California State University Channel Islands

Program Modification

Program modifications must be submitted by October 15, 2011, and finalized by the end of the fall semester for catalog production.

Enter data in YELLOWED areas.

Date (Change date if modified and update the file name with the new date): 2012 2013 Catalog Copy 10.24.11

Program Area: Biology

Semester /Year First affected: Fall 2012

Instructions: Please use this <u>Program Modification</u> form for changes to existing program requirements, units, outcomes, emphases or options, or for other programmatic concerns. For minor changes (faculty or address changes, additions of approved electives, minor editing for clarity, and other minor updates) use the <u>Program Update</u> form, available at the Curriculum website.

Paste the latest approved version of your entire program in the left AND right boxes below. Make your deletions in the LEFT column by using the strikeout feature in Word or underlining, and highlight. Insert new language or other changes to the program on the RIGHT and highlight in YELLOW for easy identification. If possible, please align the two columns so that changes appear side-by-side with the original text.

CURRENTLY APPROVED PROGRAM

PROPOSED PROGRAM

Programs Offered

Bachelor of Science in Biology

Emphasis in Clinical Laboratory Science

Emphasis in Clinical Laboratory Science

Emphasis in Ecology, Evolution and Organismal Biology Emphasis in Medical Imaging

Bachelor of Arts in Biology

Emphasis in Ecology, Evolution and Organismal Biology

Emphasis in General Biology

Emphasis in Pre-Professional Studies

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

approval)

Master of Science in Biotechnology and Bioinformatics

Emphasis in Biotechnology

Emphasis in Biomedical Engineering

Emphasis in Stem Cell Technology

and Laboratory Management

Master of Science in Biotechnology and

Programs Offered

Bachelor of Science in Biology

Emphasis in Cell and Molecular Biology

Emphasis in Clinical Laboratory Science

Emphasis in Ecology, Evolution and Organismal Biology

Emphasis in Medical Imaging

Bachelor of Arts in Biology

Emphasis in Ecology, Evolution and Organismal Biology

Emphasis in Pre-Professional Studies

Emphasis in Subject Matter Preparation in Teaching Biology

Master of Science in Biotechnology and Bioinformatics

Emphasis in Biotechnology

Emphasis in Biomedical Engineering

Emphasis in Stem Cell Technology

and Laboratory Management

Master of Science in Biotechnology and

Master of Business Administration (Dual Degree)

- Minor in Biology
- Clinical Training Certificate Program in Clinical Laboratory Science

Program Description

Biology is the study of life, its origins, diversity and intricacies. It emphasizes the relationship between structure and function in living systems and the processes, by which organisms grow, reproduce and interact with each other and their environment. The 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 Cell and Molecular Biology offers students an opportunity to study the exciting developments in genetics, molecular biology, cloning, biotechnology and bioinformatics. This program leads to careers in medical sciences, biotechnology, pharmaceuticals, research and development, intellectual property and patent law.

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

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

The Bachelor of Science in Biology with an Emphasis in Medical Imaging prepares students for graduate or professional study in the medical sciences (medical imaging,

Master of Business Administration (Dual Degree)

- Minor in Biology
- Clinical Training Certificate Program in Clinical Laboratory Science
- Stem Cell Technology Certificate Program

Program Description

Biology is the study of life: its origins, intricacies, and diversity. It emphasizes the relationship between structure and function in living systems and the processes, by which molecules, cells, organisms, and populations interact with each other and with their environments. 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 health professional (e.g., medical, dental, veterinary, pharmacy) or graduate schools, or seek careers in business, industry or government.

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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 graduate study in all aspects of biology as well as careers in environmental science, conservation, government, research, or education.

The Bachelor of Science in Biology with an Emphasis in Medical Imaging prepares students for graduate or professional study in the medical sciences (medical imaging,

medical physics, health physics, dosimetry, nuclear medicine, radiotherapy, oncology, biomedical engineering), or for entry into professional positions in the clinical environment and in medical imaging research and development.

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

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

The Clinical Training Certificate Program in Clinical Laboratory Science will be offered at several local hospitals partnering with CI which will lead to careers in clinical laboratory science.

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-

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 Emphasis in Subject Matter Preparation provides the depth of study necessary for securing a Single Subject Credential in Science for teaching at the high school and middle school levels. Additional courses in geology, astronomy, and chemistry are included to meet the breadth requirements for this credential.

The Biology Minor allows students in majors other than biology to explore selected area(s) at a greater depth. Equipped with a minor in biology, students with majors 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 <u>21</u> units.

The Clinical Training Certificate Program in Clinical Laboratory Science will be offered at several local hospitals partnering with CI which will lead to careers in clinical laboratory science.

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- Describe the relationship between life forms and their environments and ecosystems;
- Collect, organize, analyze, interpret and present quantitative and qualitative data and incorporate them into the broader context of biological knowledge;
- Effectively apply current technology and scientific methodologies for problem solving;
- Find, select and evaluate various types of scientific information including primary research articles, mass media sources and world-

wide web information; and

• Communicate effectively in written and oral forms.

Faculty

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biology@csuci.edu

For graduation roadmaps for the B.S. B.A. and M.S. programs in Biology, please visit:

http://biologv.csuci.edu.

Bachelor of Science Degree in

wide web information; and

• Communicate effectively in written and oral forms.

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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,	
		GE B2	4

Upper Division Requirements in the Major - 39 units

1. Required	' Biology	Courses - <u>25</u> units
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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, UDIGE	4
BIOL	499	Senior Capstone in Biology	3

2. Electives in Biology - 14 units

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

No more than $\underline{2}$ units taken from the following can be counted towards the $\underline{14}$ units of electives:

BIOL	492	Internship	2-3
		Independent Research	
		Directed Study	

Required Supporting and Other GE Courses

73 units

1.

Chemistry - <u>16</u> 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	

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,	
		GE B2	4

Upper Division Requirements in the Major - 39 units

1. Required Biology Courses - 25 units

BIOL	300	Cell Biology4
BIOL	302	Genetics4
BIOL	303	Evolutionary Biology3
BIOL	304	Comparative Animal Physiology3
BIOL	400	Molecular Biology4
BIOL	433*	Ecology and the Environment,
		GE B2, UDIGE4
BIOL	499	Senior Capstone in Biology3

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 <u>14</u> units of electives.

No more than $\underline{2}$ units taken from the following can be counted towards the $\underline{14}$ units of electives:

BIOL	492	Internship	2-3
		Independent Research	
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	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	college may be accepted for the Biology major in lieu of CHEM 311, 312, 314, 315		
2. Physics - <u>8</u> units	2. Physics - <u>8</u> units		
Select <u>one</u> of the following combinations:	Select <u>one</u> of the following combinations:		
PHYS 100* Introduction to Physics I, GE B14	PHYS 100* Introduction to Physics I, GE B14		
PHYS 101* Introduction to Physics II, GE B14	PHYS 101* Introduction to Physics II, GE B14		
or	or		
PHYS 200* General Physics I, GE B14	PHYS 200* General Physics I, GE B14		
PHYS 201* General Physics II, GE B14 PHYS 201* General Physics II, GE B14	PHYS 201* General Physics II, GE B14		
FIII3 201 deficial rhysics ii, de di4	FIII 201 General Flysics II, GE D14		
3. Statistics and Mathematics - Z units	3. Statistics and Mathematics - Z units		
BIOL 203* Quantitative Methods for Biology, GE B3,	BIOL 203* Quantitative Methods for Biology, GE B3,		
B43	B43		
MATH 150* Calculus I, GE B34	MATH 150* Calculus I, GE B34		
PHILI 100 Galcardo I, al Bo miniminiminimini I	PHILIT TOO GARCAIAG I) GE BOILLIAINIAINIAINIAINIAINIAINIAINIAINIAINI		
4. Other Required GE Courses in Categories A-E - <u>36</u> units	4. Other Required GE Courses in Categories A-E - <u>36</u> units		
Category A9	Category A9		
(For A3, recommend MATH 230 Mathematical Reasoning)	(For A3, recommend MATH 230 Mathematical Reasoning)		
Category C12	Category C12		
	9 •		
Category E3	Category E3		
5. American Institutions Requirement - <u>6</u> units	5. American Institutions Requirement - <u>6</u> units		
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Emphasis in Cell and Molecular Biology	Emphasis in Cell and Molecular Biology		
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Upper Division Requirements in the Major - 40 units	Upper Division Requirements in the Major - 40 units		
	1. Required Biology Courses - <u>31</u> units		
1. Required Biology Courses - <u>31</u> units BIOL 300 Cell Biology4			
BIOL 301 Microbiology4	BIOL 301 Microbiology4		
BIOL 302 Genetics4	BIOL 302 Genetics4		
BIOL 303 Evolutionary Biology3	BIOL 303 Evolutionary Biology3		
BIOL 400 Molecular Biology4	BIOL 400 Molecular Biology4		
BIOL 401 Biotechnology and Recombinant	BIOL 401 Biotechnology and Recombinant		
DNA Techniques5	DNA Techniques5		
BIOL 431* Bioinformatics, GE B2, B4, UDIGE4	BIOL 431* Bioinformatics, GE B2, B4, UDIGE4		
BIOL 499 Senior Capstone in Biology3	BIOL 499 Senior Capstone in Biology3		
2. Electives in Biology - <u>9</u> units	2. Electives in Biology - <u>9</u> units		
Select from the following list of courses:			
select from the following list of courses:	Select from the following list of courses:		

BIOL 402 Toxicology 3 BIOL 402 Toxicology 3 BIOL 403 Foundations of Structural Biology 4 BIOL 404 Plant and Animal Tissue Culture 3 BIOL 404 Plant and Animal Tissue Culture 3 BIOL 405 Biochemical Engineering 4 BIOL 406 Biochemical Engineering 4 BIOL 407 Biochemical Engineering 4 BIOL 408 Nanobiotechnology 3 BIOL 408 Nanobiotechnology 3 BIOL 406 Radiobiology and Radionuclides (PHYS) 3 BIOL 406 Radiobiology and Radionuclides (PHYS) 3 BIOL 407 Radiobiology and Radionuclides (PHYS) 3 BIOL 408 Radiobiology and Radionuclides (PHYS) 3 BIOL 408 Radiobiology and Radionuclides (PHYS) 3 BIOL 408 Radiobiology and Radionuclides (PHYS) 3 BIOL 421 Virology 4 BIOL 422 Molecular Plant Playsiology 4 BIOL 422 Molecular Plant Playsiology 4 BIOL 423 Cellular & Molecular Neurobiology 3 BIOL 423 Cellular & Molecular Neurobiology 3 BIOL 424 Human Playsiology 3 BIOL 425 Human Genetics 3 BIOL 425 Human Genetics 3 BIOL 426 Hematology 4 BIOL 427 Developmental Biology 4 BIOL 428 BIOL 428 BIOL 429 Principles of Epidemiology and Environmental Health, GE B2, D, UDIGE 3 BIOL 438 BIOL 438 Principles of Epidemiology and Environment, GE B2, UDIGE 4 BIOL 438 Ecology and the Environment, GE B2, UDIGE 4 Courses with * are double-counted toward GE credits. No more than 2 units taken from the following can be counted towards the 2 units of electives: BIOL 492 Internship 2-3 BIOL 492 Internship 2-3 BIOL 494 Independent Research 1-3 BIOL 494 Inde			
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BIOL 425 Human Genetics 3 BIOL 426 Hematology 4 BIOL 427 Developmental Biology 4 BIOL 427 Developmental Biology 4 BIOL 427 Developmental Biology 4 BIOL 428 BIOLOGY 6 Hematology 4 BIOL 432* Principles of Epidemiology and Environmental Health, GE B2, D, UDIGE 3 BIOL 433* Ecology and the Environment, GE B2, UDIGE 4 Hematology 4 BIOL 432* Principles of Epidemiology and Environmental Health, GE B2, D, UDIGE 3 BIOL 433* Ecology and the Environment, GE B2, UDIGE 4		obiology3	
BIOL 426 Hematology			
BIOL 427 Developmental Biology 4 BIOL 428 Biology of Cancer 3 BIOL 432* Principles of Epidemiology and Environmental Health, GE B2, D, UDIGE3 BIOL 433* Ecology and the Environment, GE B2, UDIGE 4 Courses with * are double-counted toward GE credits. No more than 2 units taken from the following can be counted towards the 2 units of electives: BIOL 492 Internship 2-3 BIOL 494 Independent Research 1-3 BIOL 497 Directed Study 1-3 BIOL 497 Directed Study 1-3 Required Supporting and Other GE Courses Required Supporting and Other GE Courses CHEM 121* General Chemistry I, GE B1 4 CHEM 311 Organic Chemistry I, GE B1 4 CHEM 311 Organic Chemistry I Laboratory 1 Select either: BIOL 428 Biology of Cancer 3 BIOL 428 Biology of Cancer 3 BIOL 432* Principles of Epidemiology and Environmental Health, GE B2, D, UDIGE 3 BIOL 433* Ecology and the Environment, GE B2, UDIGE 42 Courses with * are double-counted toward GE credits. Courses with * are double-counted toward GE credits. No more than 2 units taken from the following can be counted towards electives: BIOL 492 Internship 2-3 BIOL 492 Internship 2-3 BIOL 494 Independent Research 1-3 BIOL 497 Directed Study 1-3 BIOL 498 Internship 310 Office GE Courses 72 units 1. Chemistry minimum - 15 units CHEM 121* General Chemistry I, GE B1 4 CHEM 122* General Chemistry I, GE B1 4 CHEM 122* General Chemistry I, GE B1 4 CHEM 311 Organic Chemistry I Laboratory 1 CHEM 312 O			
BIOL 428 Biology of Cancer 3 BIOL 432* Principles of Epidemiology and Environmental Health, GE B2, D, UDIGE 3 BIOL 433* Ecology and the Environment, GE B2, UDIGE 4 Courses with * are double-counted toward GE credits. No more than 2 units taken from the following can be counted towards the 2 units of electives: BIOL 492 Internship 2-3 BIOL 494 Independent Research 1-3 BIOL 497 Directed Study 1-3 Required Supporting and Other GE Courses 72 units 1. Chemistry minimum - 15 units CHEM 121* General Chemistry I, GE B1 4 CHEM 311 Organic Chemistry I, GE B1 4 CHEM 311 Organic Chemistry I Laboratory 1 Select either: BIOL 432* Biology of Cancer 3 BIOL 432* Principles of Epidemiology and Environmental Health, GE B2, UDIGE 4 Principles of Epidemiology and Environmental Health, GE B2, UDIGE 4 Principles of Epidemiology and Environmental Health, GE B2, UDIGE 4 Principles of Epidemiology and Environmental Health, GE B2, UDIGE 4 Principles of Epidemiology and Environmental Health, GE B2, UDIGE 4 Principles of Epidemiology and Environmental Health, GE B2, UDIGE 4 Principles of Epidemiology and Environmental Health, GE B2, UDIGE 4 Principles of Epidemiology and Environmental Health, GE B2, UDIGE 4 Principles of Epidemiology and Environmental Health, GE B2, UDIGE 4 Principles of Epidemiology and Environmental Health, GE B2, UDIGE 4 Principles of Epidemiology and Environmental Health, GE B2, UDIGE 4 Principles of Epidemiology and Environmental Health, GE B2, UDIGE 4 Principles of Epidemiology and Environmental Health, GE B2, UDIGE 4 Principles of Epidemiology and Environmental Health, GE B2, UDIGE 4 Principles of Epidemiology and Environmental Health, GE B2, UDIGE 4 Principles of Epidemiology and Environmental Health, GE B2, UDIGE 4 Principles of Epidemiology and Environmental Health, GE B2, UDIGE 4 Principles of Epidemiology and Environmental Health, GE B2, UDIGE 4 Principles of Epidemiology and Environmental Health, GE B2, UDIGE 4 Principles of Epidemiology and Environmental Health, GE B2, UDIGE 4 Principles of Epidemiolo			
BIOL 432* Principles of Epidemiology and Environmental Health, GE B2, D, UDIGE3 BIOL 433* Ecology and the Environment, GE B2, UDIGE	1 00		
Environmental Health, GE B2, D, UDIGE			
BIOL 433* Ecology and the Environment, GE B2, UDIGE			
GE BZ, UDIGE4 Courses with * are double-counted toward GE credits. Courses with * are double-counted toward GE credits. Courses with * are double-counted toward GE credits. No more than 2 units taken from the following can be counted towards the 2 units of electives: BIOL 492 Internship			
Courses with * are double-counted toward GE credits. No more than 2 units taken from the following can be counted towards the 9 units of electives: BIOL 492 Internship		· · · · · · · · · · · · · · · · · · ·	
No more than 2 units taken from the following can be counted towards the 9 units of electives: BIOL 492 Internship	4 GE B2, UDIGE4	4	
BIOL 492 Internship	be counted towards the <u>9</u> units of No more than <u>2</u> units taken from the following can be counted to	ng can be counted towards the <u>9</u> units of No	d towards the <u>9</u> units of
BIOL 494 Independent Research 1-3 BIOL 497 Directed Study 1-3			
BIOL 497 Directed Study			
Required Supporting and Other GE Courses 72 units 1. Chemistry minimum - 15 units CHEM 121* General Chemistry I, GE B1			
72 units 72 units 1. Chemistry minimum - 15 units 1. Chemistry minimum - 15 units CHEM 121* General Chemistry I, GE B1	1-3 DIOL 497 Directed Study1-3	1-3	
1. Chemistry minimum - 15 units 1. Chemistry minimum - 15 units CHEM 121* General Chemistry I, GE B1			
CHEM 121* General Chemistry I, GE B1 4 CHEM 122* General Chemistry II, GE B1 4 CHEM 311 Organic Chemistry I 3 CHEM 311 Organic Chemistry I 3 CHEM 312 Organic Chemistry I Laboratory 1 3 CHEM 312 Organic Chemistry I Laboratory 1 Select either:	72 units	72	
CHEM 122* General Chemistry II, GE B1			
CHEM 311 Organic Chemistry I			
CHEM 312 Organic Chemistry I Laboratory			
Select either: Select either:			
	1 CHEM 312 Organic Chemistry I Laboratory1	atory1	
		3	
or OF CHEM 314 Organic Chemistry II3 CHEM 314 Organic Chemistry II3		3	
	and		

CHEM 315 Organic Chemistry II Laboratory1	CHEM 315 Organic Chemistry II Laboratory1
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	A year-long organic chemistry sequence with laboratory taken at a community college may be accepted for the Biology major in lieu of CHEM 311, 312, 314, 315
2. Physics - 8 units Select one of the following combinations: PHYS 100* Introduction to Physics I, GE B1	2. Physics - 8 units Select one of the following combinations: PHYS 100* Introduction to Physics I, GE B1
3. Statistics and Mathematics - Zunits BIOL 203* Quantitative Methods for Biology, GE B3, B4	3. Statistics and Mathematics - Z units BIOL 203* Quantitative Methods for Biology, GE B3, B4
4. Other Required GE Courses in Categories A-E - 36 units Category A	4. Other Required GE Courses in Categories A-E - 36 units Category A
5. American Institutions Requirement - <u>6</u> units	5. American Institutions Requirement - <u>6</u> units
Emphasis in Clinical Laboratory Science	Emphasis in Clinical Laboratory Science
Additional Requirements in the Major 41-43 units 1. Required Biology Courses - 37 units BIOL 217 Medical Microbiology	Additional Requirements in the Major 41-43 units 1. Required Biology Courses - 37 units BIOL 217 Medical Microbiology
BIOL 420 Cellular and Molecular Immunology4	BIOL 420 Cellular and Molecular Immunology4

BIOL 421 Virology3	BIOL 421 Virology3
BIOL 426 Hematology4	BIOL 426 Hematology4
BIOL 432* Principles of Epidemiology and	BIOL 432* Principles of Epidemiology and
Environmental Health	Environmental Health
GE B2, D, UDIGE3	GE B2, D, UDIGE3
di bi, b, obidi	GE DE, D, OD GENNAMM MANAGEMENT
Courses with * are double-counted toward GE credits.	Courses with * are double-counted toward GE credits.
2. Other Required Courses in Biology - <u>4-6</u> units	2. Other Required Courses in Biology - <u>4-6</u> units
If one chooses to complete CHEM 318 and BIOL 203, one needs to complete a	If one chooses to complete CHEM 318 and BIOL 203, one needs to complete a
minimum of $\underline{6}$ units from the following courses. Otherwise, one needs to complete	minimum of <u>6</u> units from the following courses. Otherwise, one needs to complete
minimum of	minimum of
4 units from the following courses:	4 units from the following courses:
4 units from the following courses.	4 units from the joilowing courses.
BIOL 400 Molecular Biology4	BIOL 400 Molecular Biology4
	
BIOL 425 Human Genetics3	BIOL 425 Human Genetics3
Required Supporting and Other GE Courses	Required Supporting and Other GE Courses
69-71 units	69-71 units
1. Chemistry - <u>19-20</u> units	1. Chemistry - <u>19-20</u> units
CHEM 121* General Chemistry I, GE B14	CHEM 121* General Chemistry I, GE B14
CHEM 122* General Chemistry II, GE B14	CHEM 122* General Chemistry II, GE B14
	CHEM 250 Quantitative Analysis3
CHEM 251 Quantitative Analysis Laboratory1	CHEM 251 Quantitative Analysis Laboratory1
CHEM 311 Organic Chemistry I3	CHEM 311 Organic Chemistry I3
CHEM 312 Organic Chemistry I Laboratory1	CHEM 312 Organic Chemistry I Laboratory1
and	and
CHEM 318 Biological Chemistry3	CHEM 318 Biological Chemistry3
or	or
CHEM 460 Biochemistry I4	CHEM 460 Biochemistry I4
Note: CHEM 314 is a prerequisite for CHEM 460	Note: CHEM 314 is a prerequisite for CHEM 460
The second secon	
An Organic Chemistry course with laboratory taken at a community college may be	An Organic Chemistry course with laboratory taken at a community college may be
accepted for the Biology major in lieu of CHEM 311 and 312.	accepted for the Biology major in lieu of CHEM 311 and 312.
uccepted for the biology major in new of CHEM 311 and 312.	иссертей јог тне вногоду тајог т ней ој СПЕМ 311 или 312.
2 Physics Quaits	2 Physics Quaits
2. Physics - 8 units	2. Physics - 8 units
PHYS 100* Introduction to Physics I, GE B14	PHYS 100* Introduction to Physics I, GE B14
PHYS 101* Introduction to Physics II, GE B14	PHYS 101* Introduction to Physics II, GE B14
3. Statistics and Mathematics - <u>3-4</u> units	3. Statistics and Mathematics - <u>3-4</u> units

Select <u>one</u> of the following combinations:	Select <u>one</u> of the following combinations:				
BIOL 203* Quantitative Methods for Biology,	BIOL 203* Quantitative Methods for Biology,				
GE B3, B43	GE B3, B43				
MATH 150* Calculus I, GE B34	MATH 150* Calculus I, GE B34				
1 11111 100 Galdatao 1, G2 20 millionininininininininininininininininin	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				
4. Other Required GE Courses in Categories A-E - <u>33</u> units	4. Other Required GE Courses in Categories A-E - <u>33</u> units				
Category A9	Category A9				
(For A3, recommend MATH 230 Logic	(For A3, recommend MATH 230 Logic				
and Mathematical Reasoning)	and Mathematical Reasoning)				
Category C	Category C				
Category D9	Category D9				
Category E3	Category E3				
5. American Institutions Requirement - <u>6</u> units	5. American Institutions Requirement - <u>6</u> units				
Emphasis in Ecology, Evolution	Emphasis in Ecology, Evolution				
and Organismal Biology	and Organismal Biology				
and Organisma biology	and Organisma Diology				
Upper Division Requirements in the Major 42-44 units 1. Required Core Courses - 26 units BIOL 301 Microbiology	Upper Division Requirements in the Major 42-44 units 1. Required Core Courses - 26 units BIOL 301 Microbiology				
Select <u>one</u> of the following courses: BIOL 310 Vertebrate Biology4 BIOL 316 Invertebrate Zoology4	Select <u>one</u> of the following courses: BIOL 310 Vertebrate Biology4 BIOL 316 Invertebrate Zoology4				
2. Ecology/Evolution - <u>6-7</u> units	2. Ecology/Evolution - <u>6-7</u> units				
Select <u>two</u> courses from the following list:	Select <u>two</u> courses from the following list:				
BIOL 313 Conservation Biology (ESRM)4	BIOL 313 Conservation Biology (ESRM)4				
ESRM 352 Theory and Practice of Ecological	ESRM 352 Theory and Practice of Ecological				

 $6.2.10 \text{ km}^2$

		Restoration3			Restoration	3	
BIOL	406	Evolutionary Biogeography3	BIOL	406	Evolutionary Biogeography	3	
BIOL	407	Behavioral Ecology3	BIOL	407	Behavioral Ecology		
		o.			3.		
3. Organis	mal Bio	ogy - <u>4</u> units	3. Organismal Biology - <u>4</u> units				
		om the following list:			rom the following list:		
BIOL	310	Vertebrate Biology4	BIOL	310	Vertebrate Biology	4	
		(if not taken as part of core)			(if not taken as part of core)	_	
BIOL	312	Marine Biology4	BIOL	312	Marine Biology	4	
BIOL	316	Invertebrate Zoology4	BIOL	316	Invertebrate Zoology	4	
ыоц	310	(if not taken as part of core)	DIOL	310	(if not taken as part of core)		
BIOL	317	Parasitology4	BIOL	317	Parasitology	1.	
BIOL	450	Ichthyology: The Biology of Fishes4	BIOL	450	Ichthyology: The Biology of Fishes		
BIOL	451	Ornithology4	BIOL	451	Ornithology		
DIOL	431	Offilulology4	BIOL	452	Entomology		
			DIOL	452	Entomology	I	
1 Dhysiolo	au /Dave	Johnsontal / Molagular Piology 2 Aunita	1 Dhygiela	au/Dau	olonmental/Mologular Piology 2 4 units		
		lopmental/Molecular Biology - <u>3-4</u> units			elopmental/Molecular Biology - <u>3-4</u> units		
		rom the following list:			rom the following list:	4	
BIOL	300	Cell Biology4	BIOL	300	Cell Biology		
BIOL	304	Comparative Animal Physiology3	BIOL	304	Comparative Animal Physiology		
BIOL	400	Molecular Biology4	BIOL	400	Molecular Biology		
BIOL	422	Molecular Plant Physiology4	BIOL	422	Molecular Plant Physiology		
BIOL	427	Developmental Biology4	BIOL	427	Developmental Biology	4	
	_						
		ry - <u>3-4</u> units	5. Cross-Disciplinary - <u>3-4</u> units				
		om the following list:			rom the following list:		
CHEM	301	Environmental Chemistry-Atmosphere	CHEM	301	Environmental Chemistry-Atmosphere		
		and Climate3			and Climate	3	
GEOL	321	Environmental Geology, GE B14	GEOL	321	Environmental Geology, GE B1	4	
ESRM	328	Introduction to Geographic	ESRM	328	Introduction to Geographic		
		Information Systems3			Information Systems	3	
Doguinad C	unnontis		Doguinad C	`unnonti			
-	upportii	ng and Other GE Courses	Required Supporting and Other GE Courses				
63 units	1.0		63 units				
1. Required Supporting Courses - <u>21</u> units			1. Required Supporting Courses - <u>21</u> units				
CHEM 121* General Chemistry I, GE B14			121*	General Chemistry I, GE B1			
CHEM	122*	General Chemistry II, GE B14	CHEM	122*	General Chemistry II, GE B1		
CHEM	311	Organic Chemistry I3	CHEM	311	Organic Chemistry I		
GEOL	122*	Historical Geology, GE B13	GEOL	122*	Historical Geology, GE B1	3	
BIOL	203*	Quantitative Methods for Biology,	BIOL	203*	Quantitative Methods for Biology,		
		GE B3, B43			GE B3, B4	3	
MATH	150*	Calculus I, GE B34	MATH	150*	Calculus I, GE B34	4	

An Organic Chemistry I taken at a community college may be accepted for the Biology major in lieu of CHEM 311	An Organic Chemistry I 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	2. Other Required GE Courses in Categories A-E - 36 units Category A			
3. American Institutions Requirement - <u>6</u> units	3. American Institutions Requirement - <u>6</u> units			
Electives in Any Discipline - 4-7 units One must choose enough elective units to reach the required <u>120</u> units for the degree	Electives in Any Discipline - 4-7 units One must choose enough elective units to reach the required <u>120</u> units for the degree			
Courses with * are double-counted toward GE credits.	Courses with * are double-counted toward GE credits.			
Emphasis in Medical Imaging	Emphasis in Medical Imaging			
Additional Lower Division Requirements in the Major - 8 units BIOL 210 Human Anatomy and Physiology I4 BIOL 211 Human Anatomy and Physiology II4	Additional Lower Division Requirements in the Major - 8 units BIOL 210 Human Anatomy and Physiology I4 BIOL 211 Human Anatomy and Physiology II4			
Upper Division Requirements in the Major - 38 units 1. Required Biology and Physics Courses - 30 units BIOL 300 Cell Biology	Upper Division Requirements in the Major - 38 units 1. Required Biology and Physics Courses - 30 units BIOL 300 Cell Biology			
BIOL 464 Medical Instrumentation (PHYS)4 BIOL 499 Senior Capstone in Biology3	BIOL 464 Medical Instrumentation (PHYS)4 BIOL 499 Senior Capstone in Biology3			
2. Electives in Biology and Physics - <u>8</u> units Select from the following list of courses: BIOL 315 Introduction to Biophysics (PHYS)4	2. Electives in Biology and Physics - <u>8</u> units Select from the following list of courses: BIOL 315 Introduction to Biophysics (PHYS)4			

BIOL	401	Biotechnology and Recombinant	BIOL	401	Biotechnology and Recombinant	
		DNA Techniques5			DNA Techniques5	
BIOL	420	Cellular & Molecular Immunology4	BIOL	420	Cellular & Molecular Immunology4	
BIOL	421	Virology3	BIOL	421	Virology3	
BIOL	423	Cellular and Molecular Neurobiology3	BIOL	423	Cellular and Molecular Neurobiology3	
BIOL	424	Human Physiology3	BIOL	424	Human Physiology3	
BIOL	425	Human Genetics3	BIOL	425	Human Genetics3	
BIOL	427	Developmental Biology4	BIOL	427	Developmental Biology4	
BIOL	428	Biology of Cancer3	BIOL	428	Biology of Cancer3	
BIOL	431*	Bioinformatics, GE B2, B4, UDIGE4	BIOL	431*	Bioinformatics, GE B2, B4, UDIGE4	
BIOL	432*	Principles of Epidemiology and	BIOL	432*	Principles of Epidemiology and	
		Environmental Health, GE B2, D, UDIGE3			Environmental Health, GE B2, D, UDIGE3	
BIOL	433*	Ecology and the Environment,	BIOL	433*	Ecology and the Environment,	
		GE B2, UDIGE4			GE B2, UDIGE4	
PHYS	445*	Image Analysis and Pattern Recognition,	PHYS	445*	Image Analysis and Pattern Recognition,	
		COMP/MATH GE B1, B4, UDIGE3			COMP/MATH GE B1, B4, UDIGE3	
		nits taken from the following can be			nits taken from the following can be	
counted to	owards t	the <u>8</u> units of electives:	counted to	counted towards the <u>8</u> units of electives:		
PHYS	492	Physics Internship3	PHYS	492	Physics Internship3	
		(Recommended for students pursuing a			(Recommended for students pursuing a	
		career in medical imaging).			career in medical imaging).	
BIOL	494	Independent Research1-3	BIOL	494	Independent Research1-3	
or			or			
PHYS	494	Independent Research1-3	PHYS	494	Independent Research1-3	
BIOL	497	Directed Study1-3	BIOL	497	Directed Study1-3	
or			or			
PHYS	497	Directed Study1-3	PHYS	497	Directed Study1-3	
Required 9	Sunnorti	ng and Other GE Courses	Required 9	Sunnorti	ing and Other GE Courses	
66 units	Jupporti	ng and other directionses	66 units	Jupporti	ing and other de courses	
1. Chemist	m. 15 1	mite	1. Chemist	m - 15 i	mite	
CHEM		General Chemistry I, GE B14	CHEM		General Chemistry I, GE B14	
CHEM		General Chemistry II, GE B14	CHEM		General Chemistry II, GE B14	
CHEM	311	Organic Chemistry I3	CHEM	311	Organic Chemistry I3	
СНЕМ	312		CHEM	312		
		Organic Chemistry I Laboratory1			Organic Chemistry I Laboratory1	
CHEM	318	Biological Chemistry3	CHEM	318	Biological Chemistry3	
An Ongan	ia Chami	istm. I sayinglent source with laboratory taken at a sommunity	An Ongani	ia Chama	istm. I agriculant accuracy with laboratom taken at a community	
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.					istry I-equivalent course with laboratory taken at a community	
conege mo	xy be acc	зерсеа јог спе Бююду тајог тиней ој СпЕМ 311 или 312.	conege mo	ay be act	cepted for the Biology major in lieu of CHEM 311 and 312.	

2. Mathematics - <u>4</u> units	2. Mathematics - <u>4</u> units			
MATH 150* Calculus I, GE B34	MATH 150* Calculus I, GE B34			
, and the second				
3. <i>Physics</i> - <u>8</u> <i>units</i>	3. Physics - <u>8</u> units			
Select <u>one</u> of the following combinations:	Select <u>one</u> of the following combinations:			
PHYS 100* Introduction to Physics I, GE B14	PHYS 100* Introduction to Physics I, GE B14			
PHYS 101* Introduction to Physics II, GE B14	PHYS 101* Introduction to Physics II, GE B14			
or	or			
PHYS 200* General Physics I, GE B14	PHYS 200* General Physics I, GE B14			
PHYS 201* General Physics II, GE B14	PHYS 201* General Physics II, GE B14			
in the state of th	, and the second			
4. Other Required GE Courses in Categories A-D - <u>33</u> units	4. Other Required GE Courses in Categories A-D - <u>33</u> units			
Category A9	Category A9			
(For A3, recommend MATH 230 Logic	(For A3, recommend MATH 230 Logic			
and Mathematical Reasoning)	and Mathematical Reasoning)			
Category C	Category C			
Category D	Category D			
Category E covered by a required GE course	Category E covered by a required GE course			
for the degree program	for the degree program			
for the degree program	tor the degree program			
5. American Institutions Requirement - <u>6</u> units	5. American Institutions Requirement - <u>6</u> units			
3. American institutions negativenent - <u>a</u> antis	3.American institutions requirement - <u>u</u> units			
Bachelor of Arts Degree in	Bachelor of Arts Degree in			
3	9			
Biology - (120 units)	Biology - (120 units)			
Common Lower Division Requirements for All Emphases of the Bachelor of Arts	Common Lower Division Requirements for All Emphases of the Bachelor of Arts			
Degree in Biology - <u>8</u> units	Degree in Biology - <u>8</u> units			
BIOL 200* Principles of Organismal and Population	BIOL 200* Principles of Organismal and Population			
Biology, GE B24	Biology, GE B24			
BIOL 201* Principles of Cell & Molecular	BIOL 201* Principles of Cell & Molecular			
Biology, GE B24	Biology, GE B24			
	Upper Division Requirements in the Major - 37 units			
	1. Required Biology Courses - 25 units			
	BIOL 300 Cell Biology4			
	BIOL 302 Genetics			
	BIOL 302 Genetics			

BIOL 304 Comparative Animal Physiology
2. Electives in Biology - <u>12</u> units Select a minimum of <u>12</u> 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 <u>12</u> units of electives).
No more than 2 units taken from the following can be counted towards the 12 units of electives: BIOL 492 Internship
Required Supporting and Other GE Courses 53-54 units 1. Chemistry - 8 units CHEM 121* General Chemistry I, GE B1
2. Mathematics and Statistics - <u>3-4</u> units Select one of the following: BIOL 203* Quantitative Methods for Biology, GE B3, B43
MATH 105* Pre-Calculus, GE B3
(For A3, recommend MATH 230 Logic and Mathematical Reasoning) Category C
4. American Institutions Requirements - <u>6</u> units Electives in Any Discipline - 21-22 units

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

RIOL	301	Micropiology	4
BIOL	302	Genetics	4
BIOL	303	Evolutionary Biology	3
BIOL	311	Plant Biology and Ecology	4
BIOL	433*	Ecology and the Environment, GE B2,	
		UDIGE	4
BIOL	499	Senior Capstone in Biology	3

Select <u>one</u> of the following courses:

BIOL	310	Vertebrate Biology4
BIOL	316	Invertebrate Zoology4

2. Ecology/Evolution - 3-4 units

Select one course from the following list:

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

3. Organismal Biology - <u>4</u> units
Select one course from the following list-

select <u>one</u> course from the following list:				
BIOL	310	Vertebrate Biology4		
		(if not taken as part of core)		
BIOL	312	Marine Biology4		
BIOL	316	Invertebrate Zoology4		
		(if not taken as part of core)		
BIOL	317	Parasitology4		
BIOL	450	Ichthyology: The Biology of Fishes4		
BIOL	451	Ornithology4		
Courses with * are double counted toward CE gradita				

Courses with * are double-counted toward GE credits.

4. Physiology/Developmental/Molecular Biology - <u>3-4</u> units

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

Emphasis in Ecology, Evolution and Organismal Biology

Upper Division Requirements in the Major - 36-38 units

opper b	1 1 101011	requirements in the Major 80 00 at
1. Require	d Biolog	y Core Courses - <u>26</u> units
BIOL	301	Microbiology4
BIOL	302	Genetics4
BIOL	303	Evolutionary Biology3
BIOL	311	Plant Biology and Ecology4
BIOL	433*	Ecology and the Environment, GE B2,
		UDIGE4
BIOL	499	Senior Capstone in Biology3
Select one	of the fo	ollowing courses:
BIOL	310	Vertebrate Biology4
BIOL	316	
		ion - <u>3-4</u> units
		from the following list:
BIOL	313	
BIOL	406	Evolutionary Biogeography3
BIOL	407	Behavioral Ecology3
3 Organis	mal Rio	logy - <u>4</u> units
_		from the following list:
BIOL	310	
ыод	010	(if not taken as part of core)
BIOL	312	
BIOL	316	Invertebrate Zoology4
2102	010	(if not taken as part of core)
BIOL	317	Parasitology4
BIOL	450	Ichthyology: The Biology of Fishes4
BIOL	451	Ornithology4
BIOL	452	Entomology4
Courses w	oith * are	double-counted toward GF credits

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

4. Physiology/Developmental/Molecular Biology - <u>3-4</u> units

Select <u>one</u> course from the following list:	Select <u>one</u> course from the following list:
BIOL 300 Cell Biology4	BIOL 300 Cell Biology4
BIOL 304 Comparative Animal Physiology3	BIOL 304 Comparative Animal Physiology3
BIOL 400 Molecular Biology4	BIOL 400 Molecular Biology4
BIOL 422 Molecular Plant Physiology4	BIOL 422 Molecular Plant Physiology4
BIOL 427 Developmental Biology4	BIOL 427 Developmental Biology4
Required Supporting and Other GE Courses 56 units	Required Supporting and Other GE Courses 56 units
1. Required Supporting Courses - <u>14</u> units	1. Required Supporting Courses - <u>14</u> units
CHEM 121* General Chemistry I, GE B14	CHEM 121* General Chemistry I, GE B14
CHEM 122* General Chemistry II, GE B14	CHEM 122* General Chemistry II, GE B14
GEOL 122* Historical Geology, GE B1 3	GEOL 122* Historical Geology, GE B1 3
BIOL 203* Quantitative Methods for Biology,	BIOL 203* Quantitative Methods for Biology,
GE B3, B43	GE B3, B43
2. Other Required GE Courses in Categories A-E - <u>36</u> units Category A9 (For A3, recommend MATH 230 Logic and Mathematical Reasoning)	2. Other Required GE Courses in Categories A-E - 36 units Category A9 (For A3, recommend MATH 230 Logic and Mathematical Reasoning)
Category C 12	Category C 12
Category D 12	Category D
Category E 3	Category E3
dategory I	decgory Diminion management
3. American Institutions Requirement - <u>6</u> units	3. American Institutions Requirement - <u>6</u> units
Electives in Any Discipline - 18-20 units One must choose enough elective units to reach the required 120 units for the degree.	Electives in Any Discipline - 18-20 units One must choose enough elective units to reach the required 120 units for the degree.
Emphasis in General Biology	
Upper Division Requirements in the Major - 37 units 1. Required Biology Courses - 25 units BIOL 300 Cell Biology	
Diol 199 definor dupotorie in Diology	

2. Electives in Biology - <u>12</u> units	
Select a minimum of 12 units of biology courses from 300 and 400 levels. one of whic	
Select a minimum of 12 units of biology courses from 300 and 400 levels, one of whice must be a lab course. (Biology courses numbered from 326 to 345 are counted	
toward GE credits only and they are not counted towards the 12 units of electives).	
No more than 2 units taken from the following can be counted towards the 12 units of electives:	
counted towards the <u>12</u> units of electives:	
BIOL 492 Internship2-3 BIOL 494 Independent Research1-3	
BIOL 494 Independent Research	
Required Supporting and Other GE Courses	
53-54 units	
1. Chemistry - <u>8</u> units	
CHEM 121* General Chemistry I, GE B14	
CHEM 122* General Chemistry II, GE B14	
2. Mathematics and Statistics - 3-4 units	
2. Mathematics and Statistics - <u>5-4</u> ames Select <u>one</u> of the following:	
BIOL 203* Quantitative Methods for Biology,	
GE B3. B4.	
MATH 105* Pre-Calculus GE B3 4	
MATH 150* Calculus I, GE B34	
3. Other Required GE Courses in Categories A-E - <u>36</u> units	
— Category A9	
—— (For Λ3, recommend MATH 230 Logic	
and Mathematical Reasoning)	
— Category C	
Category D 12	
— Category E 3	
4. American Institutions Requirements - 6 units	
Electives in Any Dissipline 21, 22 units	
Electives in Any Discipline - 21-22 units	
One must choose enough elective units to reach the required <u>120</u> units for the degree	
Fmnhasis in	
•	
<u>Pre-Professional Studies</u>	
Category E 3	

6.2.10 km2

	T
Upper Division Requirements in the Major - 32 units 1. Required Biology Courses - 21-22 units BIOL 300 Cell Biology4	Upper Division Requirements in the Major - 32 units 1. Required Biology Courses - 21-22 units BIOL 300 Cell Biology
BIOL 302 Genetics4	BIOL 302 Genetics4
BIOL 304 Comparative Animal Physiology3 BIOL 400 Molecular Biology4	BIOL 304 Comparative Animal Physiology3 BIOL 400 Molecular Biology4
BIOL 400 Molecular Biology4 BIOL 499 Senior Capstone in Biology3	BIOL 400 Molecular Biology4 BIOL 499 Senior Capstone in Biology3
Select <u>one</u> of the following:	Select <u>one</u> of the following:
BIOL 303 Evolutionary Biology3	BIOL 303 Evolutionary Biology3
BIOL 433* Ecology and the Environment, GE B2, UDIGE4	BIOL 433* Ecology and the Environment, GE B2, UDIGE4
2. Electives in Biology - <u>10-11</u> units Select a minimum of <u>10-11</u> units of Biology courses from 300 and 400 levels, one of	2. Electives in Biology - <u>10-11</u> units Select a minimum of <u>10-11</u> 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	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 <u>10-11</u> units of electives	toward GE credits only and they are not counted towards the <u>10-11</u> units of electives
No more than <u>2</u> units taken from the following can be counted towards the <u>10-11</u>	No more than <u>2</u> units taken from the following can be counted towards the <u>10-11</u>
units of electives: BIOL 492 Internship2-3	units of electives: BIOL 492 Internship2-3
BIOL 494 Independent Research1-3	BIOL 494 Independent Research1-3
BIOL 497 Directed Study1-3	BIOL 497 Directed Study1-3
Required Supporting and Other GE Courses	Required Supporting and Other GE Courses
69-70 units 1. <i>Chemistry</i> - <u>16</u> units	69-70 units 1. <i>Chemistry</i> - <u>16</u> units
CHEM 121* General Chemistry I, GE B14	CHEM 121* General Chemistry I, GE B14
CHEM 122* General Chemistry II, GE B14	CHEM 122* General Chemistry II, GE B14
CHEM 311 Organic Chemistry I3 CHEM 312 Organic Chemistry I Laboratory1	CHEM 311 Organic Chemistry I3 CHEM 312 Organic Chemistry I Laboratory1
CHEM 314 Organic Chemistry II3	CHEM 314 Organic Chemistry II3
CHEM 315 Organic Chemistry II Laboratory1	CHEM 315 Organic Chemistry II Laboratory1
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	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 - <u>3-4</u> units	2. Mathematics and Statistics - <u>3-4</u> units
Select <u>one</u> of the following:	Select <u>one</u> of the following:
BIOL 203* Quantitative Methods for Biology, GE B3, B43	BIOL 203* Quantitative Methods for Biology, GE B3, B43
UE D3, D43	UL DJ, D4

MATH 150* Calculus I, GE B34	MATH 150* Calculus I, GE B34
MATH 150° Calculus I, GE D54	MATH 130' Calculus I, GE D34
Check with professional schools or pre-professional advisor for specific requirements	Check with professional schools or pre-professional advisor for specific requirements
in this category.	in this category.
3. <i>Physics</i> - <u>8</u> units	3. <i>Physics</i> - <u>8</u> units
PHYS 100* Introduction to Physics I, GE B14	PHYS 100* Introduction to Physics I, GE B14
PHYS 101* Introduction to Physics II, GE B14	PHYS 101* Introduction to Physics II, GE B14
4. Other Required GE Courses in Categories A-E - <u>36</u> units	4. Other Required GE Courses in Categories A-E - <u>36</u> units
Category A9	Category A9
(For A3, recommend MATH 230 Logic	(For A3, recommend MATH 230 Logic
and Mathematical Reasoning)	and Mathematical Reasoning)
Category C	Category C
Category D 12 Category E 3	Category D
Category E 3	Category E3
5. American Institutions Requirements - $\underline{6}$ units	5. American Institutions Requirements - <u>6</u> units
Electives in Any Discipline - 10-11 units	Electives in Any Discipline - 10-11 units
One must choose enough elective units to reach the required <u>120</u> units for the degree.	One must choose enough elective units to reach the required <u>120</u> units for the degree.
one must choose enough elective units to reach the required <u>120</u> units for the degree.	one must choose enough elective units to reach the required <u>120</u> units for the degree.
Emphasis in Subject Matter	Emphasis in Subject Matter
Preparation in Teaching Biology	· · · · · · · · · · · · · · · · · · ·
• • • • • • • • • • • • • • • • • • • •	<u>Preparation in Teaching Biology</u>
(Pending CCTC Approval)	
Harry Division Description and the Main 200 miles	Howard Distriction Descriptions and the Maine 20 mails
Upper Division Requirements in the Major - 36 units	Upper Division Requirements in the Major - 36 units
1. Required Biology Courses - <u>24</u> units	1. Required Biology Courses - <u>24</u> units
BIOL 300 Cell Biology4	BIOL 300 Cell Biology4
BIOL 302 Genetics	BIOL 302 Genetics4 BIOL 303 Evolutionary Biology3
BIOL 303 Evolutionary Biology3 BIOL 304 Comparative Animal Physiology3	BIOL 303 Evolutionary Biology3 BIOL 304 Comparative Animal Physiology3
BIOL 335* The Biosphere, GE B2, UDIGE31	BIOL 335* The Biosphere, GE B2, UDIGE31
BIOL 433* Ecology and the Environment,	BIOL 433* Ecology and the Environment,
GE B2, UDIGE41	GE B2, UDIGE4 ¹
BIOL 499 Senior Capstone in Biology3	BIOL 499 Senior Capstone in Biology3
2. Electives in Biology - <u>12</u> units	2. Electives in Biology - <u>12</u> units
Select a minimum of 12 units of biology courses from 300 and 400 levels, one of which	Select a minimum of 12 units of biology courses from 300 and 400 levels, one of which
must be a lab course. (Biology courses numbered from 326 to 345, with the exception	must be a lab course. (Biology courses numbered from 326 to 345, with the exception

		is emphasis are counted toward GE credits only and they are not he <u>12</u> units of electives).	of BIOL 335 for this encounted towards the	mphasis are counted toward GE credits only and they are not <u>12</u> units of electives).		
No more to of electives BIOL BIOL BIOL		Internship2-3 Independent Research1-3 Directed Study1-3	of electives: BIOL 492 Inc BIOL 494 Inc	taken from the following can be counted towards the 12 units atternship		
76 units 1. Require	d Educa	ng and Other GE Courses tion Course - <u>3</u> units Introduction to Secondary Schooling, GE-D, UDIGE3				
complete t	he rema	33, and EDUC 330 meet only 6 of the <u>9</u> units of UDIGE; students must ining <u>3</u> units outside of courses with BIOL prefix, and excluding d with BIOL.		and EDUC 330 meet only 6 of the <u>9</u> units of UDIGE; students must ng <u>3</u> units outside of courses with BIOL prefix, and excluding with BIOL.		
Courses w	ourses with * are double-counted toward GE credits.		Courses with * are double-counted toward GE credits.			
2. Mathem Select eith		d Statistics - <u>7</u> units	2. Mathematics and St Select either:	tatistics - <u>Z</u> units		
BIOL	203*	Quantitative Methods for Biology, GE B3, B43	BIOL 203* Qu GE	uantitative Methods for Biology, E B3, B43		
and MATH or	105*	Pre-Calculus, GE B34	or	re-Calculus, GE B34		
MATH	150*	Calculus I, GE B34	MATH 150* Ca	alculus I, GE B34		
3. Physical	Science	s - <u>24</u> units	3. Physical Sciences - 2	<u>24</u> units		
ASTR	105*	Introduction to the Solar System, (PHYS) GE B14	(P	ntroduction to the Solar System, PHYS) GE B14		
CHEM		General Chemistry I, GE B14		eneral Chemistry I, GE B14		
CHEM	122*	General Chemistry II, GE B14		eneral Chemistry II, GE B14		
GEOL PHYS	121* 100*	Physical Geology, GE B14		hysical Geology, GE B14		
PHYS	100*	Introduction to Physics I, GE B14 Introduction to Physics II, GE B14		ntroduction to Physics I, GE B14 htroduction to Physics II, GE B14		
	-	GE Courses in Categories A-E - <u>36</u> units 9	-	Courses in Categories A-E - <u>36</u> units 9		

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

5. *American Institutions Requirements - 6 units*

The Master of Science Degree in Biotechnology & Bioinformatics (34-35 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, bioinformatics, biomedical engineering and stem cell technology with course work and experience in business management and regulatory affairs. The program includes a set of core courses with three emphases to choose from: biotechnology, biomedical engineering and stem cell technology and laboratory management, 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 this century, the major driving force for biotechnology will be the strategic use of the data derived from largescale genome sequencing projects. Biomedical engineering is an interdisciplinary field, fusing molecular and cellular life sciences with contents in engineering analysis, design, and synthesis approaches, business management, bioethics, law and regulation, and globalization of biotechnology. It introduces the principles and applications of bioinformatics, biomechanics, biorobotics, biomaterials, nanotechnology, genetics, cellular, tissue and organ engineering, biomedical instrumentation and devices, biosensors, and medical imaging in biological systems. Stem cell technology and laboratory management introduces the current knowledge and highly specialized technical skills in the stem cell field and trains technical and managerial personnel in stem cell research and development. Our approach also includes team projects drawn from biotechnology industries to focus on real-world problems and applications of biological sciences, internships and to inculcate interpersonal as well as problemsolving skills using multiple perspectives.

5. American Institutions Requirements - <u>6</u> units

The Master of Science Degree in Biotechnology & Bioinformatics (34-35 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, bioinformatics, biomedical engineering and stem cell technology with course work and experience in business management and regulatory affairs. The program includes a set of core courses with three emphases to choose from: biotechnology, biomedical engineering and stem cell technology and laboratory management, 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, bioinformatics, biomedical engineering or stem cell technology. They will be ready to make immediate contributions to scientific research and development, management in biotechnological, biomedical, biomedical engineering, 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.

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.
- Applicants seeking admission to the professional MS in Biotechnology and Bioinformatics program must be officially accepted into the CI academic program.
- 3. Applicants must declare themselves as graduate students in the professional MS degree program in Biotechnology and Bioinformatics.
- 4. Applicants for the Stem Cell Technology and Laboratory Management Emphasis must commit to the stem cell technology internship requirement.
- 5. 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, including all academic work, GPA, test scores, relevant work experience and other factors that may have a bearing on the individual's potential for success. The following materials are required for our evaluation and admission process:
 - Applicants must submit their transcript(s) from their undergraduate institution(s), 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 academic capacity.

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Courses with * are double-counted toward GE credits.

Courses w	ith * are	e double-counted toward GE credits.			
			Degree l	Require	ements
Degree F	Require	ements	Common	Core Cou	urses - 12 units
Common (ore Cou	rses - 12 units	BINF	500	DNA & Protein Sequence Analysis3
BINF	500	DNA & Protein Sequence Analysis	BIOL	503	Biotechnology Law and Regulation3
BIOL	503	Biotechnology Law and Regulation3	BIOL	504	Molecular Cell Biology3
BIOL	504	Molecular Cell Biology3	MGT	471	Project Management3
MGT	471	Project Management3			
		· -	Biotechi	nology	Emphasis - 22 units
Biotechn	ology	Emphasis - 22 units			res - <u>15</u> units
		es - <u>15</u> units	BINF	514	Statistical Methods in Computational
BINF	514	Statistical Methods in Computational			Biology3
		Biology3	BIOL	502	Techniques in Genomics & Proteomics3
BIOL	502	Techniques in Genomics & Proteomics3	BIOL	505	Molecular Structure4
BIOL	505	Molecular Structure4	BIOL	600	Team Project4
BIOL	600	Team Project4	BIOL	601	Seminar in Biotechnology
BIOL	601	Seminar in Biotechnology			and Bioinformatics1
		and Bioinformatics1			
			2. Elective		
2. Electives - Z Units				courses chosen from the following elective courses and/or from the	
		courses chosen from the following elective courses and/or from the			for the other emphases of the program:
-		or the other emphases of the program:	BINF	511	Computational Genomics3
BINF	511	Computational Genomics3	BIOL	490	Special Topics1-3
BIOL	490	Special Topics1-3	DIOI		ust be equivalent to a graduate level course)
BIOL	500	Introduction to Biopharmaceutical	BIOL	500	Introduction to Biopharmaceutical
DIOI	F 0.6	Production Operations3	DIOI	F0.6	Production Operations3
BIOL BIOL	506 507	Molecular Evolution4	BIOL BIOL	506 507	Molecular Evolution4
DIOL	507	Pharmacogenomics and	BIUL	507	Pharmacogenomics and
BIOL	508	Pharmacoproteomics	BIOL	508	Pharmacoproteomics
BIOL	509	Advanced Immunology4 Plant Biotechnology4	BIOL	509	Advanced Immunology4 Plant Biotechnology4
BIOL	516	Clinical Trials and Quality Assurance3	BIOL	516	Clinical Trials and Quality Assurance3
BIOL	605	Biotechnology Across National	BIOL	605	Biotechnology Across National
ыоц	003	Boundaries Field Trip1	DIOL	003	Boundaries Field Trip1
MGT	421	Human Resource Management3	MGT	421	Human Resource Management3
Mai	121	Tuman Resource Planagement	Mai	121	Tullali resource Management
			<u>Biomedi</u>	<u>ical Eng</u>	gineering Emphasis
<u>Biomedi</u>	<u>cal Eng</u>	<u>rineering Emphasis</u>	23 units	,	

23 units 1. Required Courses - 15 units BME 500 Biological Systems and Biomechanics: Principles and Applications	
BME 500 Biological Systems and Biomechanics: Principles and Applications	
BME 500 Biological Systems and Biomechanics: Principles and Applications	
Principles and Applications	
BME 501 Fundamentals of Tissue Engineering and Biomaterials	
Biomaterials	
and Bioinformatics	
and bioinformatics	
BIOL 604 Biotechnology across National	
Roundaries 2	
Select either BME 502 or PHYS 464 - <u>3-4</u> units	
Select either BME 502 or PHYS 464 - 3-4 units BME 502 Biomedical Instrumentation and Devices:	
BME 502 Biomedical Instrumentation and Devices: Technology and Applications	
Technology and Applications	
or PHYS 464 Medical Instrumentation4	
PHYS 464 Medical Instrumentation4	
Select either BIOL 600 or 603 - <u>3-4</u> units	
Select either BIOL 600 or 603 - <u>3-4</u> units BIOL 600 Team Project4	
BIOL 600 Team Project 4 Or	
or BIOL 603 Biotechnology Internship3	
BIOL 603 Biotechnology Internship3	
2. Electives - <u>6-8</u> units	
2. Electives - 6-8 units The number of elective units will be dependent on required courses taken to total	! <u>23</u>
The number of elective units will be dependent on required courses taken to total 23 units in the emphasis.	
units in the emphasis	22
Stem Cell Technology and Laboratory Management Emphasis - 22-2	<u> 23</u>
Stem Cell Technology and Laboratory Management Emphasis - 22-23 units	
units 1. Required Courses - 19 units	
1. Required Courses - 19 units BIOL 502 Techniques in Genomics and Proteomics 3	
BIOL 502 Techniques in Genomics and Proteomics 3 BIOL 510 Tissue Culture Techniques and	
BIOL 510 Tissue Culture Techniques and Stem Cell Technology	
DIOL 510 Hisbac culture recliniques and	
Stem Cell Technology	
DIOL 311 Advanced stem cen recimology	
DIOL 512 Advanced ropics in	
Regenerative Medicine	
biol 515 Celi Culture Pacinty Management	
BIOL 602 Stelli Cell Technology	of <u>6</u>
Internsing (<u>1.0</u> tilles A.4)	- , =
biob ove course is offered quarterly at <u>1.50</u> units, which is repeatable for a court of <u>0</u>	
units for a year long project. 2. Electives <u>3-4</u> units	

2. Electives 3-4 units

A minimum of <u>one</u> course chosen from the elective courses for the Biotechnology Emphasis and/or from the required courses for the other emphases of the program.

Graduate Writing

Assessment Requirement

Writing proficiency prior to the awarding of the degree is demonstrated by successful completion of BIOL 504 with a grade of B or higher.

The Master of Science Degree in Biotechnology & Masters of Business Administration (72 units)* (Dual Degree)

*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 BA/BS. 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

A minimum of <u>one</u> course chosen from the elective courses for the Biotechnology Emphasis and/or from the required courses for the other emphases of the program.

Graduate Writing

Assessment Requirement

Writing proficiency prior to the awarding of the degree is demonstrated by successful completion of BIOL 504 with a grade of B or higher.

The Master of Science Degree in Biotechnology & Masters of Business Administration (72 units)* (Dual Degree)

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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.

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Admission Requirements

- Applicants must have a BA/BS. 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 CI as graduate students.

accepted into CI 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, including all academic work, GPA, test scores, relevant work experience and other factors that may have a bearing on the individual's potential for success. The following materials are required for our evaluation and admission process:
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 - 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.

Degree Requirements

Core Courses

Required Foundation Courses - 16 units

1. Required Foundation Courses in Biology and Chemistry for Students without a B.S. in Biology or Chemistry <u>16</u> units

4	Chemistry of Life	110	CHEM
	Principles of Cell and Biology	201	BIOL
	Cell Biology	300	BIOL
	Molecular Biology	400	BIOL

2. Required Foundation Courses in Business/Economics for_Students without a B.A./B.S. in Business or Economics or ________a Related Discipline -

<u>16</u> units		
BUS	500	Economics for Managers3
BUS	502	Quantitative Methods for
		Decision-Making3
BUS	504	Introduction to Accounting and Finance4
BUS	506	Principles of Management
		and Marketing3
BUS	508	Business Ethics and Law3

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, including all academic work, GPA, test scores, relevant work experience and other factors that may have a bearing on the individual's potential for success. The following materials are required for our evaluation and admission process:
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Degree Requirements

Required Foundation Courses - 16 units

 Required Foundation Courses in Biology and Chemistry for Students without a B.S. in Biology or Chemistry <u>16</u> units

,		05	
CHEM	110	Chemistry of Life	4
BIOL	201	Principles of Cell and Molecular Bio	
BIOL	300	Cell Biology	4
BIOL	400	Molecular Biology	

2. Required Foundation Courses in Business/Economics for Students without a B.A./B.S. in Business or Economics or a Related Discipline - 16 units

nomics for Managers3	500	BUS
ntitative Methods for	502	BUS
sion-Making3		
oduction to Accounting and Finance4	504	BUS
ciples of Management	506	BUS
Marketing3		
ness Ethics and Law3	508	BUS

Core Courses

Common Required Courses in the Dual Degree Program - 9 units

Common Required Courses in the Dual Degree Program - 9 units			MGT BIOL	471 610	Project Management3 Capstone Project for MS/MBA Dual
MGT	471	Project Management3			Degree (BUS)6
BIOL	610	Capstone Project for MS/MBA Dual	Required	Courses	in the Master of Science in Biotechnology - 23 units
Degree (BUS)6		1. Required Core Courses - <u>16</u> units			
Required	Courses	in the Master of Science in Biotechnology - 23 units	BINF	500	DNA & Protein Sequence Analysis3
		Courses - 16 units	BIOL	502	Techniques in Genomics/Proteomics3
BINF	500	DNA & Protein Sequence Analysis	BIOL	503	Biotechnology Law and Regulation3
BIOL	502	Techniques in Genomics/Proteomics 3	BIOL	504	Molecular Cell Biology3
BIOL	503	Biotechnology Law and Regulation3	BIOL	510	Tissue Culture Techniques and Stem
BIOL	504	Molecular Cell Biology3			Cell Technology3
BIOL	510	Tissue Culture Techniques and Stem	BIOL	601	Seminar in Biotechnology and
		Cell Technology3			Bioinformatics1
BIOL	601	Seminar in Biotechnology and	2 Elective	Course	7 units
		Bioinformatics1	2. Elective Courses - Z units A minimum of Z units from the elective courses in MS Biotechnology and Bioinformatics		
			program.	111 0j <u>7</u> ui	mis from the elective courses in M3 biotechnology and bioinformatics
2. Elective					
	m of <u>7</u> ui	nits from the elective courses in MS Biotechnology and Bioinformatics	Required Courses in the Master of Business Administration - 24 units		
program.					Courses - <u>18</u> units
Required	Courses	in the Master of Business Administration - 24 units	BUS	510	High Performance Management3
		'ourses - <u>18</u> units	BUS BUS	520 530	Strategy and Leadership3
BUS	510	High Performance Management3	BUS	540	Managing Business Operations3 Financial Reporting and Analysis3
BUS	520	Strategy and Leadership3	BUS	550	The Contemporary Firm3
BUS	530	Managing Business Operations3	BUS	560	The Entrepreneurial Manager3
BUS	540	Financial Reporting and Analysis3	B03	300	The Bittepreneural Manager
BUS	550	The Contemporary Firm3	2. Electiv	e Course	s - 6 units
BUS	560	The Entrepreneurial Manager3	Double-counted courses:		
2 Electiv	o Couran	a Camita	BINF	500	DNA & Protein Sequence Analysis3
2. Elective Courses - <u>6</u> units Double-counted courses:			BIOL	503	Biotechnology Law and Regulation3
BINF	500	DNA & Protein Sequence Analysis3	_		
BIOL	503	Biotechnology Law and Regulation3	Graduate Writing		
ыоц	303	bioteciniology haw and regulation	Assessm	ent Re	quirement
Graduate Writing			Writing proficiency prior to awarding of the degree is demonstrated by successful		
9			completion of BIOL 504 or		
Assessment Requirement			BUS 520 with a grade of B or higher.		
Writing proficiency prior to awarding of the degree is demonstrated by successful				3	
completion of BIOL 504 or BUS 520 with a grade of B or higher.					
DUS 320 \	viui a gl	ade of D of filgher.			

Minor in Biology - (21 units)

Lower Division Requirements - 8 units

BIOL	200*	Principles of Organismal and
		Population Biology, GE B24
BIOL	201	Principles of Cell and Molecular
		Biology, GE B24

Upper Division Requirements - 13 units

1. Biology - 8 units

BIOL	300	Cell Biology	4
BIOL	302	Genetics	

2. Biology Electives - 5 units

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

Clinical Training Certificate Program in Clinical Laboratory Science (16 units)

Program Description:

The Clinical Training Certificate Program in Clinical Laboratory Science consists of twelve-months learning of the specialties of each individual department in a clinical laboratory at a partner hospital, including blood bank, chemistry, urinalysis, flow cytometry, immunohistochemistry, hematology, microbiology and parasitology. Emphasis will be placed on the importance of safety, quality control and quality assurance.

Prerequisites: BS in Biology with an Emphasis in Clinical Laboratory Science or equivalent educational credential.

Certificate Requirements - 16 units:

CLS 500 Clinical Training Certificate Program Part I (8 units)
Orientation (1 week)

General Laboratory Techniques (3 weeks)

Blood Bank (5-week rotation)

Minor in Biology - (21 units)

Lower Division Requirements - 8 units

BIOL	200*	Principles of Organismal and	
		Population Biology, GE B24	ŀ
BIOL	201	Principles of Cell and Molecular	
		Biology, GE B24	ŀ

Upper Division Requirements - 13 units

1. Biology - 8 units

BIOL	300	Cell Biology
BIOL	302	Genetics

2. Biology Electives - <u>5</u> units

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

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Program Description:

The Clinical Training Certificate Program in Clinical Laboratory Science consists of twelve-months learning of the specialties of each individual department in a clinical laboratory at a partner hospital, including blood bank, chemistry, urinalysis, flow cytometry, immunohistochemistry, hematology, microbiology and parasitology. Emphasis will be placed on the importance of safety, quality control and quality assurance

Prerequisites: BS in Biology with an Emphasis in Clinical Laboratory Science or equivalent educational credential.

Certificate Requirements - 16 units:

CLS 500 Clinical Training Certificate Program Part I (8 units)
Orientation (1 week)
General Laboratory Techniques (3 weeks)

Chemistry (15-week rotation)

Flow Cytometry and Immunohistochemistry (2 weeks)

CLS 501 Clinical Training Certificate Program Part II (8 units)

Urinalysis (3 weeks)

Hematology/Coagulation (8-week rotation)

Microbiology (9-week rotation)

Parasitology (3 weeks)

Enhancement Sites (1 week)

Central Processing and Phlebotomy (ongoing)

Review (2-week rotation)

Courses with * are double-counted toward GE credits.

Blood Bank (5-week rotation)

Chemistry (15-week rotation)

Flow Cytometry and Immunohistochemistry (2 weeks)

CLS 501 Clinical Training Certificate Program Part II (8 units)

Urinalysis (3 weeks)

Hematology/Coagulation (8-week rotation)

Microbiology (9-week rotation)

Parasitology (3 weeks)

Enhancement Sites (1 week)

Central Processing and Phlebotomy (ongoing)

Review (2-week rotation)

Courses with * are double-counted toward GE credits.

Stem Cell Technology Certificate Program (non-credit)

Program Description:

The Stem Cell Technology Certificate Program focuses on modern aspects of stem cell technology, applications in regenerative medicine, and the techniques of stem cell science, including cell culture and characterization and maintenance of pluripotent human embryonic and adult stem cell lines.

Upon completion of the program, the students are expected to:

- Describe the specific culture requirements and characteristics of various stem cell lines;
- Demonstrate ability to routinely culture and maintain human pluripotent and multipotent stem cell lines
- Apply knowledge and skills in stem cell science in research projects.

Prerequisite: BS in Biology, Chemistry, Biochemistry or related discipline.

Certificate Requirements:

Advanced Topics in Regenerative Medicine (15 hr)

A seminar series involving presentations and discussions of current knowledge of embryonic and adult stem cells and factors that regulate their growth and development. Emphasizes how advancements in cell and molecular biology and tissue engineering can be applied to the use of stem cells in regenerative

Medicine. Discusses social and ethical impacts of stem cell technology. Advanced Stem Cell Technology (45 hr) A laboratory intensive course focused on the technical aspects of human embryonic stem cell technology. Develops specific technical skills to successfully culture, characterize and maintain pluripotent human embryonic stem cells. Upon successful completion of the required courses, students will be granted a Certificate of Completion by the Extended University.

SUMMARY OF CHANGES

- 1. Changes to undergraduate program description/careers section.
- 2. Removal of "Pending CCTC Approval" from BA Emphasis in Teacher Preparation.
- 3. Elimination of the BA Emphasis in General Biology.
- 4. Addition of new courses BIOL 452 and BIOL 453 as electives in the BA and BS Emphases in Ecology, Evolution, and Organismal Biology.
- 5. Minor edits to MS course requirement sections.
- 6. Addition of the Stem Cell Technology Certificate Program to the MS.

JUSTIFICATION

- 1. Minor edits to undergraduate description/careers section were made for clarity and accuracy.
- 2. The "pending CCTC approval" statement was removed from the BA Emphasis in Subject Matter Preparation because it is confusing. The emphasis itself it *not* pending it is currently being offered and the breadth requirements in this emphasis are necessary to prepare students to take the California Subject Examination for Teachers (CSET). What is actually pending approval from the California Commission on Teacher Credentialing is exemption from the Biology/Life Sciences CSET for students completing this emphasis. The CCTC approval process is currently ongoing, but students wishing to take the exam should enroll in the SMP emphasis to get the required curriculum.
- 3. The separate BA Emphasis in General Biology was eliminated to make the BA consistent with the BS. No changes in units or requirements were made, the requirements for the Emphasis in General Biology are now listed immediately underneath the lower division requirements for the BA, just as they are for the BS. Now students who want a BA in biology do not have to choose a specific emphasis, and the catalog format reflects this adjustment.
- 4. Two new courses (non-GE) were added to the list of upper-division electives where appropriate. New course proposal forms have been sent to the Curriculum Committee.

- 5. Addition of sentence of "Must be equivalent to a graduate level course" under BIOL 490 (p. 23) clarifies that when a BIOL 490 is taught at undergraduate level, it cannot be used as an elective course for the master's degree program.

 6. A new, non-credit certificate program was added to the MS Biotechnology degree. The proposal and justification for this program have
- been sent separately to the Curriculum Committee.

Amy Denton	15 October 2011
Proposer of Program Modification	Date

The CI program review process includes a report from the respective department/program on its progress toward accessibility requirement compliance. By signing below, I acknowledge the importance of incorporating accessibility in course design.

Program Chair		
	Signature	Date
Curriculum Chair		
L	Signature	Date
AVP		
	Signature	Date