
BIOL	497	Directed Study (1-3)
or		
PHYS	497	Directed Study (1-3)

Required Supporting and Other GE Courses (66 units)

1. Chemistry (15 units)

CHEM	121*	General Chemistry I, GE-B1 (4)
CHEM	122	General Chemistry II (4)
CHEM	311	Organic Chemistry I (3)
CHEM	312	Organic Chemistry I Laboratory (1)
CHEM	318	Biological Chemistry (3)

An Organic Chemistry I-equivalent course with laboratory taken at a community college may be accepted for the Biology major in lieu of CHEM 311and 312.

2. Mathematics (4 units)

MATH	150*	Calculus I, GE-B3 (4)

3. Physics (8 units)

Select one of the following combinations:

PHYS	100	Introduction to Physics I, GE-B1 (4)
PHYS	101	Introduction to Physics II, GE-B1 (4)
or		
PHYS	200	General Physics I, GE-B1 (4)
PHYS	201	General Physics II, GE-B1 (4)

4. Other Required GE Courses in Categories A-D (33 units)

Category A . . . . . 9 units
(For A3, recommend MATH 230 Logic and Mathematical Reasoning)
Category C . . . . . 12 units
Category D . . . . . 12 units
Category E- covered by a required GE course for the degree program

5. American Institutions Requirement (6 units)

*Courses with * are double-counted toward GE credits.*

Requirements for the Bachelor of Arts Degree in Biology (120 units)

Common Lower Division Requirements for All Emphases of the Bachelor of Arts Degree in Biology (8 units)

BIOL	200*	Principles of Organismal and Population Biology, GE-B2 (4)
BIOL	201	Principles of Cell & Molecular Biology (4)

For Emphasis in Ecology, Evolution and Organismal Biology

Upper Division Requirements in the Major (36-38 units)

1. Required Biology Core Courses (26 units)

BIOL	301	Microbiology (4)
BIOL	302	Genetics (4)
BIOL	303	Evolutionary Biology (3)
BIOL	311	Plant Biology and Ecology (4)
BIOL	433*	Ecology and the Environment, GE- B2, UDID (4)
BIOL	499	Senior Capstone (3)

Select one of the following courses:

BIOL	310	Vertebrate Biology (4)
BIOL	316	Invertebrate Zoology (4)

2. Ecology/Evolution (3-4 units)

Select one course from the following list:

BIOL	313	Conservation Biology (ESRM) (4)
BIOL	406	Evolutionary Biogeography (3)
BIOL	407	Behavioral Ecology (3)

3. Organismal Biology (4 units)

Select one course from the following list:

BIOL	310	Vertebrate Biology (4) *(if not taken as part of core)*
BIOL	312	Marine Biology (4)
BIOL	316	Invertebrate Zoology (4) *(if not taken as part of core)*
BIOL	317	Parasitology (4)
BIOL	450	Ichthyology: The Biology of Fishes (4)
BIOL	451	Ornithology (4)

4. Psychology/Developmental/Molecular Biology 3-4 units)

Select one course from the following list:

BIOL	300	Cell Biology (4)
BIOL	304	Comparative Animal Physiology (3)
BIOL	400	Molecular Biology (4)
BIOL	422	Molecular Plant Physiology (4)
BIOL	427	Developmental Biology (4)

Required Supporting and Other GE Courses (56 units)

1. Required Supporting Courses (14 units)

CHEM	121*	General Chemistry I, GE-B1 (4)
CHEM	122	General Chemistry II, GE-B2 (4)
GEOL	122*	Historical Geology, GE-B1 (3)
BIOL	203*	Quantitative Methods for Biology, GE-B3, B4 (3)

2. Other Required GE Courses in Categories A-E (36 units)

Category A . . . . . 9 units
(For A3, recommend MATH 230 Logic and Mathematical Reasoning)
Category C . . . . . 12 units
Category D . . . . . 12 units
Category E . . . . . 3 units

3. American Institutions Requirement (6 units)

Electives in Any Discipline (18-20 units)

One must choose enough elective units to reach the required 120 units for the degree.

*Courses with * are double-counted toward GE credits.*

For Emphasis in General Biology

Upper Division Requirements in the Major (37 units)

1. Required Biology Courses (25 units)

BIOL	300	Cell Biology (4)
BIOL	302	Genetics (4)
BIOL	303	Evolutionary Biology (3)
BIOL	304	Comparative Animal Physiology (3)
BIOL	400	Molecular Biology (4)
BIOL	433*	Ecology and the Environment, GE-B2, UDID (4)
BIOL	499	Senior Capstone in Biology (3)

2. Electives in Biology (12 units)

Select a minimum of 12 units of biology courses from 300 and 400 levels, one of which must be a lab course. (Biology courses numbered from 326 to 345 are counted toward GE credits only and they are not counted towards the 12 units of electives).

No more than 2 units taken from the following can be counted towards the 12 units of electives:

BIOL	492	Internship (2-3)
BIOL	494	Independent Research (1-3)
BIOL	497	Directed Study (1-3)

Required Supporting and Other GE Courses (53-54 units)

1. Chemistry (8 units)

CHEM	121*	General Chemistry I, GE-B1 (4)
CHEM	122	General Chemistry II, GE-B1 (4)

2. Mathematics and Statistics (3-4 units)

Select one of the following:

BIOL	203*	Quantitative Methods for Biology, GE-B3, B4 (3)
MATH	105	Pre-Calculus (4)
MATH	150*	Calculus I, GE-B3 (4)

3. Other Required GE Courses in Categories A-E (36 units)

Category A . . . . . 9 units
(For A3, recommend MATH 230 Logic and Mathematical Reasoning)
Category C . . . . . 12 units
Category D . . . . . 12 units
Category E . . . . . 3 units

4. American Institutions Requirements (6 units)

Electives in Any Discipline (21-22 units)

One must choose enough elective units to reach the required 120 units for the degree.

*Courses with * are double-counted toward GE credits.*

For Emphasis in Pre-Professional Studies

Upper Division Requirements in the Major (32 units)

1. Required Biology Courses (21-22 units)

BIOL	300	Cell Biology (4)
BIOL	302	Genetics (4)
BIOL	304	Comparative Animal Physiology (3)
BIOL	400	Molecular Biology (4)
BIOL	499	Senior Capstone in Biology (3)

Select one of the following:

BIOL	303	Evolutionary Biology (3)
BIOL	433*	Ecology and the Environment, GE-B2, UDID (4)

2. Electives in Biology (10-11 units)

Select a minimum of 10-11 units of Biology courses from 300 and 400 levels, one of which be a lab course. (Biology courses numbered from 326 to 345 are counted toward GE credits only and they are not counted towards the 10-11 units of electives)

No more than 2 units taken from the following can be counted towards the 10-11 units of electives:

BIOL	492	Internship (2-3)
BIOL	494	Independent Research (1-3)
BIOL	497	Directed Study (1-3)

Required Supporting and Other GE Courses (69-70 units)

1. Chemistry (16 units)

CHEM	121*	General Chemistry I, GE-B1 (4)
CHEM	122	General Chemistry II GE-B1 (4)
CHEM	311	Organic Chemistry I (3)
CHEM	312	Organic Chemistry I Laboratory (1)
CHEM	314	Organic Chemistry II (3)
CHEM	315	Organic Chemistry II Laboratory (1)

A year-long organic chemistry sequence with laboratory taken at a community college may be accepted for the Biology major in lieu of CHEM 311, 312, 314, 315

2. Mathematics and Statistics (3-4 units)

Select one of the following:

BIOL	203*	Quantitative Methods for Biology, GE-B3, B4 (3)
MATH	150*	Calculus I, GE-B3 (4)

Check with professional schools or pre-professional advisor for specific requirements in this category.

3. Physics (8 units)

PHYS	100	Introduction to Physics I, GE-B1 (4)
PHYS	101	Introduction to Physics II, GE-B1 (4)

4. Other Required GE Courses in Categories A-E (36 units)

Category A . . . . . 9 units
(For A3, recommend MATH 230 Logic and Mathematical Reasoning)
Category C . . . . . 12 units
Category D . . . . . 12 units
Category E . . . . . 3 units

5. American Institutions Requirements (6 units)

Electives in Any Discipline (10-11 units)

One must choose enough elective units to reach the required 120 units for the degree.

*Courses with * are double-counted toward GE credits.*

For Emphasis in Subject Matter Preparation in Teaching Biology (Pending CCTC Approval)

Upper Division Requirements in the Major (36 units)

1. Required Biology Courses (24 units)

BIOL	300	Cell Biology (4)
BIOL	302	Genetics (4)
BIOL	303	Evolutionary Biology (3)
BIOL	304	Comparative Animal Physiology (3)
BIOL	335*	The Biosphere, GE-B2, UDID (3)
BIOL	433*	Ecology and the Environment, GE-B2, UDID (4)
BIOL	499	Senior Capstone in Biology (3)

2. Electives in Biology (12 units)

Select a minimum of 12 units of biology courses from 300 and 400 levels, one of which must be a lab course. (Biology courses numbered from 326 to 345, with the exception of BIOL 335 for this emphasis are counted toward GE credits only and they are not counted towards the 12 units of electives).

No more than 2 units taken from the following can be counted towards the 12 units of electives:

BIOL	492	Internship (2-3)
BIOL	494	Independent Research (1-3)
BIOL	497	Directed Study (1-3)

Required Supporting and Other GE Courses (76 units)

1. Required Education Course (3 units)

EDUC	330*	Introduction to Secondary Schooling, GE-D, UDID (3)

2. Mathematics and Statistics (7 units)

Select either:

BIOL	203*	Quantitative Methods for Biology, GE-B3, B4 (3)
and		
MATH	105	Pre-Calculus (4)
or		
MATH	150*	Calculus I, GE-B3 (4)

3. Physical Sciences (24 units)

ASTR	105	Introduction to the Solar System, (PHYS) GE-B1 (4)
CHEM	121*	General Chemistry I, GE-B1 (4)
CHEM	122	General Chemistry II, GE-B1 (4)
GEOL	121	Physical Geology (4)
PHYS	100	Introduction to Physics I, GE-B1 (4)
PHYS	101	Introduction to Physics II, GE-B1 (4)

4. Other Required GE Courses in Categories A-E 36 units)

Category A . . . . . 9 units
(For A3, recommend MATH 230 Logic and Mathematical Reasoning)
Category C . . . . . 12 units
Category D . . . . . 12 units
Category E . . . . . 3 units

5. American Institutions Requirements (6 units)

*Courses with * are double-counted toward GE credits.*

Requirements for the Minor in Biology (21 units)

Lower Division Requirements (8 units)

BIOL	200*	Principles of Organismal and Population Biology, GE-B2 (4)
BIOL	201	Principles of Cell and Molecular Biology, GE-B2 (4)

Upper Division Requirements (13 units)

1. Biology (8 units)

BIOL	300	Cell Biology (4)
BIOL	302	Genetics (4)

2. Biology Electives (5 units)

A minimum of five units of 300-400 level biology courses, with no more than one course selected from BIOL 331-345.

*Courses with * are double-counted toward GE credits.*

Requirements for the Certificate in Biotechnology (25-27 units)

For students with a B.S. degree in biology pursuing a certificate in biotechnology.

1. B.S. degree in biology (may be concurrent);

2. Completion of the following courses with C or better grades (16-17 units):

BIOL	401	Biotechnology and Recombinant DNA Techniques (5)
BIOL	420	Cellular & Molecular Immunology (4)
BIOL	431	Bioinformatics (4)

Select one of the following courses:

CHEM 318	Biological Chemistry (3)
CHEM 460	Biochemistry I (4)

3. Complete another 4 units of upper-division biology course in consultation with the program (4);

4. Complete BIOL 492 Internship (2-3 units);

5. Complete BIOL 499 Senior Capstone in Biology (3 units);

6. Approval by the Biology program.