## Program Modification

DATE: DECEMBER 7, 2005
Program Area: Biology
Please use the following format to modify any existing program. Any deletions from an existing program need to be underlined (left hand column), and any additions/changes to the program need to be in CAPS (right hand column).

| EXISTING PROGRAM |
| :---: |
| Name of Degree Program |
| - Bachelor of Science in Biology |
| - |
| Bachelor of Science in Biology with an |
| Emphasis in Cell and Molecular Biology |

- Bachelor of Science in Biology with an Emphasis in Medical Imaging
- 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 Pre-Nursing Studies
- Bachelor of Arts in Biology with an Emphasis in Subject Matter Preparation in Teaching Biology
- Master of Science in Biotechnology and Bioinformatics
- Minor in Biology
- Certificate in Biotechnology
- Honors in Biology


## Catalog Description of the Program

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 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

## PROPOSED PROGRAM

## Name of Degree Program

- Bachelor of Science in Biology
- Bachelor of Science in Biology with an Emphasis in Cell and Molecular Biology
- Bachelor of Science in Biology with an Emphasis in Medical Imaging
- 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 Pre-Nursing Studies
- Bachelor of Arts in Biology with an Emphasis in Subject Matter Preparation in Teaching Biology
- Master of Science in Biotechnology and Bioinformatics
- Minor in Biology
- Certificate in Biotechnology
- Honors in Biology


## Catalog Description of the Program

 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. 5/25/2004 cpupper-division electives selected from areas of special interest.

The Master of Science Degree 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.

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 largescale 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 problemsolving skills using multiple perspectives.

CAREERS: No changes made.

## Requirements for the Degree Program

COMMON LOWER DIVISION
REQUIREMENTS FOR ALL EMPHASES OF THE BACHELOR OF SCIENCE DEGREE IN BIOLOGY (8 UNITS):

Students take a series of core courses augmented by electives selected from areas of special interest.

CAREERS: No changes made.

## Requirements for the Degree Program

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 and Molecular Biology (4)

## FOR BACHELOR OF SCIENCE IN BIOLOGY: <br> 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, GEB2, UDID (4)
BIOL 499 Senior Capstone (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 Animal Biology and Ecology (4)
BIOL 311 Plant Biology and Ecology (4)
BIOL 312 Marine Biology (4)
BIOL 313 Conservation Biology (4)
BIOL 316 Invertebrate Zoology (4)
BIOL 317 Parasitology (4)
BIOL 401 Biotechnology and Recombinant
DNA Techniques (5)
BIOL 402 Toxicology (3)
BIOL 420 Cellular and Molecular Immunology (4)

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

## FOR BACHELOR OF SCIENCE IN BIOLOGY: <br> 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, GEB2, UDID (4)

AND
A MINIMUM OF 2 UNITS TAKEN FROM THE FOLLOWING:
BIOL 492 Internship (2-3)
BIOL 494 Independent Research (1-3)
BIOL 497 Directed Study (1-3)
AND
BIOL 499 Senior Capstone Colloquium (1)
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 Animal Biology and Ecology (4)
BIOL 311 Plant Biology and Ecology (4)
BIOL 312 Marine Biology (4)
BIOL 313 Conservation Biology (4)
BIOL 316 Invertebrate Zoology (4)
BIOL 317 Parasitology (4)
BIOL 401 Biotechnology and Recombinant DNA Techniques (5)
BIOL 402 Toxicology (3)
BIOL 420 Cellular and Molecular Immunology (4)

BIOL 421 Virology (3)
BIOL 422 Molecular Plant Physiology (4)
BIOL 423 Cellular and Molecular Neurobiology (3)

BIOL 424 Human Physiology (3)
BIOL 425 Human Genetics (3)
BIOL 427 Developmental Biology (4)

BIOL 421 Virology (3)
BIOL 422 Molecular Plant Physiology (4)
BIOL 423 Cellular and 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)

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 (73 units)

1. Chemistry (16 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 314 Organic Chemistry II (3)
CHEM 315 Organic Chemistry II Laboratory (1)
2. Physics (8 units)
select either
PHYS 100 Introduction to Physics I (4)
PHYS 101 Introduction to Physics II (4)
or
PHYS 200 General Physics I (4)
PHYS 201 General Physics II (4)
3. Statistics and Mathematics (7 units)

BIOL 203* QUANTITATIVE METHODS FOR BIOLOGY, GE-B3 (3)
MATH 150* Calculus I, GE-B3 (4)
4. Other Required GE Courses in Categories A-E
(36
units)
Category A (9)
Category C (12)
Category D (12)

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)

## 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 (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)
2. Physics (8 units)
select either
PHYS 100 Introduction to Physics I (4)
PHYS 101 Introduction to Physics II (4)
or
PHYS 200 General Physics I (4)
PHYS 201 General Physics II (4)
3. Statistics and Mathematics (7 units)

BIOL 202 Biostatistics (3)
MATH 150* Calculus I, GE-B3 (4)
4. Other GE Courses in Categories A-E (36 units)
Category A (9)
Category B- covered by required courses for the degree program
Category C (12)
Category D (12)
Category E (3)
5. 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)

Category E (3)
5. 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)
BIOL 401 Biotechnology and Recombinant DNA Techniques (5)
BIOL 431* Bioinformatics, GE-B2, B4, UDID (4)
BIOL 499 Senior Capstone (3)
2. Electives in Biology (9 units)

Select from the following list of courses:
BIOL 402 Toxicology (3)
BIOL 416 Radiobiology and Radionuclides
(3)

BIOL 420 Cellular and Molecular Immunology (4)
BIOL 421 Virology (3)
BIOL 422 Molecular Plant Physiology (4)
BIOL 423 Cellular And 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

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) AND
A MINIMUM OF 2 UNITS TAKEN FROM the following:
BIOL 492 Internship (2-3)
BIOL 494 Independent Research (1-3)
BIOL 497 Directed Study (1-3) AND
BIOL 499 Senior Capstone Colloquium (1)
2. Electives in Biology (9 units)

Select from the following list of courses:
BIOL 402 Toxicology (3)
BIOL 416 Radiobiology and Radionuclides (3)
BIOL 420 Cellular and Molecular Immunology (4)

BIOL 421 Virology (3)
BIOL 422 Molecular Plant Physiology (4)
BIOL 423 Cellular And 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, GEB2, UDID (4)

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 (4)
CHEM 311 Organic Chemistry I (3)
CHEM 312 Organic Chemistry I Laboratory
(1)

AND select either
CHEM 318 Biological Chemistry (3)
or
CHEM 314 Organic Chemistry II (3)
CHEM 315 Organic Chemistry II Laboratory
(1)

GE COURSES (72 units):

1. Chemistry (minimum 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)

AND select either
CHEM 318 Biological Chemistry (3)
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 (4)
PHYS 101 Introduction to Physics II (4)
or
PHYS 200 General Physics I (4)
PHYS 201 General Physics II (4)
3. Statistics and Mathematics (7 units)

BIOL 203* QUANTITATIVE METHODS
FOR BIOLOGY, GE-B3 (3)
MATH 150* Calculus I, GE-B3 (4)
4. Other Required GE Courses in Categories A-E (36
units)
Category A (9)
Category C (12)
Category D (12)
Category E (3)
5. American Institutions Requirement (6 units)
(Note: Students completing the following courses to satisfy this category will obtain a Minor in Chemistry in addition to a Major in Biology:

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 314 Organic Chemistry II (3)
CHEM 315 Organic Chemistry II Laboratory (1)

CHEM 400 Biochemistry (4)
(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 (4)
PHYS 101 Introduction to Physics II (4) or
PHYS 200 General Physics I (4)
PHYS 201 General Physics II (4)
3. Statistics and Mathematics (7 units)

BIOL 202 Biostatistics (3)
MATH 150* Calculus I, GE-B3 (4)
4. Required General Education Courses (6 UNITS)
ENGL 330 Writing in the Disciplines, GE-A1, A2, UDID (3)
AND select one of the following:
BIOL 326* Scientific and Professional Ethics, GE-D (3)
PHYS/ENGL 338* Science and Conscience, GE-B1, C2, UDID (3)
5. Other GE Courses in Categories A-E (3 $\underline{0}$
units)
Category A (6) three units covered by a required GE course for the degree program
Category B- covered by required courses for the degree program
Category C (9) three units covered by a required GE course for the degree program
Category D (12)
Category E (3)
6. American Institutions Requirement (6 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)

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UPPER DIVISION REQUIREMENTS IN THE MAJOR (38 units):
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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/PHYS 416 Radiobiology and
Radionuclides (3)
BIOL/PHYS 434* Introduction to Biomedical Imaging, GE-B1, E, UDID (4)
BIOL/PHYS 464 Biomedical Instrumentation (4)

BIOL 499 Senior Capstone (3)
2. Electives in Biology and Physics (8 units): Select from the following list of courses:
BIOL/PHYS 315 Introduction to Biophysics (4)
BIOL 401 Biotechnology and Recombinant
DNA Techniques (5)
BIOL 420 Cellular and Molecular Immunology
(4)

## FOR EMPHASIS IN MEDICAL IMAGING:

## ADDITIONAL LOWER DIVISION REQUIREMENTS IN THE MAJOR (8 units): <br> BIOL 210 Human Anatomy and Physiology I (4) <br> 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
BIOL 301 Microbiology (4)
BIOL 302 Genetics (4)
BIOL 400 Molecular Biology (4)
BIOL/PHYS 416 Radiobiology and
Radionuclides (3)
BIOL/PHYS 434* Introduction to Biomedical Imaging, GE-B1, E, UDID (4)
BIOL/PHYS 464 Biomedical Instrumentation
(4)

AND A MINIMUM OF 2 UNITS
TAKEN FROM the following:
PHYS 492 Physics Internship (3)
BIOL or PHYS 494 Independent Research
(1-

## 3)

BIOL or PHYS 497 Directed Study (1-3) AND
BIOL or PHYS 499 Senior Capstone
Colloquium (1)
2. Electives in Biology and Physics (8 units):

Select from the following list of courses:
BIOL/PHYS 315 Introduction to Biophysics (4)
BIOL 401 Biotechnology and Recombinant
DNA Techniques (5)
BIOL 420 Cellular and Molecular Immunology (4)

BIOL 421 Virology (3)
BIOL 423 Cellular And Molecular Neurobiology (3)

BIOL 424 Human Physiology (3)
BIOL 425 Human Genetics (3)
BIOL 427 Developmental Biology (4)

BIOL 421 Virology (3)
BIOL 423 Cellular And 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, GEB2, UDID (4)
PHYS 445* Image Analysis and Pattern
Recognition, GE-B1, B4, UDID (3)
NO MORE THAN 2 units taken from the following:
PHYS 492 PHYSICS INTERNSHIP (3)
BIOL OR PHYS 494 INDEPENDENT RESEARCH (1-3)
BIOL OR PHYS 497 DIRECTED STUDY (13)

## 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 311 and 312.)
2. Mathematics (4 units) MATH 150* Calculus I, GE-B3 (4)
3. PHYSICS (8 units)

## select either

PHYS 100 Introduction to Physics I (4)
PHYS 101 Introduction to Physics II (4)
or
PHYS 200 General Physics I (4)
PHYS 201 General Physics II (4)
4. Other Required GE Courses in Categories A-

D (33 units)
Category A (9)

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, GEB2, UDID (4)
PHYS 445* Image Analysis and Pattern Recognition, GE-B1, B4, UDID (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 311 and 312.)
2. Mathematics (4 units)

MATH 150 Calculus I (4)
3. PHYSICS (8 units)
select either
PHYS 100 Introduction to Physics I (4)
PHYS 101 Introduction to Physics II (4)
or
PHYS 200 General Physics I (4)
PHYS 201 General Physics II (4)
4. Required General Education Courses (6 units)
ENGL 330 Writing in the Disciplines, GE-A1, A2, UDID (3) AND select one of the following:
BIOL 326* Scientific and Professional Ethics, GE-D (3)
PHYS/ENGL 338* Science and Conscience, GE-B1, C2, UDID (3)
5. Other GE Courses in Categories A-D (27 units)
Category A (6) three units covered by a required GE course for the degree program
Category B- covered by required courses for the degree program
Category C (9) three units covered by a

Category C (12)
Category d (12)
Category E- covered by a required GE course for the degree program
6. 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 (8 units):

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

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 (4) BIOL 499 Senior Capstone (3)
2. Electives in Biology (12 units)

Select at least three courses from the following list, one of which must be a lab
required GE course for the degree program category d (12)
Category E- covered by a required GE course for the degree program
6. 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 (8 units):

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

## 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 (4) AND
A minimum of 2 units taken from the following:
BIOL 492 Internship (2-3)
BIOL 494 Independent Research (1-3)
BIOL 497 Directed Study (1-3)

## AND

BIOL 499 Senior Capstone Colloquium (1)
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 Animal Biology and Ecology (4)
BIOL 311 Plant Biology and Ecology (4)
BIOL 312 Marine Biology (4)
course.
BIOL 301 Microbiology (4)
BIOL 310 Animal Biology and Ecology (4)
BIOL 311 Plant Biology and Ecology (4)
BIOL 312 Marine Biology (4)
BIOL 313 Conservation Biology (4)
BIOL 316 Invertebrate Zoology (4)
BIOL 317 Parasitology (4)
BIOL 401 Biotechnology and Recombinant DNA Techniques (5)
BIOL 402 Toxicology (3)
BIOL 420 Cellular and Molecular Immunology (4)
BIOL 421 Virology (3)
BIOL 422 Molecular Plant Physiology (4)
BIOL 423 Cellular and 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)

NO MORE THAN 2 UNITS TAKEN FROM
THE FOLLOWING:
BIOL 492 INTERNSHIP (2-3)
BIOL 494 INDEPENDENT RESEARCH (13)

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 (4)
2. Mathematics and Statistics (3-4 units)

Select one of the following:
BIOL 203* QUANTITATIVE METHODS
FOR BIOLOGY, GE-B3 (3)
MATH 105 Pre-Calculus (4)
MATH 150* Calculus I, GE-B3 (4)
3. Other Required GE Courses in Categories A-E (36)

BIOL 313 Conservation Biology (4)
BIOL 316 Invertebrate Zoology (4)
BIOL 317 Parasitology (4)
BIOL 401 Biotechnology and Recombinant DNA Techniques (5)
BIOL 402 Toxicology (3)
BIOL 420 Cellular and Molecular Immunology (4)
BIOL 421 Virology (3)
BIOL 422 Molecular Plant Physiology (4)
BIOL 423 Cellular and 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)

## 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 (4)
2. Mathematics and Statistics (3-4 units)

Select one of the following:
BIOL 202* Biostatistics, GE-B3 (3)
MATH 105 Pre-Calculus (4)
MATH 150* Calculus I, GE-B3 (4)
3. Other GE Courses in Categories A-E (36)

Category A (9)
Category B - covered by required courses for the degree program
Category C (12)
Category D (12)
Category E (3)
4. American Institutions Requirements (6)

ELECTIVES IN ANY DISCIPLINE (21-22 units)

Category A (9)
Category C (12)
Category D (12)
Category E (3)
4. American Institutions Requirements (6)

ELECTIVES IN ANY DISCIPLINE (21-22 units)

## 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)

## AND

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 (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 Animal Biology and Ecology (4)
BIOL 311 Plant Biology and Ecology (4)
BIOL 312 Marine Biology (4)
BIOL 313 Conservation Biology (4)
BIOL 316 Invertebrate Zoology (4)
BIOL 317 Parasitology (4)
BIOL 401 Biotechnology and Recombinant DNA Techniques (5)
BIOL 402 Toxicology (3)
BIOL 420 Cellular and Molecular Immunology (4)
BIOL 421 Virology (3)
BIOL 422 Molecular Plant Physiology (4)

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) AND
Select one of the following:
BIOL 303 Evolutionary Biology (3)
BIOL 433* Ecology and the Environment, GE-B2, UDID (4) AND
A minimum of 2 units taken from the following:
BIOL 492 Internship (2-3)
BIOL 494 Independent Research (1-3)
BIOL 497 Directed Study (1-3) AND
BIOL 499 Senior Capstone Colloquium (1)
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 Animal Biology and Ecology (4)
BIOL 311 Plant Biology and Ecology (4)
BIOL 312 Marine Biology (4)
BIOL 313 Conservation Biology (4)
BIOL 316 Invertebrate Zoology (4)
BIOL 317 Parasitology (4)
BIOL 401 Biotechnology and Recombinant DNA Techniques (5)
BIOL 402 Toxicology (3)
BIOL 420 Cellular and Molecular Immunology (4)
BIOL 421 Virology (3)
BIOL 422 Molecular Plant Physiology (4)
BIOL 423 Cellular and 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,

BIOL 423 Cellular and 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)

NO MORE THAN 2 UNITS TAKEN FROM THE FOLLOWING:

BIOL 492 INTERNSHIP (2-3)
BIOL 494 INDEPENDENT RESEARCH (13)

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 (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)
2. Mathematics and Statistics (3-4 units) Select one of the following:
BIOL 203*, QUANTITATIVE METHODS FOR BIOLOGY, GE-B3 (3)
MATH 150* Calculus I, GE-B3 (4)
(check with professional schools or preprofessional advisor for specific requirements in this category.)
3. Physics (8 units)

PHYS 100 Introduction to Physics I (4)
PHYS 101 Introduction to Physics II (4)
4. Other Required GE Courses in Categories A-E (36)

Category A (9)
Category C (12)
Category D (12)
Category E (3)

UDID (4)
BIOL 432* Principles of Epidemiology and Environmental Health, GE-B2, D, UDID (3)

BIOL 450 Ichthyology: The Biology of Fishes (4)

## 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 (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)
2. Mathematics and Statistics (3-4 units)

Select one of the following:
BIOL 202* Biostatics, GE-B3 (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 (4)
PHYS 101 Introduction to Physics II (4)
4. Other GE Courses in Categories A-E (36)

Category A (9)
Category B - covered by required courses for the degree program
Category C (12)
Category D (12)
Category E (3)
5. American Institutions Requirements (6)

ELECTIVES IN ANY DISCIPLINE (10-11 units)

| FOR EMPHASIS IN SUBJECT MATTER |
| :--- |
| PREPARATION IN TEACHING BIOLOGY: |
| 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) |

5. American Institutions Requirements (6)

ELECTIVES IN ANY DISCIPLINE (10-11 units)

FOR EMPHASIS IN SUBJECT MATTER PREPARATION IN TEACHING BIOLOGY: 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 (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 Animal Biology and Ecology (4)
BIOL 311 Plant Biology and Ecology (4)
BIOL 312 Marine Biology (4)
BIOL 313 Conservation Biology (4)
BIOL 316 Invertebrate Zoology (4)
BIOL 317 Parasitology (4)
BIOL 400 Molecular Biology (4)
BIOL 401 Biotechnology and Recombinant DNA Techniques (5)
BIOL 402 Toxicology (3)
BIOL 420 Cellular and Molecular Immunology (4)
BIOL 421 Virology (3)
BIOL 422 Molecular Plant Physiology (4)
BIOL 423 Cellular and 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

BIOL 304 Comparative Animal Physiology

## (3)

BIOL 335* The Biosphere, GE-B2, UDID (3)
BIOL 433* Ecology and the Environment, GE-B2, UDID (4)

## AND

A minimum of 2 units taken from the
following:
BIOL 492 Internship (2-3)
BIOL 494 Independent Research (1-3)
BIOL 497 Directed Study (1-3)

## AND

BIOL 499 Senior Capstone Colloquium (1)
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 Animal Biology and Ecology (4)
BIOL 311 Plant Biology and Ecology (4)
BIOL 312 Marine Biology (4)
BIOL 313 Conservation Biology (4)
BIOL 316 Invertebrate Zoology (4)
BIOL 317 Parasitology (4)
BIOL 400 Molecular Biology (4)
BIOL 401 Biotechnology and Recombinant DNA Techniques (5)
BIOL 402 Toxicology (3)
BIOL 420 Cellular and Molecular Immunology (4)
BIOL 421 Virology (3)
BIOL 422 Molecular Plant Physiology (4)
BIOL 423 Cellular and 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)

REQUIRED SUPPORTING AND OTHER
GE COURSES ( 76 units):
(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 (13)

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)

BIOL 203* QUANTITATIVE METHODS
FOR BIOLOGY, GE-B3 (3)
AND
MATH 105 Pre-Calculus (4) Or
MATH 150* Calculus I, GE-B3 (4)
3. Physical Sciences (24 units)

CHEM 121* General Chemistry I, GE-B1 (4)
CHEM 122 General Chemistry II (4)
GEOL 121 Physical Geology (4)
PHYS 100 Introduction to Physics I (4)
PHYS 101 Introduction to Physics II (4)
PHYS 105 Introduction to the Solar System
(4)
4. Other Required GE Courses in Categories A-E (36)

Category A (9)
Category C (12)
Category D (12)
Category E (3)
5. American Institutions Requirements (6)
(Courses with * are double-counted toward GE credits.)

## REQUIREMENTS FOR THE MASTER OF SCIENCE DEGREE IN BIOTECHNOLOGY AND BIOINFORMATICS (33-34 units)

(Pending approval from the Chancellor's Office and offered through California State University

1. Required Education Course (3 units)

EDUC 330* Introduction To Secondary Schooling, GE-D, UDID (3)
2. Mathematics and Statistics (7 units) BIOL 202* Biostatistics, GE-B3 (3) AND
MATH 105 Pre-Calculus (4) Or
MATH 150* Calculus I, GE-B3 (4)
3. Physical Sciences (24 units)

CHEM 121* General Chemistry I, GE-B1 (4)
CHEM 122 General Chemistry II (4)
GEOL 121 Physical Geology (4)
PHYS 100 Introduction to Physics I (4)
PHYS 101 Introduction to Physics II (4)
PHYS 105 Introduction to the Solar System (4)
4. Other GE Courses in Categories A-E (36)

Category A (9)
Category B - covered by required courses for the degree program
Category C (12)
Category D (12)
Category E (3)
5. American Institutions Requirements (6)
(Courses with * are double-counted toward GE credits.)

REQUIREMENTS FOR THE MASTER OF SCIENCE DEGREE IN BIOTECHNOLOGY AND BIOINFORMATICS (33-35 units)
(Pending approval from the Chancellor's Office and offered through California State University Channel Islands Extended Education Program)

## ADMISSION REQUIREMENTS:

- Applicants must have a BS/BA degree in Biology, Computer Science, Chemistry, Biochemistry, or Mathematics. Alternatively, they must have a BA/BS degree in any field and equivalent work experiences in one of the above fields. The prerequisite courses for the graduate level courses should be completed at the undergraduate level or before enrolling in the set required

Channel Islands Extended Education Program)

## PROGRAM DESCRIPTION:

The Master of Science Degree 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.

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 largescale 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 problemsolving skills using multiple perspectives.

## 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
courses after conditional admission.

- Applicants seeking admission to the professional MS in Biotechnology and Bioinformatics program must be officially accepted into the CSUCI academic program.
- Applicants must declare themselves as graduate students in the professional MS degree program in Biotechnology and Bioinformatics.
- 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. No arbitrary grade point or test score will be used in the evaluation process. However, the following materials are required for our evaluation and admission process.
- Applicants must submit to the program 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 to the program their Test of English as a Foreign Language (TOEFL) scores for evaluation.
- A one page "Statement of Purpose" from the applicant and two letters of recommendations from people who are able to judge the applicant's capacity for both academic and professional success should be submitted to the program for evaluation.
- Applicants will be interviewed by the program admissions committee before admission to the program.

ADMISSION AND THEY MUST FULFILL ALL THE 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.
5. Applicants must submit to the program their transcript from their undergraduate institution, Graduate Record Examinations (GRE) General Test scores or the Medical College Admission Test (MCAT) scores.
6. 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 to the program their Test of English as a Foreign Language (TOEFL) scores for evaluation.
7. A one page "Statement of Purpose" from the applicant and two letters of recommendations from people who are able to judge the applicant's capacity for both academic and professional success should be submitted to the program for evaluation.

[^0]| Although a BS/BA in the natural or life science, computer science, or mathematics is likely to provide the most thorough academic preparation for our program, it is not a prerequisite for admission. Relevant work experience in fields of biotechnology, computing, pharmaceuticals, medical, environmental, and agricultural biotechnology, clinical trials, regulatory affairs, intellectual property law, and management in biotechnology is looked upon favorably. However, as our program demands sophisticated technical training which requires a comparable level of requisite knowledge and skills, some deficiency in academic preparation among applicants who have relevant work experience may be offered conditional admission, contingent upon successful completion of prerequisite academic work specified by the admissions committee. <br> Once admitted, students must remain in good academic standing throughout the duration of their enrollment in CSUCI. <br> Students must complete and fulfill the requirements of the degree program within a designated period specified by the university. | (3) <br> BIOL 502 Techniques in Genomics and Proteomics (2) <br> BIOL 503 Biotechnology Law and Regulation <br> (3) <br> MGT 471 Project Management (3) <br> BIOL 600 Team Project (4) <br> BIOL 601 Seminar Series in Biotechnology and Bioinformatics (1) <br> For Biotechnology Emphasis (17 units): <br> REQUIRED COURSES (7 units): <br> BIOL 504 Molecular Cell Biology (3) <br> BIOL 505 Molecular Structure (4) <br> ELECTIVES (10 units): <br> A minimum of 10 units chosen from the following courses and/or from the elective courses under the Bioinformatics Emphasis: <br> BIOL 506 Molecular Evolution (4) <br> BIOL 507 Pharmacogenomics and <br> Pharmacoproteomics (3) <br> BIOL 508 Advanced Immunology (4) <br> BIOL 509 Plant Biotechnology (4) <br> MGT 421 Human Resource Management (3) <br> For Bioinformatics Emphasis (18 units): <br> REQUIRED COURSES (12 units): <br> BINF 501 BIOLOGICAL INFORMATICS (3) <br> BINF 510 Database Systems for Bioinformatics (3) <br> BINF 511 Computational Genomics (3) <br> BINF 513 Programming for Bioinformatics (3) |
| :---: | :---: |
| DEGREE REQUIREMENTS: COMMON CORE COURSES (19 units): | ELECTIVES (6 units): |
| BINF 500 DNA and Protein Sequence Analysis (3) | A minimum of two courses chosen from the following and/or from the elective courses under |
| BINF 501 Biological Informatics (3) | the Biotechnology Emphasis, with at least one |
| BIOL 502 Techniques in Genomics and Proteomics (2) | course in the BINF category: <br> BINF 512 Algorithms for Bioinformatics (3) |
| BIOL 503 Biotechnology Law and Regulation (3) | BINF 514 Statistical Methods in Computational Biology (3) |
| MGT 471 Project Management (3) | PHYS 445 Image Analysis and Pattern |
| BIOL 600 Team Project (4) | Recognition (3) |
| BIOL 601 Seminar Series in Biotechnology and Bioinformatics (1) | MGT 421 Human Resource Management (3) |


| For Biotechnology Emphasis (14 units): | PROPOSED COURSE OF STUDY: For Biotechnology Emphasis: |
| :---: | :---: |
| REQUIRED COURSES (7 units): | (The following are mostly rearrangement of |
| BIOL 504 Molecular Cell Biology (3) | courses) |
| BIOL 505 Molecular Structure (4) | Year 1 (13 units) <br> Semester 1 |
| ELECTIVES ( $7 \underline{\text { units }}$ ): | BIOL 504 Molecular Cell Biology (3) |
| A minimum of $\underline{Z}$ units chosen from the following courses and/or from the elective courses under | MGT 471 Project Management (3) |
| the Bioinformatics Emphasis: | Semester 2 |
| BIOL 506 Molecular Evolution (4) | BINF 500 DNA and Protein Sequence |
| BIOL 507 Pharmacogenomics and | Analysis (3) |
| Pharmacoproteomics (3) | BIOL 503 Biotechnology Law and |
| BIOL 508 Advanced Immunology (4) | Regulation (3) |
| BIOL 509 Plant Biotechnology (4) | BIOL 601 Seminar Series in Biotechnology |
| MGT 421 Human Resource Management (3) | and Bioinformatics (1) |
| For Bioinformatics Emphasis (15-16 units) | Year 2 (20 units) Semester 1 |
| REQUIRED COURSES ( $\underline{9}$ units): | BIOL 502 Techniques in Genomics and |
| BINF 510 Database Systems for Bioinformatics (3) | Proteomics (2) |
| BINF 511 Computational Genomics (3) | Electives (3) |
| BINF 513 Programming for Bioinformatics (3) | Semester 2 |
| ELECTIVES (6-7 | BIOL 600 Team Project (4) |
| A minimum of two courses chosen from the following and/or from the elective courses und | Electives (7) |
| the Biotechnology Emphasis, with at least one course in the BINF category: | For Bioinformatics Emphasi |
| BINF 512 Algorithms for Bioinformatics (3) | Year 1 (13 units) |
| BINF 514 Statistical Methods in Computational Biology (3) | Semester 1 <br> BINF 501 Biological Informatics (3) |
| PHYS 445 Image Analysis and Pattern Recognition (3) | MGT 471 Project Management (3) |
| MGT 421 Human Resource Management (3) | Semester 2 |
| PROPOSED COURSE OF STUDY | BINF 500 DNA and Protein Sequence Analysis (3) |
| For Biotechnology Emphasis: | BIOL 503 Biotechnology Law and Regulation (3) |
| Year 1 (19 units) | BIOL 601 Seminar Series in Biotechnology and Bioinformatics (1) |
| Semester 1 |  |
| BINF 500 DNA and Protein Sequence Analysis (3) | Year 2 (21 units) Semester 1 |
| BIOL 501 Biological Informatics (3) | BIOL 502 Techniques in Genomics and |
| BIOL 502 Techniques in Genomics and | Proteomics (2) |


| Proteomics (2) | BINF 510 Database Systems for Bioinformatics (3) |
| :---: | :---: |
| Semester 2 | BINF 511 Computational Genomics (3) |
| BIOL 503 Biotechnology Law and Regulation (3) | Semester 2 |
| MGT 471 Project Management (3) | BINF 513 Programming for Bioinformatics |
| BIOL 601 Seminar Series in Biotechnology and Bioinformatics (1) | (3) <br> BIOL 600 Team Project (4) <br> Electives (6) |
| Year 2 (19 units) |  |
| Semester 1 |  |
| BIOL 504 Molecular Cell Biology (3) |  |
| BIOL 505 Molecular Structure (4) | REQUIREMENTS FOR THE MINOR IN |
| Electives (3) | BIOLOGY (21 units) <br> No changes made. |
| Semester 2 |  |
| BIOL 600 Team Project (4) | REQUIREMENTS FOR THE |
| Electives (4) | CERTIFICATE IN BIOTECHNOLOGY (2324units) |
| For Bioinformatics Emphasis: | No changes made. |
| Year 1 (19 units) | REQUIREMENTS FOR HONORS IN |
| Semester 1 | BIOLOGY |
| BINF 500 DNA and Protein Sequence Analysis (3) | No changes made. |
| BINF 501 Biological Informatics (3) |  |
| BIOL 502 Techniques in Genomics and |  |
| Semester 2 |  |
| BIOL 503 Biotechnology Law and Regulation (3) |  |
| MGT 471 Project Management (3) |  |
| BIOL 601 Seminar Series in Biotechnology and Bioinformatics (1) |  |
| Year 2 (16-17 units) |  |
| Semester 1 |  |
| BINF 510 Database Systems for |  |
| Electives (6-7) |  |
| Semester 2 |  |
| BINF 511 Computational Genomics (3) |  |
| BIOL 600 Team Project (4) |  |


|  |  |
| :--- | :--- |
| REQUIREMENTS FOR THE MINOR IN |  |
| BIOLOGY (21 units) |  |
| No changes made. |  |
| EQUIREMENTS FOR THE CERTIFICATE |  |
| IN BIOTECHNOLOGY (23-24units) |  |
| No changes made. |  |
| REQUIREMENTS FOR HONORS IN |  |
| BIOLOGY |  |
| No changes made. |  |

## SUMMARY OF CHANGES

1. Moved BIOL 492, 494 and 497 courses from required to elective courses in biology for the BS and BA programs;
2. Made BIOL 499 a 3-unit course for the BS and BA programs;
3. Removed ENGL 330, BIOL 326 and PHYS 338 from required GE courses for the following emphases: BS in Biology (ENGL 330), BS in Biology with Emphases in Cell and Molecular Biology and Medical Imaging (ENGL 330 and BIOL 326 or PHYS 338);
4. Modified the Admission Requirements for the MS program;
5. Streamlined the Admission Requirements for the MS program;
6. Deleted BINF 501 course from the MS in Biotechnology and Bioinformatics with an Emphasis in Biotechnology, and
7. Rearranged the sequence of Proposed Course of Study for the MS program.

## JUSTIFICATION

1. In the last four-and-a-half years of offering the biology degree programs, we have observed uneven experiences from the students who completed the BIOL 499 Senior Capstone Colloquium where students were required to present what they had completed in their service learning projects in BIOL 492, 494 or 497. This was mainly due to the sheer numbers of students required to complete either BIOL 492, 494 or 497 , and the limited faculty members who could supervise students carrying out these projects. To enrich our students’ educational experience and to improve the quality of the Biology Program, we would like to move the BIOL 492, 494 and 497 courses from required to elective courses in biology. All biology undergraduate students are still required to complete the newly designed BIOL 499 course that will provide them with an enriched capstone course. We realize that various other program areas have been using these similar types of service learning courses as electives as well.
2. BIOL 499 in its original design was to have students to present in written and oral forms what they have learned from carrying out the BIOL 492, 494 and 497 projects. Since the latter three courses are no longer required but only elective courses, the previous objectives of BIOL 499 as a capstone course for students are no longer there. We redesigned the BIOL 499 course to make it a senior capstone course that will have major scientific writing and bioethics components incorporated into the course and its discussions. Students will also orally present their study of scientific journals and findings in the course.
3. Because of the modification of BIOL 499 which will emphasize writing and bioethics as well as oral and written communications, there is no longer a need to require students to take ENGL 330, BIOL 326 or PHYS 338.
4. The modification is to align MS program admission requirements with the general CSU admission requirements for graduate students.
5. All applicants for the MS program need to go through a dual admission process: the CSUCI university admission process and the MS in Biotechnology and Bioinformatics program admission process. The Catalog lists the CSUCI University Admission Requirements for graduate students under the section of Admissions, Recruitment, Records, and Registration. However, it does not cover specific program admission requirements. For the convenience of the potential graduate student applicants and for the clarity of the dual admission process, the specific Admission Requirements for the MS program need to be listed under the program description. For example, the Education Program listed all the program specific

Admission Requirements under each of their Credential Programs in the Catalog. The Biology Program believes that it is important for us to list all the program admission requirements as well.
6. BINF 501, as a bioinformatics course, is not necessary for students in the Biotechnology Emphasis of the MS program, and therefore is deleted from this emphasis. It remains as a required course for the Bioinformatics Emphasis.
7. The rearrangement is stemming from our current implementation of the MS program.

Nov. 22, 2005
Proposer of Program Modification
Date

## Approvals

Program Chair Date
Curriculum Committee Chair Date

Dean
Date

## California State University Channel Islands <br> Program Modification Consultation Sheet

1. Course Title: $\qquad$
2. Program Area: $\qquad$ Biology $\qquad$

## Recommend Approval

| Program Area/Unit | Program/Unit Chair | YES | NO <br> (attach <br> objections) | Date |
| :---: | :--- | :--- | :--- | :--- |
| Art |  |  |  |  |
| Biology |  |  |  |  |
|  <br> Economics |  |  |  |  |
| Education |  |  |  |  |
| English |  |  |  |  |
| History |  |  |  |  |
| Liberal Studies |  |  |  |  |
| Mathematics \& CS |  |  |  |  |
| Multiple Programs |  |  |  |  |
| Psychology |  |  |  |  |
| Library |  |  |  |  |
| Information |  |  |  |  |
| Technology |  |  |  |  |
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|  |  |  |  |  |


[^0]:    DEGREE REQUIREMENTS: COMMON CORE COURSES (16 units): BINF 500 DNA and Protein Sequence Analysis

