

## 2. Mathematics and Statistics - 7 units

### Select either:

BIOL	203*	Quantitative Methods for Biology, GE B3, B4 . . . . .	.3
<b>and</b>			
MATH	105*	Pre-Calculus, GE B3 . . . . .	.4
<b>or</b>			
MATH	150*	Calculus I, GE B3 . . . . .	.4

## 3. Physical Sciences - 24 units

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

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

Category A . . . . .	.9
(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 large-scale 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 problem-solving skills using multiple perspectives.

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.
2. 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.

## Degree Requirements

### Common Core Courses - 12 units

BINF	500	DNA & Protein Sequence Analysis. . . . .	.3
BIOL	503	Biotechnology Law and Regulation. . . . .	.3
BIOL	504	Molecular Cell Biology . . . . .	.3
MGT	471	Project Management . . . . .	.3

## Biotechnology Emphasis - 22 units

### 1. Required Courses - 15 units

BINF	514	Statistical Methods in Computational Biology . . . . .	.3
BIOL	502	Techniques in Genomics & Proteomics . . . . .	.3
BIOL	505	Molecular Structure . . . . .	.4
BIOL	600	Team Project . . . . .	.4
BIOL	601	Seminar in Biotechnology and Bioinformatics . . . . .	.1

### 2. Electives - 7 Units

A minimum of two courses chosen from the following elective courses and/or from the required courses for the other emphases of the program:

BINF	511	Computational Genomics . . . . .	.3
BIOL	490	Special Topics . . . . .	1-3
BIOL	500	Introduction to Biopharmaceutical Production Operations . . . . .	.3
BIOL	506	Molecular Evolution . . . . .	.4
BIOL	507	Pharmacogenomics and Pharmacoproteomics . . . . .	.3
BIOL	508	Advanced Immunology . . . . .	.4
BIOL	509	Plant Biotechnology . . . . .	.4
BIOL	516	Clinical Trials and Quality Assurance . . . . .	.3
BIOL	605	Biotechnology Across National Boundaries Field Trip . . . . .	.1
MGT	421	Human Resource Management . . . . .	.3

## Biomedical Engineering Emphasis 23 units

### 1. Required Courses - 15 units

BME	500	Biological Systems and Biomechanics: Principles and Applications . . . . .	.3
BME	501	Fundamentals of Tissue Engineering and Biomaterials . . . . .	.3
BIOL	601	Seminar in Biotechnology and Bioinformatics . . . . .	.1
BIOL	604	Biotechnology across National Boundaries . . . . .	.2

Select either BME 502 or PHYS 464 - 3-4 units

BME	502	Biomedical Instrumentation and Devices: Technology and Applications . . . . .	.3
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or

PHYS	464	Medical Instrumentation . . . . .	.4
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Select either BIOL 600 or 603 - 3-4 units

BIOL	600	Team Project . . . . .	.4
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or

BIOL	603	Biotechnology Internship . . . . .	.3
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### 2. Electives - 6-8 units

The number of elective units will be dependent on required courses taken to total 23 units in the emphasis.

## Stem Cell Technology and Laboratory Management Emphasis - 22-23 units

### 1. Required Courses - 19 units

BIOL	502	Techniques in Genomics and Proteomics . . . . .	.3
BIOL	510	Tissue Culture Techniques and Stem Cell Technology . . . . .	.3
BIOL	511	Advanced Stem Cell Technology . . . . .	.3
BIOL	512	Advanced Topics in Regenerative Medicine . . . . .	.1
BIOL	513	Cell Culture Facility Management . . . . .	.3

BIOL	602	Stem Cell Technology Internship (1.5 units X 4) . . . . .	.6
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\*BIOL 602 course is offered quarterly at 1.5 units, which is repeatable for a total of 6 units for a year long project.

### 2. Electives 3-4 units

A minimum of one 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 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:

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

## Degree Requirements

### Required Foundation Courses - 16 units

- Required Foundation Courses in Biology and Chemistry for Students without a B.S. in Biology or Chemistry 16 units*

CHEM	110	Chemistry of Life . . . . .	.4
BIOL	201	Principles of Cell and Biology . . . . .	.4
BIOL	300	Cell Biology . . . . .	.4
BIOL	400	Molecular Biology . . . . .	.4
- Required Foundation Courses in Business/Economics for Students without a B.A./B.S. in Business or Economics or a Related Discipline - 16 units*

BUS	500	Economics for Managers . . . . .	.3
BUS	502	Quantitative Methods for Decision-Making . . . . .	.3
BUS	504	Introduction to Accounting and Finance . . . . .	.4
BUS	506	Principles of Management and Marketing . . . . .	.3
BUS	508	Business Ethics and Law . . . . .	.3

## Core Courses

### Common Required Courses in the Dual Degree Program - 9 units

- |      |     |   |    |
|------|-----|---|----|
| MGT  | 471 | Project Management . . . . .                            | .3 |
| BIOL | 610 | Capstone Project for MS/MBA Dual Degree (BUS) . . . . . | .6 |

### Required Courses in the Master of Science in Biotechnology - 23 units

- Required Core Courses - 16 units*

BINF	500	DNA & Protein Sequence Analysis . . . . .	.3
BIOL	502	Techniques in Genomics/Proteomics . . . . .	.3
BIOL	503	Biotechnology Law and Regulation . . . . .	.3
BIOL	504	Molecular Cell Biology . . . . .	.3
BIOL	510	Tissue Culture Techniques and Stem Cell Technology . . . . .	.3
BIOL	601	Seminar in Biotechnology and Bioinformatics . . . . .	.1

### 2. Elective Courses - 7 units

A minimum of 7 units from the elective courses in MS Biotechnology and Bioinformatics program.

### Required Courses in the Master of Business Administration - 24 units

- Required Core Courses - 18 units*

BUS	510	High Performance Management . . . . .	.3
BUS	520	Strategy and Leadership . . . . .	.3
BUS	530	Managing Business Operations . . . . .	.3
BUS	540	Financial Reporting and Analysis . . . . .	.3
BUS	550	The Contemporary Firm . . . . .	.3

- |     |     |                                       |    |
|-----|-----|---------------------------------------|----|
| BUS | 560 | The Entrepreneurial Manager . . . . . | .3 |
|-----|-----|---------------------------------------|----|

### 2. Elective Courses - 6 units

#### Double-counted courses:

- |      |     |  |    |
|------|-----|--|----|
| BINF | 500 | DNA & Protein Sequence Analysis . . . . .  | .3 |
| BIOL | 503 | Biotechnology Law and Regulation . . . . . | .3 |

## Graduate Writing Assessment Requirement

Writing proficiency prior to awarding of the degree is demonstrated by successful completion of BIOL 504 or BUS 520 with a grade of B or higher.

## Minor in Biology - (21 units)

### Lower Division Requirements - 8 units

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

### Upper Division Requirements - 13 units

- Biology - 8 units*

BIOL	300	Cell Biology . . . . .	.4
BIOL	302	Genetics . . . . .	.4

### 2. Biology Electives - 5 units

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

## 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)
- 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)