

BIOCHEMISTRY

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Advising Web site: www.biology.neu.edu/bioadvising.html

Biochemistry includes nearly the entire spectrum of science—from physics and chemistry to biology and medicine. The biochemistry major, sponsored jointly by the Departments of Biology and Chemistry and Chemical Biology, provides a strong foundation in mathematics and the physical sciences as well as thorough training in biochemistry, biology, and chemistry. In addition to formal class work, opportunities are available for participation in faculty research programs on an individual basis or through the Honors Program. The large number of biotechnology companies and biomedical facilities in the Boston area provides a rich source of opportunities through Northeastern's program of cooperative education. Two combined BS/MS programs are also available: BS in biochemistry/MS in biotechnology and BS in biochemistry/MS in chemistry.

A Bachelor of Science degree in biochemistry allows students to enter the job market directly or go on to graduate, medical, veterinary, dental, law, or business school. Students may find positions in biotechnology companies, pharmaceutical companies, or government agencies, working in laboratory or clinical research, quality control, production, information systems, marketing, or technical sales. Students may also pursue graduate study in biochemistry, molecular biology, cell biology, biophysics, genetics, toxicology, biotechnology, clinical chemistry, animal science, nutrition, plant science, or other biomedical sciences.

Students who are interested in attending medical, dental, or veterinary school following graduation are urged to consult with the preprofessional advisory committee early in their careers at Northeastern.

Transferring to the Major

Upperclass students transferring to biochemistry must have a minimum GPA of 2.000 and have completed a year in chemistry and a year in calculus, preferably the following courses:

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

with a grade of C or better.

Transferring into biochemistry requires the approval of the Biochemistry Coordinating Committee Chair. Acceptance into the major will be based on students' meeting the criteria for admission and availability of space in the program.

Academic Progression Standards

After four semesters in the major, students must have a GPA of at least 2.000 in all science and math courses and have completed at least six of the following courses:

BIO U101	Principles of Biology 1	4 SH
with BIO U102	Lab for BIO U101	1 SH
and BIO U103	Principles of Biology 2	4 SH
with BIO U104	Lab for BIO U103	1 SH
BIO U301	Genetics and Molecular Biology	4 SH
with BIO U302	Lab for BIO U301	1 SH
CHM U211	General Chemistry 1	4 SH
with CHM U212	Lab for CHM U211	1 SH
and 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
and CHM U313	Organic Chemistry 2	4 SH
with CHM U314	Lab for CHM U313	1 SH
MTH U151	Calculus and Differential Equations for Biology 1	4 SH
and MTH U152	Calculus and Differential Equations for Biology 2	4 SH

Students who transfer into the biochemistry major will be allowed two semesters after entering the major to meet the minimum standards for their class. Students who fail to meet the above standards will be placed on departmental probation. Two consecutive semesters on departmental probation will result in dismissal from the major.

To graduate with a major in biochemistry, 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 biochemistry and biology or in biochemistry and behavioral neuroscience due to similarity in course curricula. Students must maintain a minimal grade-point average of 2.000 to remain in this program.

BS in Biochemistry

NU CORE REQUIREMENTS

See page 42 for requirement list.

BIOCHEMISTRY BREADTH COURSES

Mathematics Courses

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

Physics Courses

Complete a lecture/lab set for Physics 1 and Physics 2:

PHYSICS 1

PHY U145	Physics for Life Sciences 1	4 SH
with PHY U146	Lab for PHY U145	1 SH
PHY U151	Physics for Engineering 1	4 SH
with PHY U152	Lab for PHY U151	1 SH
PHY U161	Physics 1	4 SH
with PHY U162	Lab for PHY U161	1 SH

PHYSICS 2

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

BIOCHEMISTRY MAJOR REQUIREMENTS**Principles of Biology**

Complete the following two 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

Molecular Biology

Complete the following two courses with corresponding lab as indicated:

BIO U301	Genetics and Molecular Biology	4 SH
with BIO U302	Lab for BIO U301	1 SH
BIO U407	Molecular Cell Biology	4 SH

Chemistry Courses

Complete the following six 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
CHM U321	Analytical Chemistry	4 SH
with CHM U322	Lab for CHM U321	1 SH
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
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Experiential Education

An activity related to biochemistry and approved by the experiential education advisor 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
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or other approved experiences.

Capstone

Complete the following course:

BIO U701	Biology Capstone	4 SH
or CHM U770	Chemistry 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 list "Approved Labs" below. Up to 4 semester hours may be research in a faculty lab.

Biology

BIO U311 to BIO U699

BIO U970	Junior/Senior Honors Project 1	4 SH
BIO U971	Junior/Senior Honors 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 Honors Project 1	4 SH
CHM U971	Junior/Senior Honors Project 2	4 SH

Approved Labs

BIO U579	Biochemistry/Molecular Biology Experimental Approaches	5 SH
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 Lab	4 SH
with CHM U531	Chemical Synthesis Characterization	1 SH

Faculty Labs

BIO U964	Research	4 SH
BIO U970	Junior/Senior Honors Project 1	4 SH
CHM U750	Senior Research	4 SH
CHM U901	Undergraduate Research	4 SH
CHM U970	Junior/Senior Honors Project 1	4 SH

BIOCHEMISTRY MAJOR CREDIT/GPA REQUIREMENTS

Complete 94 semester hours for 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**APPLICATION PROCEDURES**

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.

NU CORE REQUIREMENTS

See page 42 for requirement list.

BIOCHEMISTRY BREADTH COURSES**Mathematics Courses**

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

Physics

Complete a lecture/lab set for Physics 1 and Physics 2:

PHYSICS 1		
PHY U145	Physics for Life Sciences 1	4 SH
with PHY U146	Lab for PHY U145	1 SH
PHY U151	Physics for Engineering 1	4 SH
with PHY U152	Lab for PHY U151	1 SH
PHY U161	Physics 1	4 SH
with PHY U162	Lab for PHY U161	1 SH

PHYSICS 2

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

BIOCHEMISTRY MAJOR REQUIREMENTS**Principles of Biology**

Complete the following two 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

Molecular Biology

Complete the following course with corresponding lab:

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

Chemistry Courses

Complete the following six 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
CHM U321	Analytical Chemistry	4 SH
with CHM U322	Lab for CHM U321	1 SH
CHM U401	Physical Chemistry 1	4 SH
with CHM U402	Lab for CHM U401	1 SH

Biochemistry Courses

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
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Experiential Education

Two undergraduate co-ops and one graduate co-op are required, preferably in the biotechnology industry.

Approved Lab

Complete one course with corresponding lab where applicable:

BIO U579	Biochemistry/Molecular Biology Experimental Approaches	5 SH
CHM U331	Bioanalytical Chemistry	4 SH
with CHM U332 Lab for CHM U331		1 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

Capstone

Complete the following course:

BIO U701	Biology Capstone	4 SH
or CHM U770	Chemistry Capstone	4 SH

GRADUATE COURSES TAKEN AS AN UNDERGRADUATE

Required Courses

Complete the following five courses for graduate credit:

BIO G279	Biochemistry/Molecular Biology Experimental Approaches	5 SH
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

GRADUATE COURSES TAKEN AS A GRADUATE STUDENT

Required Courses

Complete the following five courses:

BIO G382	Research Problem Solving	2 SH
CHM G211	Analytical Separations	3 SH
CHM G212	Principles of Mass Spectrometry	3 SH
CHM G316	Analytical Biochemistry	3 SH
MGT G219	The Business of Biotechnology	3 SH

Elective Course Work

Complete 2 semester hours of graduate electives.

BIOCHEMISTRY/BIOTECHNOLOGY MAJOR CREDIT/GPA REQUIREMENTS

Complete 127 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

156 total semester hours required
Minimum 3.000 GPA required

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. Consult the department for information on this program.