## Description

Bioengineering, as defined by the NIH, is "the application of life sciences, mathematics, and engineering principles to define and solve problems in biology, medicine, health care, and other fields."

The bioengineering program will train graduates in biology and physiology as well as engineering. The program will provide graduates with capabilities in advanced mathematics (including differential equations and statics), science, and engineering. Graduates will be conversant with solving problems at the interface of biology and engineering that may arise in the fields of biotechnology and pharmaceuticals, as well as medicine and biofuels. By graduation, students will have experience measuring and interpreting data from living systems and addressing the interactions between living and non-living materials.

Students are required to obtain a minimum 2.0 grade-point average in CHE 501 Introduction to Chemical Engineering I/CHE 502 Introduction to Chemical Engineering II and in overall standing at the end of the sophomore year in order to continue in the major. Study abroad (Exchange) students are required to have a cumulative GPA of 3.0 or better in math, physics, chemistry, and other required courses at the end of the semester prior to their exchange semester.

For more information on the bioengineering program, please contact Xiaowei Teng, professor and chair, X.W.Teng@unh.edu.

### Requirements

#### Major Requirements

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BENG 763</td>
<td>Bioengineering Design I</td>
<td>2</td>
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<td>BENG 764</td>
<td>Bioengineering Design II</td>
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<tr>
<td>BENG 766</td>
<td>Biomothers</td>
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<tr>
<td>BMCB 658 &amp; BMCB 659</td>
<td>General Biochemistry &amp; General Biochemistry Lab</td>
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<tr>
<td>BMS 503</td>
<td>General Microbiology</td>
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<td>BMS 504</td>
<td>General Microbiology Laboratory</td>
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<td>BMS 508</td>
<td>Human Anatomy and Physiology II</td>
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<td>BIOL 410</td>
<td>Principles of Molecular and Cellular Biology</td>
<td>3</td>
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<td>CHE 400</td>
<td>Chemical Engineering Lectures</td>
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<td>CHE 501</td>
<td>Introduction to Chemical Engineering I</td>
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<tr>
<td>CHE 502</td>
<td>Introduction to Chemical Engineering II</td>
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<tr>
<td>CHE 601</td>
<td>Fluid Mechanics and Unit Operations</td>
<td>3</td>
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<tr>
<td>CHE 604</td>
<td>Chemical Engineering Thermodynamics</td>
<td>3</td>
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<tr>
<td>CHE 614</td>
<td>Separation Processes</td>
<td>3</td>
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<tr>
<td>CHE 761</td>
<td>Biochemical Engineering</td>
<td>4</td>
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<td>CHE 782</td>
<td>Biomedical Engineering</td>
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<tr>
<td>CHEM 405</td>
<td>Chemical Principles for Engineers</td>
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<tr>
<td>CHEM 545 &amp; CHEM 546</td>
<td>Organic Chemistry &amp; Organic Chemistry Laboratory</td>
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<td>GEN 604</td>
<td>Principles of Genetics</td>
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<tr>
<td>MATH 425</td>
<td>Calculus I</td>
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<td>MATH 426</td>
<td>Calculus II</td>
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<tr>
<td>MATH 527</td>
<td>Differential Equations with Linear Algebra</td>
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<td>MATH 644</td>
<td>Statistics for Engineers and Scientists</td>
<td>4</td>
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<tr>
<td>PHYS 407</td>
<td>General Physics I</td>
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#### Electives

Select five courses from the following:

- BENG 725 Cell Phenotyping and Tissue Engineering Laboratory
- BENG 755 Computational Molecular Bioengineering
- BMCB 763 Cell Culture
- BMS 507 Human Anatomy and Physiology I
- BMS 702 Endocrinology
- BMS 704 Pathologic Basis of Disease
- BMS 706 Virology
- & BMS 708 and Virology Laboratory
- CEE 502 Project Engineering
- CEE 724 Environmental Engineering Microbiology
- CHE 602 Heat Transfer and Unit Operations
- CHE 603 Applied Mathematics for Chemical Engineers
- CHE 709 Fundamentals of Air Pollution and Its Control
- CHE 712 Introduction to Nuclear Engineering
- CHE 714 Chemical Sensors
- CHE 651 Biotech Experience/Biomanufacturing
- CHE 703 Mass Transfer and Stagewise Operations
- CHE 722 Introduction to Microfluidics
- CHE 752 Process Dynamics and Control
- ECE 537 Introduction to Electrical Engineering
- ECE 541 Electric Circuits
- ECE 543 Introduction to Digital Systems
- ECE 633 Signals and Systems I
- ECE 633H Signals and Systems I/Honors
- ECE 717 Introduction to Digital Image Processing
- ECE 784 Biomedical Instrumentation
- GEN 711 Genomics and Bioinformatics
- GEN 711W Genomics and Bioinformatics
- GEN 712 Programming for Bioinformatics
- GEN 717 Molecular Microbiology
- GEN 711 Molecular Genetics
- GEN 774 Techniques in Plant Genetic Engineering and Biotechnology
- TECH 780 Intellectual Property Law for Engineers & Scientists

Total Credits: 84

At least four of the elective courses must be engineering.

### Degree Plan

#### First Year

**Fall**

- CHE 400 Chemical Engineering Lectures
- MATH 425 Calculus I
- CHEM 405 Chemical Principles for Engineers
- BIOL 410 Principles of Molecular and Cellular Biology

 Credits: 16

**Spring**

- MATH 426 Calculus II
- GEN 604 Principles of Genetics
- PHYS 407 General Physics I
- ENGL 401 First-Year Writing

 Credits: 16

#### Second Year

**Fall**

- CHE 501 Introduction to Chemical Engineering I

 Credits: 3
MATH 527  Differential Equations with Linear Algebra  4
CHEM 545  Organic Chemistry  3
CHEM 546  Organic Chemistry Laboratory  2
Discovery Program Elective (1)  4

Credits  16

Spring
CHE 502  Introduction to Chemical Engineering II  3
MATH 644  Statistics for Engineers and Scientists  4
Discovery Program Elective (1)  4
BMS 503  General Microbiology  3
BMS 504  General Microbiology Laboratory  2

Credits  16

Third Year
Fall
CHE 601  Fluid Mechanics and Unit Operations  3
BENG 766  Biomaterials  4
BMCB 658  General Biochemistry  3
BMCB 659  General Biochemistry Lab  2
Bioengineering Program Elective  4

Credits  16

Spring
CHE 604  Chemical Engineering Thermodynamics  3
CHE 761  Biochemical Engineering  4
BMS 508  Human Anatomy and Physiology II  4
Bioengineering Program Elective  4

Credits  15

Fourth Year
Fall
BENG 763  Bioengineering Design I  2
BENG 762  Biomedical Engineering  4
Discovery Program Elective (1)  4
Bioengineering Program Electives (2)  8

Credits  18

Spring
BENG 764  Bioengineering Design II  4
CHE 614  Separation Processes  3
Discovery Program Elective (1)  4
Bioengineering Program Elective (1)  4

Credits  15

Total Credits  128

1 MATH 425 Calculus I satisfies the Discovery Foundation Quantitative Reasoning category.
2 CHEM 405 Chemical Principles for Engineers satisfies the Discovery Physical Science (with lab) category.
3 ENGL 401 First-Year Writing satisfies the Discovery Foundation Writing Skills category.

34 credits engineering, 16 credits math, 14 credits chemistry, 16 credits life science
Five electives: 15 to 16 credits engineering; 4 credits science, math, or engineering

Student Learning Outcomes

• The ability to apply knowledge of mathematics, physical and life science and engineering.
• The ability to design and safely conduct experiments on living cells and nonliving materials.
• The ability to analyze and interpret data The ability to identify, formulate and solve bioengineering problems.
• The ability to design a process or device that meets desired specifications with consideration of environmental, safety, economic and ethical criteria.
• An appreciation of contemporary issues relevant to bioengineering.
• Completed the Discovery program and obtained a broad education useful to understand the impact of engineering solutions in a global and societal context.
• The ability to use computers effectively for engineering practice.