

CHM U401 Physical Chemistry 1 4 SH
with CHM U402 Lab for CHM U401 1 SH

Biochemistry Course

Complete the following course with corresponding lab:

BIO U323 Biochemistry 4 SH
with BIO U324 Lab for BIO U323 1 SH

Experiential Education Introduction

Complete the following course:

BIO U106 Introduction to Experiential Education 1 SH

Experiential Education

An activity related to biochemistry and approved by the experiential education adviser must be completed before the capstone. Among the possibilities are co-op experience, junior/senior honors thesis, research project in a faculty lab, study abroad with submission of a paper, 120 hours of supervised volunteer work in a biochemistry-related area, completion of the following course:

CHM U750 Senior Research 4 SH
or other approved experiences.

Capstone

Complete the following course:

BIO U701 Biology Capstone 4 SH

BIOLOGY AND CHEMISTRY ADVANCED ELECTIVES

Complete four advanced courses for a total of at least 17 semester hours from biology and chemistry with a minimum of one from each department. At least one course must be an approved lab course from the "Approved Labs" list below. Up to 4 semester hours may be research in a faculty lab.

Biology

BIO U311 to BIO U699

BIO U970 Junior/Senior Project 1 4 SH

BIO U971 Junior/Senior Project 2 4 SH

Chemistry

CHM U310 to CHM U699

CHM U901 Undergraduate Research 4 SH

CHM U921 Directed Study 1 SH

CHM U922 Directed Study 2 SH

CHM U923 Directed Study 3 SH

CHM U924 Directed Study 4 SH

CHM U970 Junior/Senior Project 1 4 SH

CHM U971 Junior/Senior Project 2 4 SH

Approved Labs

BIO U579 Biochemistry/Molecular Biology 5 SH
Experimental Approaches

CHM U332 Lab for CHM U331 1 SH

with CHM U331 Bioanalytical Chemistry 4 SH

CHM U522 Instrumental Methods of Analysis Lab 4 SH

with CHM U521 Instrumental Methods of Analysis 1 SH

CHM U532 Chemical Synthesis Characterization 4 SH

Lab

with CHM U531 Chemical Synthesis Characterization 1 SH

Faculty Labs

BIO U964 Research 4 SH

BIO U970 Junior/Senior Project 1 4 SH

CHM U750 Senior Research 4 SH

CHM U901 Undergraduate Research 4 SH

CHM U970 Junior/Senior Project 1 4 SH

BIOCHEMISTRY MAJOR CREDIT/GPA REQUIREMENTS

Complete 98 semester hours in the major with a cumulative GPA of 2.000.

Due to overlap in course content, double majoring in biochemistry and biology or biochemistry and behavioral neuroscience is not permitted.

GENERAL ELECTIVES

Additional courses taken beyond college and major course requirements to satisfy graduation credit requirements.

COOPERATIVE EDUCATION

If elected

UNIVERSITY-WIDE REQUIREMENTS

136 total semester hours required

Minimum 2.000 GPA required

BS in Biochemistry/MS in Biotechnology

Undergraduate students apply to the combined program through the graduate school. Once admitted, students may count a limited amount of graduate credit toward the undergraduate degree.

BS in Biochemistry/MS in Chemistry

Undergraduate students apply to the combined program through the graduate school. Once admitted, students may count a limited amount of graduate credit toward the undergraduate degree.

BIOLOGY

www.biology.neu.edu

SUSAN POWERS-LEE, PhD

Professor and Chair

MATTHEWS DISTINGUISHED UNIVERSITY PROFESSORS

Phyllis R. Strauss, PhD

Carol M. Warner, PhD

PROFESSORS

Ahmed T. Abdelal, PhD

Frederick C. Davis, PhD

H. William Detrich, PhD

Edward L. Jarroll, PhD

Gwilym S. Jones, PhD

Kim Lewis, PhD

James M. Manning, PhD

Richard L. Marsh, PhD

Charles A. M. Meszoely, PhD

Michail V. Sitkovsky, PhD

**COLLEGE OF ARTS AND SCIENCES
DISTINGUISHED ASSOCIATE PROFESSOR**

Wendy A. Smith, PhD

ASSOCIATE PROFESSORS

Joseph L. Ayers, PhD

Kostia Bergman, PhD

Donald P. Cheney, PhD

Slava S. Epstein, PhD

Donald M. O'Malley, PhD

Jacqueline M. Piret, PhD

Daniel C. Scheirer, PhD

ASSISTANT PROFESSORS

Matthew Bracken, PhD

Erin Cram, PhD

Veronica Godoy, PhD

Valentin A. Ilyin, PhD

Rebeca B. Rosengaus, PhD

Geoffrey C. Trussell, PhD

ASSISTANT ACADEMIC SPECIALISTS

Gail S. Begley, PhD

Mary-Susan Potts-Santone, PhD

LECTURERS

Louis D'Amico, PhD

Leslie Day, MS

By majoring in biology, students develop a basic understanding of the organization and the processes of life, from molecules and cells through organs and organ systems to populations, species, ecosystems, and evolution. The major offers the mathematical, chemical, and physical background necessary for understanding biology and the practical scientific skills associated with each of these areas. It allows students to begin to specialize in a subdiscipline of biology such as animal physiology, cell biology, ecology, marine biology, microbiology, molecular biology, plant biology, zoology, and so forth. Numerous opportunities for relevant positions are available through Northeastern's program of cooperative education.

There are several interdisciplinary opportunities involving biology: BS in biochemistry; BS in behavioral neuroscience; BS in computer science and biology; BS in biology and geology; BS in biology and environmental geology; BS in biology/MS in biotechnology; and BS in biochemistry/MS in biotechnology. A marine biology concentration, designed to provide biology majors with a strong foundation in marine biology and related disciplines, is offered through the Northeastern University Marine Science Center in Nahant.

The undergraduate biology major prepares students for careers in the life sciences, including medical, dental, and other health-related fields. Students may find employment in federal, state, industrial, hospital, or university laboratories or in industries involved in the manufacture and distribution of pharmaceuticals, biological products, food, or scientific equipment. Biologists also work in fisheries, forestry services,

county and state agencies, museums, aquariums, research vessels, and marine stations. Graduate study culminating in a master's or doctoral degree can lead to careers in upper-level teaching or research in any of the life sciences.

Premedical, pre dental, and other preprofessional students are urged to consult with the preprofessional advisory committee early in their careers at Northeastern.

The Biology department strongly encourages undergraduate research by providing opportunities and support through a number of departmental programs, including research co-ops and internships, course credit for research in faculty labs, honors theses, and work-study research positions. Undergraduates are encouraged to present their findings at Northeastern's annual Scholarship and Technology Expo, as well as at external research conferences and in scholarly journals.

To graduate with a major in biology, a student must have a cumulative GPA of 2.000 for all science and mathematics courses required for the major. No double majors are offered in biology and biochemistry or in biology and behavioral neuroscience due to similarity in course curricula. See pages 283–289 for course descriptions.

BS in Biology

**COLLEGE OF ARTS AND SCIENCES BS CORE
REQUIREMENTS FOR NATURAL SCIENCE MAJORS**

See page 51 for requirement list.

BREADTH COURSES FOR BIOLOGY

Mathematics

Complete the following two courses:

MTH U151 Calculus and Differential Equations 4 SH
for Biology 1

MTH U152 Calculus and Differential Equations 4 SH
for Biology 2

Chemistry

Complete the following four courses with corresponding labs:

CHM U211 General Chemistry 1 4 SH

with CHM U212 Lab for CHM U211 1 SH

CHM U214 General Chemistry 2 4 SH

with CHM U215 Lab for CHM U214 1 SH

CHM U311 Organic Chemistry 1 4 SH

with CHM U312 Lab for CHM U311 1 SH

CHM U313 Organic Chemistry 2 4 SH

with CHM U314 Lab for CHM U313 1 SH

Physics

Complete two courses from the following list with corresponding labs (PHY U145 and PHY U147 are recommended):

PHY U145 Physics for Life Sciences 1 4 SH

with PHY U146 Lab for PHY U145 1 SH

or PHY U151 Physics for Engineering 1 4 SH

with PHY U152 Lab for PHY U151 1 SH

or PHY U161 Physics 1 4 SH

with PHY U162 Lab for PHY U161 1 SH

PHY U147	Physics for Life Sciences 2	4 SH
with PHY U148	Lab for PHY U147	1 SH
or PHY U155	Physics for Engineering 2	4 SH
with PHY U156	Lab for PHY U155	1 SH
or PHY U165	Physics 2	4 SH
with PHY U166	Lab for PHY U165	1 SH

Intermediate or Advanced Science

Complete one intermediate or advanced science course from the following list:

BIO U311 to BIO U699		
CHM U321	Analytical Chemistry	4 SH
CHM U331 to CHM U699		
GEO U300 to GEO U699		
MTH U280 to MTH U699		
PHY U303 to PHY U699		
PSY U202	Biological Basis of Mental Illness	4 SH
PSY U458	Psychobiology	4 SH
PSY U510	Psychopharmacology	4 SH
PSY U608	Laboratory in Animal Behavior Research	4 SH

BIOLOGY MAJOR REQUIREMENTS**Required Biology**

Complete the following three courses with corresponding labs:

BIOLOGY 1

BIO U101	Principles of Biology 1	4 SH
with BIO U102	Lab for BIO U101	1 SH
or BIO U111	General Biology 1	4 SH
with BIO U112	Lab for BIO U111	1 SH

BIOLOGY 2

BIO U103	Principles of Biology 2	4 SH
with BIO U104	Lab for BIO U103	1 SH
or BIO U113	General Biology 2	4 SH
with BIO U114	Lab for BIO U113	1 SH

GENETICS

BIO U301	Genetics and Molecular Biology	4 SH
with BIO U302	Lab for BIO U301	1 SH

Experiential Education Introduction

Complete the following course:

BIO U106	Introduction to Experiential Education	1 SH
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BIOLOGY MAJOR ELECTIVES**Cellular and Molecular Biology**

Complete one course with corresponding lab from the following list:

BIO U319	Regulatory Cell Biology	4 SH
with BIO U320	Lab for BIO U319	1 SH
or BIO U321	Microbiology	4 SH
with BIO U322	Lab for BIO U321	1 SH
or BIO U323	Biochemistry	4 SH
with BIO U324	Lab for BIO U323	1 SH

Organismal and Population Biology

Complete one course with corresponding lab from the following list:

BIO U311	Ecology	4 SH
with BIO U312	Lab for BIO U311	1 SH

BIO U313	Plant Biology	4 SH
with BIO U314	Lab for BIO U313	1 SH
BIO U315	Invertebrate Zoology	4 SH
with BIO U316	Lab for BIO U315	1 SH
BIO U317	Vertebrate Zoology	4 SH
with BIO U318	Lab for BIO U317	1 SH

Intermediate and Advanced Biology

Complete three biology courses (at least 13 semester hours) from the following list. Up to 4 semester hours may be research in a faculty lab.

BIO U311 to BIO U699**RESEARCH**

BIO U921	Directed Study	1 SH
BIO U922	Directed Study	2 SH
BIO U923	Directed Study	3 SH
BIO U924	Directed Study	4 SH
BIO U964	Research	4 SH
BIO U970	Junior/Senior Project 1	4 SH

Experiential Education

An activity related to biology and approved by the experiential education adviser must be completed before the capstone.

Among the possibilities are co-op experience, junior/senior honors thesis, research project in a faculty lab, study abroad with submission of a paper, 120 hours of supervised volunteer work in a biology-related area, participation in the Three Seas Program with submission of a project paper, or other approved experiences.

Biology Capstone

Complete the following course:

BIO U701	Biology Capstone	4 SH
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BIOLOGY MAJOR CREDIT/GPA REQUIREMENTS

Complete 85 semester hours in the major with a cumulative GPA of 2.000.

Due to overlap in course content, double majoring in biology and biochemistry or biology and behavioral neuroscience is not permitted.

GENERAL ELECTIVES

Additional courses taken beyond college and major course requirements to satisfy graduation credit requirements.

COOPERATIVE EDUCATION

If elected

UNIVERSITY-WIDE REQUIREMENTS

136 total semester hours required
Minimum 2.000 GPA required

BS in Biology with Concentration in Marine Biology**COLLEGE OF ARTS AND SCIENCES BS CORE REQUIREMENTS FOR NATURAL SCIENCE MAJORS**

See page 51 for requirement list.

BREADTH COURSES FOR BIOLOGY**Mathematics**

Complete the following two courses:

MTH U151	Calculus and Differential Equations for Biology 1	4 SH
MTH U152	Calculus and Differential Equations for Biology 2	4 SH

Chemistry

Complete the following four courses with corresponding labs:

CHM U211	General Chemistry 1	4 SH
with CHM U212	Lab for CHM U211	1 SH
CHM U214	General Chemistry 2	4 SH
with CHM U215	Lab for CHM U214	1 SH
CHM U311	Organic Chemistry 1	4 SH
with CHM U312	Lab for CHM U311	1 SH
CHM U313	Organic Chemistry 2	4 SH
with CHM U314	Lab for CHM U313	1 SH

Physics

Complete two courses from the following list with corresponding labs (PHY U145 and PHY U147 are recommended):

PHY U145	Physics for Life Sciences 1	4 SH
with PHY U146	Lab for PHY U145	1 SH
or PHY U151	Physics for Engineering 1	4 SH
with PHY U152	Lab for PHY U151	1 SH
or PHY U161	Physics 1	4 SH
with PHY U162	Lab for PHY U161	1 SH
PHY U147	Physics for Life Sciences 2	4 SH
with PHY U148	Lab for PHY U147	1 SH
or PHY U155	Physics for Engineering 2	4 SH
with PHY U156	Lab for PHY U155	1 SH
or PHY U165	Physics 2	4 SH
with PHY U166	Lab for PHY U165	1 SH

REQUIREMENTS FOR BIOLOGY MAJOR WITH MARINE BIOLOGY CONCENTRATION**Required Biology**

Complete the following three courses with corresponding labs:

BIO U101	Principles of Biology 1	4 SH
with BIO U102	Lab for BIO U101	1 SH
or BIO U111	General Biology 1	4 SH
with BIO U112	Lab for BIO U111	1 SH
BIO U103	Principles of Biology 2	4 SH
with BIO U104	Lab for BIO U103	1 SH
or BIO U113	General Biology 2	4 SH
with BIO U114	Lab for BIO U113	1 SH
BIO U301	Genetics and Molecular Biology	4 SH
with BIO U302	Lab for BIO U301	1 SH

Experiential Education Introduction

Complete the following course:

BIO U106	Introduction to Experiential Education	1 SH
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Cellular and Molecular Biology

Complete one course with corresponding lab from the following list:

BIO U319	Regulatory Cell Biology	4 SH
with BIO U320	Lab for BIO U319	1 SH
or BIO U321	Microbiology	4 SH
with BIO U322	Lab for BIO U321	1 SH
or BIO U323	Biochemistry	4 SH
with BIO U324	Lab for BIO U323	1 SH

Organismal and Population Biology

Complete the following course with corresponding lab:

BIO U311	Ecology	4 SH
with BIO U312	Lab for BIO U311	1 SH

Marine Biology Courses

Complete four marine biology electives from the course range below for a minimum total of 16 semester hours:

BIO U501 to BIO U531

Marine Biology Research

Complete 4 semester hours of directed study/research:

BIO U964	Research	4 SH
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or consult adviser for additional courses

Experiential Education

An activity related to biology and approved by the experiential education adviser must be completed before the capstone. Among the possibilities are co-op experience, junior/senior honors thesis, research project in a faculty lab, study abroad with submission of a paper, 120 hours of supervised volunteer work in a biology-related area, participation in the Three Seas Program with submission of a project, paper, or other approved experiences.

Biology Capstone

Complete the following course:

BIO U701	Biology Capstone	4 SH
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BIOLOGY MAJOR CREDIT/GPA REQUIREMENTS

Complete 88 semester hours for the major with a cumulative GPA of 2.00.

GENERAL ELECTIVES

Additional courses taken beyond college and major course requirements to satisfy graduation credit requirements.

COOPERATIVE EDUCATION

If elected

UNIVERSITY-WIDE REQUIREMENTS

136 total semester hours required
Minimum 2.000 GPA required

BS in Biology and Geology**COLLEGE OF ARTS AND SCIENCES BS CORE REQUIREMENTS FOR NATURAL SCIENCE MAJORS**

See page 51 for requirement list.

BREADTH COURSES FOR BIOLOGY/GEOLOGY DUAL MAJOR

Mathematics

Complete the following two courses:

MTH U151	Calculus and Differential Equations for Biology 1	4 SH
MTH U152	Calculus and Differential Equations for Biology 2	4 SH

Chemistry

Complete the following four courses with corresponding labs:

CHM U211	General Chemistry 1	4 SH
with CHM U212	Lab for CHM U211	1 SH
CHM U214	General Chemistry 2	4 SH
with CHM U215	Lab for CHM U214	1 SH
CHM U311	Organic Chemistry 1	4 SH
with CHM U312	Lab for CHM U311	1 SH
CHM U313	Organic Chemistry 2	4 SH
with CHM U314	Lab for CHM U313	1 SH

Physics

Complete two courses with corresponding labs from the following list (PHY U145 and PHY U147 are recommended):

PHY U145	Physics for Life Sciences 1	4 SH
with PHY U146	Lab for PHY U145	1 SH
or PHY U151	Physics for Engineering 1	4 SH
with PHY U152	Lab for PHY U151	1 SH
or PHY U161	Physics 1	4 SH
with PHY U162	Lab for PHY U161	1 SH
PHY U147	Physics for Life Sciences 2	4 SH
with PHY U148	Lab for PHY U147	1 SH
or PHY U155	Physics for Engineering 2	4 SH
with PHY U156	Lab for PHY U155	1 SH
or PHY U165	Physics 2	4 SH
with PHY U166	Lab for PHY U165	1 SH

BIOLOGY/GEOLOGY DUAL-MAJOR REQUIREMENTS

Required Biology

Complete the following three courses with corresponding labs:

BIO U101	Principles of Biology 1	4 SH
with BIO U102	Lab for BIO U101	1 SH
or BIO U111	General Biology 1	4 SH
with BIO U112	Lab for BIO U111	1 SH
BIO U103	Principles of Biology 2	4 SH
with BIO U104	Lab for BIO U103	1 SH
or BIO U113	General Biology 2	4 SH
with BIO U114	Lab for BIO U113	1 SH
BIO U301	Genetics and Molecular Biology	4 SH
with BIO U302	Lab for BIO U301	1 SH

Required Geology

Complete the following four courses with corresponding labs:

GEO U200	Dynamic Earth	4 SH
with GEO U201	Lab for GEO U200	1 SH
GEO U220	History of Earth and Life	4 SH
with GEO U221	Interpreting Earth History	1 SH

GEO U310	Earth Materials	4 SH
with GEO U311	Lab for GEO U310	1 SH
GEO U320	Igneous Petrology and Volcanology	4 SH
with GEO U321	Lab for GEO U320	1 SH

Experiential Education Introduction

Complete the following course:

BIO U106	Introduction to Experiential Education	1 SH
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BIOLOGY/GEOLOGY DUAL-MAJOR ELECTIVES

Intermediate and Advanced Biology

Complete two biology courses with at least one lab (for a minimum total of 9 semester hours) from the following list:

BIO U311 to BIO U699

Intermediate and Advanced Geology

Complete one geology course and lab elective (for a total of 5 semester hours) from the following list:

GEO U300 to GEO U699

Integrative Courses

Complete two courses with corresponding labs from the following list:

BIO U571	Microbial Ecology	4 SH
with BIO U572	Lab for BIO U571	1 SH
BIO U585	Evolution	4 SH
with BIO U586	Lab for BIO U585	1 SH
GEO U523	Soil Science	4 SH
GEO U560	Geographic Information Systems	4 SH
with GEO U561	Lab for GEO U560	1 SH

Experiential Education

An activity related to biology or geology and approved by the experiential education adviser must be completed before the capstone. Among the possibilities are co-op experience, junior/senior honors thesis, research project in a faculty lab, study abroad with submission of a paper, 120 hours of supervised volunteer work in a biology-related area, participation in the Three Seas Program with submission of a project paper, or other approved experiences.

Biology Capstone

Complete the following course:

BIO U701	Biology Capstone	4 SH
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BIOLOGY/GEOLOGY DUAL-MAJOR CREDIT/GPA REQUIREMENTS

Complete 99 semester hours in the major with a cumulative GPA of 2.000.

GENERAL ELECTIVES

Additional courses taken beyond college and major course requirements to satisfy graduation credit requirements.

COOPERATIVE EDUCATION

If elected

UNIVERSITY-WIDE REQUIREMENTS

136 total semester hours required

Minimum 2.000 GPA required

BS in Biology and Environmental Geology**COLLEGE OF ARTS AND SCIENCES BS CORE REQUIREMENTS FOR NATURAL SCIENCE MAJORS**

See page 51 for requirement list.

BREADTH COURSES FOR BIOLOGY/ENVIRONMENTAL GEOLOGY DUAL MAJOR**Mathematics**

Complete the following two courses:

MTH U151	Calculus and Differential Equations for Biology 1	4 SH
MTH U152	Calculus and Differential Equations for Biology 2	4 SH

Chemistry

Complete the following four courses with corresponding labs:

CHM U211	General Chemistry 1	4 SH
with CHM U212	Lab for CHM U211	1 SH
CHM U214	General Chemistry 2	4 SH
with CHM U215	Lab for CHM U214	1 SH
CHM U311	Organic Chemistry 1	4 SH
with CHM U312	Lab for CHM U311	1 SH
CHM U313	Organic Chemistry 2	4 SH
with CHM U314	Lab for CHM U313	1 SH

Physics

Complete two courses with corresponding labs from the following list (PHY U145 and PHY U147 are recommended):

PHY U145	Physics for Life Sciences 1	4 SH
with PHY U146	Lab for PHY U145	1 SH
or PHY U151	Physics for Engineering 1	4 SH
with PHY U152	Lab for PHY U151	1 SH
or PHY U161	Physics 1	4 SH
with PHY U162	Lab for PHY U161	1 SH
PHY U147	Physics for Life Sciences 2	4 SH
with PHY U148	Lab for PHY U147	1 SH
or PHY U155	Physics for Engineering 2	4 SH
with PHY U156	Lab for PHY U155	1 SH
or PHY U165	Physics 2	4 SH
with PHY U166	Lab for PHY U165	1 SH

BIOLOGY/ENVIRONMENTAL GEOLOGY DUAL-MAJOR REQUIREMENTS**Required Biology**

Complete the following three courses with corresponding labs:

BIO U101	Principles of Biology 1	4 SH
with BIO U102	Lab for BIO U101	1 SH
or BIO U111	General Biology 1	4 SH
with BIO U112	Lab for BIO U111	1 SH
BIO U103	Principles of Biology 2	4 SH
with BIO U104	Lab for BIO U103	1 SH
or BIO U113	General Biology 2	4 SH
with BIO U114	Lab for BIO U113	1 SH
BIO U301	Genetics and Molecular Biology	4 SH
with BIO U302	Lab for BIO U301	1 SH

Required Geology

Complete the following four courses with corresponding labs:

GEO U200	Dynamic Earth	4 SH
with GEO U201	Lab for GEO U200	1 SH
GEO U220	History of Earth and Life	4 SH
with GEO U221	Interpreting Earth History	1 SH
GEO U310	Earth Materials	4 SH
with GEO U311	Lab for GEO U310	1 SH
GEO U340	Earth Landforms and Processes	4 SH
with GEO U341	Lab for GEO U340	1 SH

Experiential Education Introduction

Complete the following course:

BIO U106	Introduction to Experiential Education	1 SH
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BIOLOGY/ENVIRONMENTAL GEOLOGY DUAL-MAJOR ELECTIVES**Intermediate and Advanced Biology**

Complete two biology courses with at least one lab (for a minimum total of 9 semester hours) from the following list:
BIO U311 to BIO U699

Intermediate and Advanced Geology

Complete one geology course (for a total of 4 semester hours) from the following list:
GEO U300 to GEO U699

Integrative Courses

Complete two courses with corresponding labs from the following list:

BIO U571	Microbial Ecology	4 SH
with BIO U572	Lab for BIO U571	1 SH
BIO U585	Evolution	4 SH
with BIO U586	Lab for BIO U585	1 SH
GEO U523	Soil Science	4 SH
GEO U560	Geographic Information Systems	4 SH
with GEO U561	Lab for GEO U560	1 SH

Experiential Education

An activity related to biology or geology and approved by the experiential education adviser must be completed before the capstone. Among the possibilities are co-op experience, junior/senior honors thesis, research project in a faculty lab, study abroad with submission of a paper, 120 hours of supervised volunteer work in a biology-related area, participation in the Three Seas Program with submission of a project paper, or other approved experiences.

Biology Capstone

Complete the following course:

BIO U701	Biology Capstone	4 SH
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BIOLOGY/ENVIRONMENTAL GEOLOGY DUAL-MAJOR CREDIT/GPA REQUIREMENTS

Complete 99 semester hours in the major with a cumulative GPA of 2.000.

GENERAL ELECTIVES

Additional courses taken beyond college and major course requirements to satisfy graduation credit requirements.

COOPERATIVE EDUCATION

If elected

UNIVERSITY-WIDE REQUIREMENTS

136 total semester hours required

Minimum 2.000 GPA required

BS in Computer Science and Biology

See page 211.

BS in Biology/MS in Biotechnology

Students should apply for the BS/MS program during their fifth academic semester. Before applying, students must have completed 80 semester hours and one co-op experience.

COLLEGE OF ARTS AND SCIENCES BS CORE REQUIREMENTS FOR NATURAL SCIENCE MAJORS

See page 51 for requirement list.

INTRODUCTION TO COLLEGE

Complete the following course:

BIO U100 College: An Introduction 1 SH

BREADTH COURSES FOR BIOLOGY**Mathematics**

Complete the following two courses:

MTH U151 Calculus and Differential Equations 4 SH
for Biology 1

MTH U152 Calculus and Differential Equations 4 SH
for Biology 2

Chemistry

Complete the following four courses with corresponding labs:

CHM U211 General Chemistry 1 4 SH
with CHM U212 Lab for CHM U211 1 SH

CHM U214 General Chemistry 2 4 SH
with CHM U215 Lab for CHM U214 1 SH

CHM U311 Organic Chemistry 1 4 SH
with CHM U312 Lab for CHM U311 1 SH

CHM U313 Organic Chemistry 2 4 SH
with CHM U314 Lab for CHM U313 1 SH

Physics

Complete two courses with corresponding labs from the following list: (PHY U145 and PHY U147 are recommended)

PHY U145 Physics for Life Sciences 1 4 SH
with PHY U146 Lab for PHY U145 1 SH

or PHY U151 Physics for Engineering 1 4 SH
with PHY U152 Lab for PHY U151 1 SH

or PHY U161 Physics 1 4 SH
with PHY U162 Lab for PHY U161 1 SH

PHY U147 Physics for Life Sciences 2 4 SH
with PHY U148 Lab for PHY U147 1 SH

or PHY U155 Physics for Engineering 2 4 SH
with PHY U156 Lab for PHY U155 1 SH

or PHY U165 Physics 2 4 SH
with PHY U166 Lab for PHY U165 1 SH

BIOLOGY MAJOR REQUIREMENTS**Required Biology**

Complete the following three courses with corresponding labs:

BIOLOGY 1

BIO U101 Principles of Biology 1 4 SH
with BIO U102 Lab for BIO U101 1 SH

or BIO U111 General Biology 1 4 SH
with BIO U112 Lab for BIO U111 1 SH

BIOLOGY 2

BIO U103 Principles of Biology 2 4 SH
with BIO U104 Lab for BIO U103 1 SH

or BIO U113 General Biology 2 4 SH
with BIO U114 Lab for BIO U113 1 SH

GENETICS

BIO U301 Genetics and Molecular Biology 4 SH
with BIO U302 Lab for BIO U301 1 SH

Experiential Education Introduction

Complete the following course:

BIO U106 Introduction to Experiential Education 1 SH

BIOLOGY MAJOR ELECTIVES**Cellular and Molecular Biology**

Complete the following course with corresponding lab:

BIO U323 Biochemistry 4 SH
with BIO U324 Lab for BIO U323 1 SH

Organismal and Population Biology

Complete one course with corresponding lab from the following list:

BIO U311 Ecology 4 SH
with BIO U312 Lab for BIO U311 1 SH

BIO U313 Plant Biology 4 SH
with BIO U314 Lab for BIO U313 1 SH

BIO U315 Invertebrate Zoology 4 SH
with BIO U316 Lab for BIO U315 1 SH

BIO U317 Vertebrate Zoology 4 SH
with BIO U318 Lab for BIO U317 1 SH

Biology Capstone

Complete the following course:

BIO U701 Biology Capstone 4 SH

GRADUATE COURSES TAKEN AS AN UNDERGRADUATE**Required Courses**

Complete the following five courses for graduate credit:

BIO G279 Biochemistry/Molecular Biology 5 SH
Experimental Approaches

BIO G301 Molecular Cell Biology 4 SH

INT G120 Introduction to Biotechnology 2 SH

INT G245 Biotechnology Applications Laboratory 2 SH

PSC G100 Concepts in Pharmaceutical Science 2 SH

Elective Course Work

Complete one additional advanced biology elective at the 500 level or a biology course with a graduate equivalent for 4 semester hours of credit.

GRADUATE COURSES TAKEN AS A GRADUATE STUDENT

Required Courses

Complete the following four courses:

BIO G382	Research Problem Solving	2 SH
CHM G211	Analytical Separations	3 SH
CHM G212	Principles of Mass Spectrometry	3 SH
CHM G317	Analytical Biotechnology	3 SH

Elective Course Work

Complete 5 semester hours of graduate electives.

GENERAL ELECTIVES

Additional courses taken beyond college and major course requirements to satisfy graduation credit requirements.

COOPERATIVE EDUCATION

Required Co-op

Complete three co-op assignments.

GRADUATE GPA REQUIREMENT

Minimum 3.000 GPA required for all graduate courses

Minor in Biology

This minor is not available for students who major in biochemistry, behavioral neuroscience, or any dual major that involves biology.

REQUIRED BIOLOGY COURSES/LABS

Complete five biology courses from the following list for a total of at least 23 semester hours. At least three courses must be intermediate or advanced. Three of the five courses must contain a lab co-requisite.

Introductory

BIO U101 to BIO U299

Intermediate to Advanced

BIO U301 to BIO U599

BREADTH COURSE

To provide breadth of knowledge, complete one additional science course from the BIO, CHM, GEO, or PHY departments or any course from the following list:

PSY U202	Biological Basis of Mental Illness	4 SH
PSY U458	Psychobiology	4 SH
PSY U510	Psychopharmacology	4 SH

GPA REQUIREMENT

2.000 GPA required in the minor

Minor in Marine Biology

This minor is not available for students who major in biochemistry, behavioral neuroscience, or any dual major that involves biology.

REQUIRED COURSES

Complete the following two courses with corresponding labs:

BIO U101	Principles of Biology 1	4 SH
with BIO U102	Lab for BIO U101	1 SH
or BIO U111	General Biology 1	4 SH
with BIO U112	Lab for BIO U111	1 SH

BIO U103	Principles of Biology 2	4 SH
with BIO U104	Lab for BIO U103	1 SH
or BIO U113	General Biology 2	4 SH
with BIO U114	Lab for BIO U113	1 SH

ELECTIVE COURSES

Complete three courses from the following list:

BIO U151	Introduction to Marine Biology	4 SH
BIO U315	Invertebrate Zoology	4 SH
BIO U501	Marine Botany	4 SH
with BIO U502	Lab for BIO U501	1 SH
BIO U503	Marine Invertebrate Zoology	4 SH
with BIO U504	Lab for BIO U503	1 SH
BIO U505	Biology of Corals and Coral Reefs	3 SH
BIO U507	Biology and Ecology of Fishes	3 SH
BIO U509	Marine Birds and Mammals	2 SH
with BIO U510	Lab for BIO U509	1 SH
BIO U511	Adaptations of Aquatic Organisms	3 SH
BIO U515	Benthic Marine Ecology	3 SH
BIO U517	Oceanography	2 SH
with BIO U518	Lab for BIO U517	1 SH
BIO U519	Ocean and Coastal Processes	3 SH
BIO U521	Experimental Design Marine Ecology	4 SH
with BIO U522	Lab for BIO U521	1 SH
BIO U523	Molecular Marine Biology	3 SH
BIO U525	Marine Microbial Ecology	2 SH
with BIO U526	Lab for BIO U525	1 SH
BIO U527	Marine Conservation Biology	3 SH
BIO U529	Physiological and Molecular Marine Ecology	3 SH
BIO U589	Diving Research Methods	2 SH

BREADTH COURSE

To provide breadth of knowledge, complete one additional science course from the BIO, CHM, GEO, or PHY department or from the following list:

PSY U202	Biological Basis of Mental Illness	4 SH
PSY U458	Psychobiology	4 SH
PSY U510	Psychopharmacology	4 SH

GPA REQUIREMENT

2.000 GPA required in the minor

CHEMISTRY AND CHEMICAL BIOLOGY

www.chem.neu.edu/web

GRAHAM B. JONES, PhD, DIC
Professor and Chair

RAYMOND AND CLAIRE BRADSTREET CHAIR
William S. Hancock, PhD

JAMES A. WATERS PROFESSOR OF ANALYTICAL
CHEMISTRY
Barry L. Karger, PhD

MATTHEWS DISTINGUISHED UNIVERSITY PROFESSOR

Geoffrey Davies, DSc

PROFESSORS

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Bill C. Giessen, ScD

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Mary Jo Ondrechen, PhD

William M. Reiff, PhD

Eugene Smotkin, PhD

Paul Vouros, PhD

Philip M. Warner, PhD

ASSOCIATE PROFESSORS

David E. Budil, PhD

Thomas R. Gilbert, PhD

Rein U. Kirss, PhD

Ira S. Krull, PhD

Sanjeev Mukerjee, PhD

ASSISTANT PROFESSORS

Penny Beuning, PhD

Eriks Rozners, PhD

ASSOCIATE ACADEMIC SPECIALIST

Paul DiMilla, PhD

LABORATORY COORDINATOR

Edward H. Witten, PhD

PROFESSORS EMERITI

John L. Roebber, PhD

Alfred Viola, PhD

The Department of Chemistry and Chemical Biology provides education in basic chemistry and modern chemistry-related disciplines. The department offers an American Chemical Society–certified program leading to a Bachelor of Science in Chemistry, and also offers a Bachelor of Science in Biochemistry jointly with the Department of Biology. The overall objective of the Bachelor of Science in Chemistry major program is to provide the fundamental scientific background and practical training for students as they prepare for chemically related careers or advanced study in fields including the traditional chemical specialties, as well as biochemistry, materials science, forensic science, medicine, education, law, and other endeavors that may draw upon an understanding of the chemical basis of the world around us.

Key general objectives are the development of qualitative and quantitative problem-solving skills and effective communication skills. Specific learning objectives for the chemistry major include to develop conceptual understanding and problem-solving abilities in the fundamental chemical subfields of analytical chemistry, biochemistry, inorganic chemistry, organic

chemistry, and physical chemistry; gain a foundation of physics and mathematics and integrate these areas with chemical principles; perform quantitative measurements; synthesize and characterize compounds; learn proper laboratory practices including safety; develop proficiency with modern instruments and computers for data acquisition and analysis; and learn the relevance of chemistry to biology, pharmacology, medicine, manufactured and natural materials, and the environment.

Most of our chemistry majors participate in the cooperative education program and thereby gain invaluable professional experience to augment their classroom and laboratory work. Not only does that experience add immensely to the overall education received, it also provides contacts and references for later employment or graduate school admissions. Chemistry majors also undertake a research project for at least one semester under the supervision of a faculty member. Sufficient electives are available in the program either to take more advanced courses or research within the department, or to add courses in an area of special interest, such as criminal justice in the case of an interest in forensic science. Qualified students may also participate in a five-year combined BS/MS program. See pages 296–301 for course descriptions.

BS in Chemistry**COLLEGE OF ARTS AND SCIENCES BS CORE REQUIREMENTS FOR NATURAL SCIENCE MAJORS**

See page 51 for requirement list.

CHEMISTRY MAJOR TECHNICAL REQUIREMENTS**Mathematics**

Complete the following two courses:

MTH U151	Calculus and Differential Equations for Biology 1	4 SH
MTH U152	Calculus and Differential Equations for Biology 2	4 SH

Biochemistry

Complete the following course with corresponding lab:

BIO U323	Biochemistry	4 SH
with BIO U324	Lab for BIO U323	1 SH

Physics

Complete the following two courses with corresponding labs:

PHY U145	Physics for Life Sciences 1	4 SH
with PHY U146	Lab for PHY U145	1 SH
or PHY U161	Physics 1	4 SH
with PHY U162	Lab for PHY U161	1 SH
PHY U147	Physics for Life Sciences 2	4 SH
with PHY U148	Lab for PHY U147	1 SH
or PHY U165	Physics 2	4 SH
with PHY U166	Lab for PHY U165	1 SH

CHEMISTRY MAJOR REQUIREMENTS**General Chemistry**

Complete the following two courses with corresponding labs:

CHM U217	General Chemistry 1 for Chemical Science Majors	4 SH
with CHM U218	Lab for CHM U217	2 SH

CHM U220	General Chemistry 2 for Chemical Science Majors	4 SH
with CHM U221	Lab for CHM U220	2 SH

Intermediate-Level Chemistry

Complete the following five courses with corresponding labs:

CHM U315	Organic Chemistry 1 for Chemistry Majors	4 SH
with CHM U316	Lab for CHM U315	2 SH
CHM U317	Organic Chemistry 2 for Chemistry Majors	4 SH
with CHM U318	Lab for CHM U317	2 SH
CHM U331	Bioanalytical Chemistry	4 SH
with CHM U332	Lab for CHM U331	1 SH
CHM U401	Physical Chemistry 1	4 SH
with CHM U402	Lab for CHM U401	1 SH
CHM U403	Physical Chemistry 2	4 SH
with CHM U404	Lab for CHM U403	1 SH

Advanced-Level Chemistry

Complete the following four courses with corresponding labs:

CHM U501	Inorganic Chemistry	4 SH
CHM U521	Instrumental Methods of Analysis	1 SH
with CHM U522	Instrumental Methods of Analysis Lab	4 SH
CHM U531	Chemical Synthesis Characterization	1 SH
with CHM U532	Chemical Synthesis Characterization Lab	4 SH
CHM U628	Spectroscopy of Organic Compounds	3 SH
with CHM U629	Identification of Organic Compounds	2 SH

Senior Research

Complete the following course:

CHM U750	Senior Research	4 SH
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Chemistry Capstone

Complete the following course:

CHM U770	Chemistry Capstone	4 SH
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EXPERIENTIAL EDUCATION REQUIREMENT

Complete one course in experiential education. Please see department for approved courses.

CHEMISTRY MAJOR CREDIT REQUIREMENT

Complete 89 semester hours in the major.

GENERAL ELECTIVES

Additional courses taken beyond college and major course requirements to satisfy graduation credit requirements.

COOPERATIVE EDUCATION

If elected

UNIVERSITY-WIDE REQUIREMENTS

136 total semester hours required
Minimum 2.000 GPA required

BS in Environmental Geology and Chemistry

See page 88.

BS in Geology and Chemistry

See page 87.

BS/MS in Chemistry

Undergraduate students apply to the combined program through the graduate school. Once admitted, students may count a limited amount of graduate credit toward the undergraduate degree.

Minor in Chemistry**REQUIRED COURSES**

Complete the following six courses with corresponding labs. Engineering students may take CHM U151 in place of CHM U211 and two other chemistry courses in place of CHM U214 and CHM U401:

GENERAL CHEMISTRY 1

CHM U211	General Chemistry 1	4 SH
with CHM U212	Lab for CHM U211	1 SH

GENERAL CHEMISTRY 2

CHM U214	General Chemistry 2	4 SH
with CHM U215	Lab for CHM U214	1 SH

ORGANIC CHEMISTRY 1

CHM U311	Organic Chemistry 1	4 SH
with CHM U312	Lab for CHM U311	1 SH

ORGANIC CHEMISTRY 2

CHM U313	Organic Chemistry 2	4 SH
with CHM U314	Lab for CHM U313	1 SH

PHYSICAL CHEMISTRY 1

CHM U401	Physical Chemistry 1	4 SH
with CHM U402	Lab for CHM U401	1 SH

PHYSICAL CHEMISTRY 2

CHM U403	Physical Chemistry 2	4 SH
with CHM U404	Lab for CHM U403	1 SH

GPA REQUIREMENT

2.000 GPA required in the minor

CINEMA STUDIES

www.cinemastudies.neu.edu

INEZ HEDGES, PHD, *Stotsky Professor of Jewish Historical and Cultural Studies, Modern Languages*

KATHY HOWLETT, PHD, *Associate Professor, English Codirectors of the Program in Cinema Studies*

MATTHEWS DISTINGUISHED UNIVERSITY PROFESSOR

Harlow L. Robinson, PhD, *History and Modern Languages*

PROFESSORS

Kathleen Kelly, PhD, *English and Education*

Michael Ryan, PhD, *English*