## California State University Channel Islands

## Program Modification

Program Changes must be submitted by November 5, 2007
Date: Oct. 15, 2007 rev 12.5.07
Program Area: Biology
Semester /Year First effected: Fall 2008
Instructions: Please use the following format to modify any existing program.
Enter the latest approved version of your entire program in the left and right boxes below.
Make your deletions in the left hand column by using the strike-out feature of Word or underline what you wish to delete, and highlight.
Amendments to the program (on the right side) also need to be highlight in GREY so they can be identified for approval.
Please align your changes so that they appear side-by-side as much as possible for readability. Thank you.

## CURRENTLY APPROVED PROGRAM

## 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 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
- Master of Science in Biotechnology and Bioinformatics
- Master of Science in Biotechnology and Master of Business Administration
- 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

## PROPOSED PROGRAM

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
- Master of Science in Biotechnology and Bioinformatics
- Master of Science in Biotechnology and Master of Business Administration
- Minor in Biology
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## PROGRAM DESCRIPTION

Biology is the study of life, its origins, diversity and intricacies. It emphasizes the
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.

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.
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 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

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).

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## 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;
- 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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Director of MS in Biotechnology and Bioinformatics
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Nancy Mozingo, PhD, Associate Professor of Biology

- 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:

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## 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) |

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Nancy Mozingo, PhD, Associate Professor of Biology
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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 from the following list of courses, one of which must be a lab course. |  |  |
| BIOL | 301 | Microbiology (4) |
| BIOL | 310 | Vertebrate Biology (4) |
| BIOL | 311 | Plant Biology and Ecology (4) |
| BIOL | 312 | Marine Biology (4) |
| BIOL/ | 313 | Conservation Biology (4) |
| ESRM |  |  |
| BIOL | 316 | Invertebrate Zoology (4) |
| BIOL | 317 | Parasitology (4) |
| BIOL | 401 | Biotechnology and Recombinant DNA Techniques (5) |
| 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 | 406 | Evolutionary Biogeography (3) |
| BIOL | 407 | Behavioral Ecology (3) |
| BIOL | 408 | Nanobiotechnology (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 | 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, |  |
| BIOL | 450 | Dchthyology: The Biology of Fishes (4) |
| BIOL | 451 | Ornithology (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. The following courses can be taken as biology electives. However, 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 either
PHYS 100 Introduction to Physics I, GE-B1 (4)
and
PHYS 101 Introduction to Physics II, GE-B1 (4)
or
PHYS 200 General Physics I, GE-B1 (4)
and

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No more than 2 units taken from the following:
    BIOL 492 Internship (2-3)
    BIOL 494 Independent Research (1-3)
    BIOL 497 Directed Study (1-3)
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## 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 either
PHYS 100 Introduction to Physics I, GE-B1 (4)
and
PHYS 101 Introduction to Physics II, GE-B1 (4)
or
PHYS 200 General Physics I, GE-B1 (4)
and
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)
Category C (12 units)
Category D (12 units)
Category E (3 units)

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 Logic and Mathematical Reasoning (3)
Category C (12 units)
Category D (12 units)
Category E (3 units)
5. American Institutions Requirement (6 units)
5. American Institutions Requirement (6 units)

## 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 (4)
PHYS
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 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)

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(49 Units)

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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 (12 units)

Select from the following list of courses:
BIOL/315 Introduction to Biophysics (4)
PHYS
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) |
| Category C (12 units) |
| Category D (12 units) |
| Category E (3 units) |
| 4. American Institutions Requirement (6 units) |
|  |
| 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) |

## Required Supporting and Other GE Courses

1. Chemistry (14 units)

CHEM 122 Garal Chist, GEB1 (4)
CHEM 122 General Chemistry II, GE-B1 (4)
(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)
AATH
(36 units)
Cagor C (12 unis)
ategory C (12 units)
Category E (3 units)
4. American Institutions Requirement (6 units)

## L AND <br> MOLECULAR BIOLOGY

## (40 Units)

Required Biology Courses (31 units)
301 Microbiology (4)
BIOL 302 Genetics (4)
BIOL 400 Molecular Biology (4)

## 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 Logic and Mathematical Reasoning (3)
Category C (12 units)
Category D (12 units)
Category E (3 units)
4. American Institutions Requirement (6 units)

## 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)

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BIOL 401 Biotechnology and Recombinant DNA Techniques (5)
BIOL 431* Bioinformatics, GE-B2, B4, UDID (4)
BIOL 499 Senior Capstone in Biology (3)
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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 (3)
PHYS
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 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:
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)

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 (3)
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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:
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)

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or
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 either
PHYS 100 Introduction to Physics I, GE-B1 (4)
and
PHYS 101 Introduction to Physics II, GE-B1 (4)
or
PHYS 200 General Physics I, GE-B1 (4)
and
PHYS 201 General Physics II, GE-B1 (4)
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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)
Category C (12 units)
Category D (12 units)
Category E (3 units)
5. American Institutions Requirement (6 units)

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CHEM 318 Biological Chemistry (3)
or
CHEM 314 Organic Chemistry II (3)
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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 either

PHYS 100 Introduction to Physics I, GE-B1 (4)
and
PHYS 101 Introduction to Physics II, GE-B1 (4)
or
PHYS 200 General Physics I, GE-B1 (4)
and
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 Logic and Mathematical Reasoning (3)
Category C (12 units)
Category D (12 units)
Category E (3 units)
5. American Institutions Requirement (6 units)

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)


|  | 3. Statistics and Mathematics (3 - 4 units) <br> Select one of the following courses: <br> BIOL 203* Quantitative Methods for Biology, GE-B3, B4 (3) |
| :--- | :--- | :--- |
| MATH 150* Calculus I, GE-B3 (4) |  |


| ESRM |  |
| :---: | :---: |
| ESRM | 352 Theory and Practice of Ecological Restoration (3) |
| BIOL | 406 Evolutionary Biogeography (3) |
| BIOL | 407 Behavioral Ecology (3) |
| 3. Organismal Biology |  |
| Select one course from the following list (4 units): |  |
| 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 |  |
| Select one course from the following list (3-4 units): |  |
| 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 |  |
| Select one course from the following list (3-4 units): |  |
| 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) |


| ESRM |  |  |
| :--- | :--- | :--- |
| ESRM | 352 | Theory and Practice of Ecological Restoration (3) |
| BIOL | 406 | Evolutionary Biogeography (3) |
| BIOL | 407 | Behavioral Ecology (3) |

3. Organismal Biology

Select one course from the following list (4 units):
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

Select one course from the following list (3-4 units):
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

Select one course from the following list (3-4 units):
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)

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(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)
    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)
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## FOR EMPHASIS IN MEDICAL IMAGING

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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 (3)
PHYS
BIOL/ 434* Introduction to Biomedical Imaging,
HLTH/ PHYS GE-B1, E, UDID (4)
BIOL/ 464 Biomedical Instrumentation (4)
PHYS
BIOL 499 Senior Capstone in Biology (3)
```


## (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 (3)
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)

## 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 $\quad 300$ Cell Biology (4)
BIOL 301 Microbiology (4)
BIOL 302 Genetics (4)
BIOL 400 Molecular Biology (4)
BIOL/ 416 Radiobiology and Radionuclides (3)
PHYS
BIOL/ 434* Introduction to Biomedical Imaging,
HLTH/ PHYS GE-B1, E, UDID (4)
BIOL/ 464 Biomedical Instrumentation (4)
PHYS
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 (4)
PHYS
BIOL
BIOL
BIOL $\quad 420$ Biotechnology and Recombinant DNA Techniques (5)

## 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
2. Electives in Biology and Physics (8 units)

Select from the following list of courses:
BIOL/ 315 Introduction to Biophysics (4)
PHYS
BIOL 401 Biotechnology and Recombinant DNA Techniques (5)
BIOL 420 Cellular \& Molecular 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
COMP/MATH Recognition, GE-B1, B4, UDID (3)
No more than 2 units taken from the following:
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


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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\mathrm{ Genetics (4)
    BIOL }303\mathrm{ Evolutionary Biology (3)
    BIOL 311 Plant Biology and Ecology (4)
    BIOL 310 Vertebrate Biology (4) or
    BIOL 316 Invertebrate Zoology (4)
    BIOL 433* Ecology and the Environment, GE- B2, UDID (4)
    BIOL 499 Senior Capstone (3)
2. Ecology/Evolution
    Select one course from the following list (3-4 units):
    BIOL/ 313 Conservation Biology (4)
    ESRM
    BIOL 406 Evolutionary Biogeography (3)
    BIOL 407 Behavioral Ecology (3)
3. Organismal Biology
    Select one course from the following list (4 units):
    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
    Select one course from the following list (3-4 units)
    BIOL 300 Cell Biology (4)
    BIOL 304 Comparative Animal Physiology (3)
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## FOR EMPHASIS IN ECOLOGY, EVOLUTION AND

 ORGANISMAL BIOLOGYUpper 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 310 Vertebrate Biology (4) or
BIOL 316 Invertebrate Zoology (4)
BIOL $433^{*}$ Ecology and the Environment, GE- B2, UDID (4)
BIOL 499 Senior Capstone (3)
2. Ecology/Evolution

Select one course from the following list (3-4 units):
BIOL/ 313 Conservation Biology (4)
ESRM
BIOL 406 Evolutionary Biogeography (3)
BIOL 407 Behavioral Ecology (3)
3. Organismal Biology

Select one course from the following list (4 units):
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

Select one course from the following list (3-4 units)
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)
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)

## 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 | 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 (3)
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)

## 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 at least three courses from the following list, one of which must be a lab |  |
| course. |  |
| BIOL | 301 Microbiology (4) |
| BIOL | 310 Vertebrate Biology (4) |
| BIOL | 311 Plant Biology and Ecology (4) |
| BIOL | 312 Marine Biology (4) |
| BIOL/ | 313 Conservation Biology (4) |
| ESRM |  |
| BIOL | 316 Invertebrate Zoology (4) |
| BIOL | 317 Parasitology (4) |
| BIOL | 401 Biotechnology and Recombinant DNA Techniques (5) |
| 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 | 406 Evolutionary Biogeography (3) |
| BIOL | 407 Behavioral Ecology (3) |
| BIOL | 408 Nanobiotechnology (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 | 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 | 450 Ichthyology: The Biology of Fishes (4) |
| BIOL | 451 Ornithology (4) |
| No more than 2 units taken from the following: |  |
| BIOL | 492 Internship (2-3) |
| BIOL | 494 Independent Research (1-3) |

$\begin{array}{ll}\text { BIOL } & 433 * \text { Ecology and the Environment, GE-B2, UDID (4) } \\ \text { BIOL } & 499 \text { Senior Capstone in Biology (3) }\end{array}$
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. The following courses can be taken as biology electives. However, no more than 2 units taken from the following can be counted towards the 12 units of electives:
No more than 2 units taken from the following:
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 (3) 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)

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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)
    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)
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## FOR EMPHASIS IN PRE-PROFESSIONAL STUDIES

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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)
Select one of the following:
BIOL 303 Evolutionary Biology (3)
BIOL 433* Ecology and the Environment, GE-B2, UDID (4)
and
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## 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)
Select one of the following:
BIOL 303 Evolutionary Biology (3)
BIOL 433* Ecology and the Environment, GE-B2, UDID (4)
and
BIOL 499 Senior Capstone in Biology (3)

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BIOL 499 Senior Capstone in Biology (3)
2. Electives in Biology (10-11 units)
    Select at least three courses from the following list, one of which must be a lab
    course.
    BIOL 301 Microbiology (4)
    BIOL 310 Vertebrate Biology (4)
    BIOL 311 Plant Biology and Ecology (4)
    BIOL }312\mathrm{ Marine Biology (4)
    BIOL/ 313 Conservation Biology (4)
    ESRM
    BIOL }316\mathrm{ Invertebrate Zoology (4)
    BIOL }317\mathrm{ Parasitology (4)
    BIOL 401 Biotechnology and Recombinant DNA Techniques (5)
    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 }406\mathrm{ Evolutionary Biogeography (3)
    BIOL 407 Behavioral Ecology (3)
    BIOL 408 Nanobiotechnology (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 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 450 Ichthyology: The Biology of Fishes (4)
    BIOL 451 Ornithology (4)
    No more than 2 units taken from the following:
    BIOL 492 Internship (2-3)
    BIOL }494\mathrm{ Independent Research (1-3)
    BIOL 497 Directed Study (1-3)
BIOL 499 Senior Capstone in Biology (3)
2. Electives in Biology (10-11 units)
Select at least three courses from the following list, one of which must be a lab course.
O1 Microbiology (4)
BIOL 310 Vertebrate Biology (4)
BIOL 312 Marine Biology (4)
ESRM
BIOL 316 Invertebrate Zoology (4)
BIOL 317 Parasitology (4)
BIOL 402 Toxicology (3)
BIOL 404 Plant and Animal Tissue Culture (3)
BIOL 405 Biochemical Engineering (4)
BIOL 406 Evolutionary Biogeography (3)
BIOL 408 Nanobiotechnology (3)
BIOL 420 Cellular \& Molecular Immunology (4)
BIOL 421 Virology (3)
BIOL 423 Cellular \& Molecular Neurobiology (3)
BIOL 424 Human Physiology (3)
BIOL 425 Human Genetics (3)
BIOL 428 Biology of Cancer (3)
BIOL 432* Principles of Epidemiology and Environmental Health, GE-B2, D, UDID (3)
BIOL 450 Ichthyology: The Biology of Fishes (4)
No more than 2 units taken from the following:
BIOL 492 Internship (2-3)
BIOL 494 Independent Research (1-3)
BIOL 497 Directed Study (1-3)
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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 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 10-11 units of electives. The following courses can be taken as biology electives. However, 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)

[^0]Category A (9 units) -
For A3, recommend MATH 230 Logic and Mathematical Reasoning (3)
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)

| TEACHING BIOLOGY | FOR EMPHASIS IN SUBJECT MATTER PREPARATION IN TEACHING BIOLOGY (PENDING CCTC APPROVAL) |
| :---: | :---: |
| Upper Division Requirements in the Major |  |
| (36 Units) | Upper Division Requirements in the Major |
| 1. Required Biology Courses (24 units) | (36 Units) |
| BIOL 300 Cell Biology (4) | 1. Required Biology Courses (24 units) |
| BIOL 302 Genetics (4) | BIOL 300 Cell Biology (4) |
| BIOL 303 Evolutionary Biology (3) | BIOL 302 Genetics (4) |
| BIOL 304 Comparative Animal Physiology (3) | BIOL 303 Evolutionary Biology (3) |
| BIOL 335* The Biosphere, GE-B2, UDID (3) | BIOL 304 Comparative Animal Physiology (3) |
| BIOL 433* Ecology and the Environment, GE-B2, UDID (4) | BIOL 335* The Biosphere, GE-B2, UDID (3) |
| BIOL 499 Senior Capstone in Biology(3) | BIOL 433* Ecology and the Environment, GE-B2, UDID (4) |
|  | BIOL 499 Senior Capstone in Biology(3) |
| 2. Electives in Biology (12 units) | 2. Electives in Biology (12 units) |
| $\frac{\text { course. }}{\text { BIOL }} 301$ Microbiology (4) | Select a minimum of 12 units of biology courses from 300 and 400 levels, one |
| BIOL 310 Vertebrate Biology (4) | the exception of BIOL 335 for this emphasis, are counted toward GE credits only |
| BIOL 311 Plant Biology and Ecology (4) | and they are not counted towards the 12 units of electives. The following courses |
| BIOL 312 Marine Biology (4) | can be taken as biology electives. However, no more than 2 units taken from the |
| BIOL/ 313 Conservation Biology (4) | following can be counted towards the 12 units of electives: |
| ESRM | BIOL 492 Internship (2-3) |
| BIOL 316 Invertebrate Zoology (4) | BIOL 494 Independent Research (1-3) |
| BIOL 317 Parasitology (4) | BIOL 497 Directed Study (1-3) |
| BIOL 400 Molecular Biology (4) |  |
| BIOL 401 Biotechnology and Recombinant DNA Techniques (5) | Required Supporting and Other GE Courses (76 units) |
| BIOL 402 Toxicology (3) | 1. Required Education Course (3 units) |
| BIOL 403 Foundations of Structural Biology (4) | EDUC 330* Introduction to Secondary Schooling, GE-D, UDID (3) |
| BIOL 404 Plant and Animal Tissue Culture (3) | EDUC 330 Intoductionto Secondary Schooling, GE-D, UDID (3) |
| BIOL 405 Biochemical Engineering (4) | 2. Mathematics and Statistics (7 units) |
| BIOL 406 Evolutionary Biogeography (3) | BIOL 203* Quantitative Methods for Biology, GE-B3, B4 (3) |
| BIOL 407 Behavioral Ecology (3) | and |
| BIOL 408 Nanobiotechnology (3) | MATH 105 Pre-Calculus (4) |
| BIOL 420 Cellular \& Molecular Immunology (4) | or or |
| BIOL 421 Virology (3) | MATH 150* Calculus I, GE-B3 (4) |
| BIOL 422 Molecular Plant Physiology (4) | MATH 150 Calculus I, GE-B3 (4) |
| BIOL 423 Cellular \& Molecular Neurobiology (3) | 3. Physical Sciences (24 units) |
| BIOL 424 Human Physiology (3) | 3. Physical Sciences (24 units) |



| 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) |
| PHYS/ | 105 | Introduction to the Solar System, GE- |
| ASTR | 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 (3)
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.)

## Category D (12 units) <br> Category E (3 units)

5. American Institutions Requirements (6 units)
(Courses with * are double-counted toward GE credits.)

## REQUIREMENTS FOR THE MASTER OF SCIENCE DEGREE IN BIOTECHNOLOGY \& BIOINFORMATICS (33-34 UNITS)

## PROGRAM DESCRIPTION

The Master of Science in Biotechnology and Bioinformatics is a professional degree program designed to meet the needs of biotechnology industry and related public and private agencies and organizations. The program combines rigorous scientific training in interdisciplinary areas in biotechnology and bioinformatics with course work and experience in business management and regulatory affairs. The program includes a set of core courses with two emphases to choose from: biotechnology and bioinformatics, and several elective courses.

Biotechnology is centered in the laboratory and employs sophisticated molecular biology techniques for applications in human and animal health, agriculture, environment, and specialty biochemical manufacturing. In the next century, the major driving force for biotechnology will be the strategic use of the data derived from large-scale genome sequencing projects. Bioinformatics turns raw data from genome sequencing and new experimental methodologies such as microarrays and proteomics into useful and accessible information about gene function, protein structure, molecular evolution, drug targets and disease mechanisms using computational analyses, statistics, and pattern recognition. Our approach also includes team projects drawn from biotechnology industries to focus on real-world problems and applications of biological and computational sciences and to inculcate interpersonal as well as problem-solving skills using multiple perspectives.

Graduates from this program will develop analytical, managerial and interpersonal skills along with sophisticated expertise in biotechnology and bioinformatics. They will be ready to make immediate contributions to scientific research and development, management in biotechnological, biomedical and pharmaceutical industries, biotechnology law and regulations, governmental or environmental

## REQUIREMENTS FOR THE MASTER OF SCIENCE DEGREE IN BIOTECHNOLOGY \& BIOINFORMATICS (33-34 UNITS)

## PROGRAM DESCRIPTION

The Master of Science in Biotechnology and Bioinformatics is a professional degree program designed to meet the needs of biotechnology industry and related public and private agencies and organizations. The program combines rigorous scientific training in interdisciplinary areas in biotechnology and bioinformatics with course work and experience in business management and regulatory affairs. The program includes a set of core courses with two emphases to choose from: biotechnology and bioinformatics, and several elective courses.

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Graduates from this program will develop analytical, managerial and interpersonal skills along with sophisticated expertise in biotechnology and bioinformatics. They will be ready to make immediate contributions to scientific research and
agencies, research institutes, consulting firms, research and clinical laboratories, private and public health organizations, or education.

## ADMISSION REQUIREMENTS

1. Applicants must have a BS/BA degree in Biology, Computer Science, Chemistry, Biochemistry, or Mathematics. Alternatively, applicants with a BA/BS degree in any field and equivalent work experiences in one of the above fields may be granted conditional admission, and they must fulfill all conditional requirements before they can be fully classified.
2. Applicants seeking admission to the professional MS in Biotechnology and Bioinformatics program must be officially accepted into the CSUCI academic program.
3. Applicants must declare themselves as graduate students in the professional MS degree program in Biotechnology and Bioinformatics.
4. Applicants will be evaluated by the program admissions committee which will consider the applicants in the context of the total applicant pool using our general admission standards. The following materials are required for our evaluation and admission process:

- Applicants must submit their transcript from their undergraduate institution, Graduate Record Examinations (GRE) General Test scores or the Medical College Admission Test (MCAT) scores.
- Applicants who have received their undergraduate degrees from a university where English is not the language of instruction, or have studied fewer than two years at a university where instruction is in English, must submit their Test of English as a Foreign Language (TOEFL) scores for evaluation.
- Applicants must submit a one page "Statement of Purpose" and two letters of recommendations from people able to judge the applicant's capacity for both academic and professional success.


## DEGREE REQUIREMENTS

## Common Core Courses (16 units)

BINF 500 DNA \& Protein Sequence Analysis (3)
BIOL 502 Techniques in Genomics \& Proteomics (2)
BIOL 503 Biotechnology Law and Regulation (3)
MGT 471 Project Management (3)
BIOL 600 Team Project (4)
BIOL 601 Seminar Series in Biotechnology and Bioinformatics (1)
development, management in biotechnological, biomedical and pharmaceutical industries, biotechnology law and regulations, governmental or environmental agencies, research institutes, consulting firms, research and clinical laboratories, private and public health organizations, or education.

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## DEGREE REQUIREMENTS

| Common Core Courses (16 units) |  |  |
| :--- | :--- | :--- |
| BINF | 500 | DNA \& Protein Sequence Analysis (3) |
| BIOL | 502 | Techniques in Genomics \& Proteomics (2) |
| BIOL | 503 | Biotechnology Law and Regulation (3) |
| MGT | 471 | Project Management (3) |
| BIOL | 600 | Team Project (4) |

BINF 500 DNA \& Protein Sequence Analysis (3)
BIOL 502 Techniques in Genomics \& Proteomics (2)
Regulation (3)
BIOL 600 Team Project (4)

## FOR BIOTECHNOLOGY EMPHASIS (17 UNITS)

## Required Courses (7 units)

BIOL 504 Molecular Cell Biology (3)
BIOL 505 Molecular Structure (4)
Electives (10 units)
A minimum of 10 units chosen from the following courses and/or from the elective courses under the Bioinformatics Emphasis:
BIOL 506 Molecular Evolution (4)
BIOL 507 Pharmacogenomics and Pharmacoproteomics (3)
BIOL 508 Advanced Immunology (4)
BIOL 509 Plant Biotechnology (4)
MGT 421 Human Resource Management (3)
BIOL 490 Special Topics (1-3)

## FOR BIOINFORMATICS EMPHASIS (18 UNITS)

Required Courses (12 units)
BINF 501 Biological Informatics (3)
BINF 510 Database Systems for Bioinformatics (3)
BINF 511 Computational Genomics (3)
BINF 513 Programming for Bioinformatics (3)
Electives (6 units)
A minimum of two courses chosen from the following and/or from the elective courses under the Biotechnology Emphasis, with at least one course in the BINF category:
BINF 512 Algorithms for Bioinformatics (3)
BINF 514 Statistical Methods in Computational Biology (3)
PHYS 445 Image Analysis \& Pattern Recognition (3)
COMP/MATH GE-B1, B4, UDID (3)
MGT 421 Human Resource Management (3)
BIOL 490 Special Topics (1-3)

BIOL 601 Seminar Series in Biotechnology and Bioinformatics (1)
FOR BIOTECHNOLOGY EMPHASIS (17 UNITS)
Required Courses (7 units)
BIOL 504 Molecular Cell Biology (3)
BIOL 505 Molecular Structure (4)
Electives (10 units)
A minimum of 10 units chosen from the following courses and/or from the elective courses under the Bioinformatics Emphasis:
BIOL 506 Molecular Evolution (4)
BIOL 507 Pharmacogenomics and Pharmacoproteomics (3)
BIOL 508 Advanced Immunology (4)
BIOL 509 Plant Biotechnology (4)
BIOL 510 Tissue Culture Techniques and Stem Cell Technology (3)
MGT 421 Human Resource Management (3)
BIOL 490 Special Topics (1-3)
FOR BIOINFORMATICS EMPHASIS (18 UNITS)
Required Courses (12 units)
BINF 501 Biological Informatics (3)
BINF 510 Database Systems for Bioinformatics (3)
BINF 511 Computational Genomics (3)
BINF 513 Programming for Bioinformatics (3)
Electives (6 units)
A minimum of two courses chosen from the following and/or from the elective courses under the Biotechnology Emphasis, with at least one course in the BINF category:
BINF 512 Algorithms for Bioinformatics (3)
BINF 514 Statistical Methods in Computational Biology (3)
PHYS 445 Image Analysis \& Pattern Recognition (3)
COMP/MATH GE-B1, B4, UDID (3)
MGT 421 Human Resource Management (3)
BIOL 490 Special Topics (1-3)

## REQUIREMENTS FOR THE MASTER OF SCIENCE DEGREE IN BIOTECHNOLOGY AND MASTER OF BUSINESS ADMINISTRATION (71 UNITS*)

*Assumes that at least one set of the Foundation Courses listed below has been completed in a business or science undergraduate degree program.

## PROGRAM DESCRIPTION

The Master of Science in Biotechnology and Master of Business Administration is a dual professional degree program designed to meet the needs of biotechnology industry and related public and private agencies and organizations. The program combines rigorous scientific training in biotechnology with graduate course work and experience in business management and regulatory affairs. The program includes the foundation courses for the dual degree program, a set of graduate level core courses in both biotechnology and business, and several elective courses.

Our approach includes team projects drawn from biotechnology industries to focus on real-world problems and applications of biological sciences and business. We approach interpersonal skills and problem-solving skills from multiple perspectives.

## ADMISSION REQUIREMENTS

1. Applicants must have a BS/BA. degree in Biology, Chemistry, Biochemistry, or Business/ Economics related discipline. Alternatively, applicants with a BA/BS degree in any field and equivalent work experiences in one of the above fields may be admitted and must fulfill the foundation course requirements before taking the core courses and electives in the degree program.
2. Applicants seeking admission to the dual degree program must be officially accepted into CSUCI as graduate students.
3. Applicants must declare themselves as graduate students in the dual degree program.
4. Applicants will be evaluated by the program admissions committee which will consider the applicants in the context of the total applicant pool using our general admission standards. The following materials are required for our evaluation and admission process:

- Applicants must submit their transcript(s) from their undergraduate institution(s) and Graduate Record Examinations (GRE) General Test scores.
- Applicants who have received their undergraduate degrees from a university


## REQUIREMENTS FOR THE MASTER OF SCIENCE DEGREE IN BIOTECHNOLOGY AND MASTER OF BUSINESS ADMINISTRATION (71 UNITS*)

*Assumes that at least one set of the Foundation Courses listed below has been completed in a business or science undergraduate degree program.

## PROGRAM DESCRIPTION

The Master of Science in Biotechnology and Master of Business Administration is a dual professional degree program designed to meet the needs of biotechnology industry and related public and private agencies and organizations. The program combines rigorous scientific training in biotechnology with graduate course work and experience in business management and regulatory affairs. The program includes the foundation courses for the dual degree program, a set of graduate level core courses in both biotechnology and business, and several elective courses.

Our approach includes team projects drawn from biotechnology industries to focus on real-world problems and applications of biological sciences and business. We approach interpersonal skills and problem-solving skills from multiple perspectives.

## ADMISSION REQUIREMENTS

1. Applicants must have a BS/BA. degree in Biology, Chemistry, Biochemistry, or Business/ Economics related discipline. Alternatively, applicants with a BA/BS degree in any field and equivalent work experiences in one of the above fields may be admitted and must fulfill the foundation course requirements before taking the core courses and electives in the degree program.
2. Applicants seeking admission to the dual degree program must be officially accepted into CSUCI as graduate students.
3. Applicants must declare themselves as graduate students in the dual degree program.
4. Applicants will be evaluated by the program admissions committee which will consider the applicants in the context of the total applicant pool using our general admission standards. The following materials are required for our evaluation and admission process:

- Applicants must submit their transcript(s) from their undergraduate
where English is not the language of instruction, or have studied fewer than two years at a university where instruction is in English, must submit their Test of English as a Foreign Language (TOEFL) scores.
- Applicants must submit a one page "Statement of Purpose" and two letters of recommendations from people able to judge the applicant's capacity for both academic and professional success.


## DEGREE REQUIREMENTS

## Required Foundation Courses (16 Units)

1. Required Foundation Courses in Biology and Chemistry for students without a B.S. in Biology or Chemistry (16 units)

CHEM 110 Chemistry of Life (4)
BIOL 201 Principles of Cell and Molecular Biology (4)
BIOL 300 Cell Biology (4)
BIOL 400 Molecular Biology (4)
2. Required Foundation Courses in Business/Economics for students without a

BS/BA in Business or Economics or a related discipline (16 units)
BUS 500 Economics for Managers (3)
BUS 502 Quantitative Methods for Decision-Making (3)
BUS 504 Introduction to Accounting and Finance (4)
BUS 506 Principles of Management and Marketing (3)
BUS 508 Business Ethics and Law (3)

## CORE COURSES

Common Required Courses in the Dual Degree Program (9 Units)
MGT 471 Project Management (3)
BIOL/ 610 Capstone Project for MS/MBA Dual
BUS Degree (6)
Required Courses in the Master of Science in Biotechnology (22 Units)

1. Required Core Courses (15 units)

BINF 500 DNA \& Protein Sequence Analysis (3)
BIOL 502 Techniques in Genomics/Proteomics (2)
institution(s) and Graduate Record Examinations (GRE) General Test scores.

- Applicants who have received their undergraduate degrees from a university where English is not the language of instruction, or have studied fewer than two years at a university where instruction is in English, must submit their Test of English as a Foreign Language (TOEFL) scores.
- Applicants must submit a one page "Statement of Purpose" and two letters of recommendations from people able to judge the applicant's capacity for both academic and professional success.


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BIOL 201 Principles of Cell and Molecular Biology (4)
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MGT 471 Project Management (3)
BIOL/ 610 Capstone Project for MS/MBA Dual
BUS Degree (6)
Required Courses in the Master of Science in Biotechnology (22 Units)

1. Required Core Courses (15 units)


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

## 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)
CHEM 318 Biological Chemistry (3)
or
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.

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1. Biology (8 units)

BIOL 300 Cell Biology (4)
BIOL 302 Genetics (4)
2. Biology Electives (5 units)

A minimum of 5 units of 300-400 level biology courses, with no more than one course selected from BIOL 331-345.

## 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)
CHEM 318 Biological Chemistry (3)
or
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.
$\square$

## SUMMARY OF CHANGES

1. We are proposing to offer a new Emphasis in Clinical Laboratory Science within the BS in Biology program. This emphasis takes 120 units to complete. All, except two, courses supporting this emphasis are already being offered by various programs in biology, chemistry, physics and mathematics.
2. We are proposing to add a recommended course, MATH 230 Logic and Mathematics Reasoning, for A3 Category of GE requirements for all the undergraduate biology programs.
3. We included a course, BIOL 510 Tissue Culture Techniques and Stem Cell Technology that is required for the MS Biotechnology/MBA dual degree program, as an elective course for the MS Biotechnology and Bioinformatics program.
4. We have deleted the long list of elective courses in biology in several emphases and replaced it with a general statement to shorten the program description.

## JUSTIFICATION

1. In August, 2007, a research report was completed by Continuing and Professional Education Program. The research assessed the occupational projections in California and the region. It indicates that there is an immediate and long-term need in healthcare-related educational programming in this region. Clinical laboratory science (CLS) is one of the fields identified in the report. The average age of professionals working in the field of CLS is 53 . There is also a strong need in public health professionals who are trained to deal with epidemics and potential biological disasters, man-made or other wise, caused by microorganisms. In order to become a licensed CLS or public health microbiologist and be able to work in hospitals/clinics and public health organizations, students need to take a set of required courses in biology, chemistry, physics and mathematics and get a BS degree in Biology. Once they complete their BS degree with the highly prescribed and required courses, they would be able to apply for and get admitted into CLS or public health programs offered by various hospitals and professional institutions to obtain further clinical training and pass the examination to acquire a license to become a practicing CLS or public health professional. Because of the demand which is much like the field of nursing, hospitals offering CLS programs have been providing incentives by paying for qualified students to join their programs. The preparation for both professions at the undergraduate level is essentially the same. Most of the courses required by this emphasis are already being offered by biology, chemistry, physics and mathematics programs. The only additional required courses are BIOL 318 Medical Mycology and BIOL 426 Hematology.
2. We believe that as science majors, our students will benefit from taking MATH 230. They would learn deductive reasoning and critical thinking skills by taking this course. As a recommended course, students still have flexibility to take other courses in the A3 category.
3. BIOL 510 is a required course for the MS Biotechnology and MBA dual degree program. We believe that with the new development in stem cell technology, it is to the benefit of our students in the MS Biotechnology and Bioinformatics program to make this course available as an elective course.
4. The statement serves the same purpose of the long list of elective courses.

Ching-Hua Wang 10/15/07
Proposer of Program Modification Date

## Program:



Signature
Date

| Curriculum Chair |  |  |
| :--- | :---: | :---: |
| Signature |  | Date |




[^0]:    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)
    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)
    FOR EMPHASIS IN SUBJECT MATTER PREPARATION IN

