BIOCHEMISTRY - BACHELOR OF ARTS (BA)

Biochemistry major students are prepared for many different careers after graduation. Career Services (http://www.colorado.edu/careerservices) offers a number of programs and services designed to help students plan their career, including workshops, internships, and placement services after graduation. For an appointment with a career counselor or for more information, call 303-492-6541 or stop by Center for Community, N352.

Announcements

See the undergraduate blog (http://www.colorado.edu/chembio/undergraduate-blog) and the second-floor Ekeley bulletin board for announcements and postings. Some examples of the information posted are:

- **Main page:** contact information and general announcements.
- **Student opportunities:** internship/job announcements, summer programs, e vents/programs offered by other campus offices and departments that may be of interest.
- **Scholarship announcements:** announcements of scholarships opportunities and information meetings.
- **Seminars and conferences:** seminar and conference announcements.
- **Academic support:** SASC workshop schedule, tutors, and other academic support opportunities.
- **Career services:** schedule of events offered by this office.
- **Study abroad:** announcements from study abroad about their programs and information meetings.
- **Courses:** information about new and/or interesting courses for core and elective credit.

Research Opportunities

Undergraduate Research Opportunities Program (UROP and other opportunities)

The Undergraduate Research Opportunities Program (UROP) offers students a chance to work alongside a faculty sponsor on original research. Learn to write proposals, conduct research, pursue creative work, analyze data and present the results. For more information, visit the UROP Website (http://www.colorado.edu/suep/about-urop).

Study Abroad

The experience of studying abroad can prove invaluable. For information about study abroad programs, visit the Office of International Education/Study Abroad (http://studyabroad.colorado.edu) website.

Teaching Certification

Biochemistry majors can also earn certification as teachers through the School of Education. The program for a secondary school science-teaching certificate is challenging requiring a broad, strong background in science, as well as coursework in education and practice teaching. It usually requires at least five years of study. Students interested in teacher certification are encouraged to contact the School of Education (http://www.colorado.edu/education).

Requirements

Program Requirements

The biochemistry major requires extensive coursework, including courses in general, organic, physical and analytical/instrumental chemistry, as well as in biology, calculus and physics.

In addition to these, students must fulfill the graduation requirements of the College of Arts and Sciences. No more than 45 credits of CHEM courses can be applied to the 120-credit minimum to graduate.

Transfer students who plan to complete a BA degree in biochemistry must complete at the Boulder campus a minimum of 12 credits of upper-division courses in biochemistry covering at least two of the sub-disciplines in their major: organic, physical and biochemistry.

Students may want to consult each semester's Registration Handbook and Schedule of Courses (http://www.colorado.edu/registrar), as well as the Professor Performance Guide (http://www.colorado.edu/pba/fcq) for further information about course offerings and faculty.

Required Courses and Credits

Code	Title	Credit Hours
General Chemistry		
CHEM 1400 & CHEM 1401	Foundations of Chemistry and Foundations of Chemistry Lab [1]	5
Organic Chemistry		10-12
Organic Chemistry 1		
CHEM 3451	Organic Chemistry for Chemistry and Biochemistry Majors	
or CHEM 3310	Organic Chemistry 1	
CHEM 3361	Laboratory in Organic Chemistry 1 for Chemistry Majors	
or CHEM 3321	Laboratory in Organic Chemistry 1	
Organic Chemistry 2		
CHEM 3491	Organic Chemistry 2 for Biochemistry Majors	
or CHEM 3471	Organic Chemistry 2 for Chemistry Majors	
or CHEM 3331	Organic Chemistry 2	
CHEM 3381	Laboratory in Organic Chemistry 2 for Chemistry Majors	
or CHEM 3341	Laboratory in Organic Chemistry 2	
Physical Chemistry		
CHEM 4400	Core Concepts in Physical Chemistry for Biochemists [1]	4
Required Advanced Biochemistry Coursework		
CHEM 4700	Foundations of Biochemistry	4
CHEM 4720	Metabolic Pathways and Human Disease	4
CHEM 4740	Biochemistry of Gene Transmission, Expression and Regulation	4
CHEM 4761	Biochemistry Laboratory	4
Advanced Major Electives		
Select three of the following elective courses:		10-8
CHEM 4751	Current Topics in Biochemical Research	
CHEM 4791	Bioorganic Chemistry in Biotechnology	
CHEM 4011	Modern Inorganic Chemistry	

CHEM 4171	Instrumental Analysis - Lecture and Laboratory 1
CHEM 4181	Instrumental Analysis - Lecture and Laboratory 2
CHEM 5341	Chemical Biology and Drug Design
MCDB 3145	Molecular Cell Biology II
MCDB 3150	Biology of the Cancer Cell
MCDB 3501	Structural Methods for Biological Macromolecules
MCDB 3650	The Brain - From Molecules to Behavior
MCDB 3990	Introduction to Systems Biololgy for Biologists
MCDB 4310	Microbial Genetics and Physiology
MCDB 4410	Human Molecular Genetics
MCDB 4471	Mechanisms of Gene Regulation in Eukaryotes
MCDB 4520	Bioinformatics and Genomics
EBIO 2070	Genetics: Molecules to Populations (cannot also count MCDB 2150 as a required ancillary course)
EBIO 3400	Microbiology
EBIO 4530	Functional Plant Biology
IPHY 3430	Human Physiology
IPHY 3470	Human Physiology 1
IPHY 3480	Human Physiology 2
Total Credit Hours	45

Required Ancillary Coursework from Outside Chemistry

Code	Title	Credit Hours
Required Physics Courses		
PHYS 1110 & PHYS 1120	General Physics 1 and General Physics 2	8
PHYS 1140	Experimental Physics 1	1
Calculus		
Complete two semesters of calculus:		8-10
MATH 1300 or APPM 135	Calculus 1 Calculus 1 for Engineers	
MATH 2300 or APPM 1360	Calculus 2 Calculus 2 for Engineers	
Biology Sequence with Labs		
Complete a biology sequence with labs:		
Lectures		
MCDB 1150 & MCDB 2150	Introduction to Cellular and Molecular Biology and Principles of Genetics	
MCDB 1111 & MCDB 2222	Core Concepts in Biology I: Evolutionary, Molecular and Cell Biology and Core Concepts in Biology II: Genes, Genetics and Phenotypes	
EBIO 1210 & EBIO 1220	General Biology 1 and General Biology 2	
Labs		
MCDB 1161	From Dirt to DNA: Phage Genomics Laboratory I	
or MCDB 1170	Drug Discovery Through Hands-on Screens I	
or MCDB 2170	Drug Discovery Through Hands-On Screens 2	
EBIO 1230 & EBIO 1240	General Biology Laboratory 1 and General Biology Laboratory 2	
Total Credit Hours		17-19

[1] Or equivalent non-major CHEM sequence.

All students, and especially those intending to go onto graduate school in biochemistry, will benefit from additional advanced courses. Recommended electives include graduate courses in various fields of chemistry, or advanced courses in biology or mathematics.

Graduating in Four Years

Consult the Four-Year Guarantee Requirements for information on eligibility. The concept of "adequate progress" as it is used here only refers to maintaining eligibility for the four-year guarantee; it is not a requirement for the major. To maintain progress in chemistry and biochemistry, students should meet the following requirements:

- In the first semester, declare the biochemistry major.

Students must consult with a major advisor to determine adequate progress toward completion of the major.

Recommended Four-Year Plan of Study

Through the required coursework for the major, students will fulfill all 12 credits of the Natural Sciences area of the Gen Ed Distribution Requirement and the QRMS component of the Gen Ed Skills Requirement.

Course	Title	Credit Hours
Year One		
Fall Semester		
CHEM 1400	Foundations of Chemistry	4
CHEM 1401	Foundations of Chemistry Lab	1
MATH 1300 or APPM 1350	Calculus 1 or Calculus 1 for Engineers	4-5
Gen. Ed. Distribution course (example: Social Sciences)		3
Gen. Ed. Skills course (example: Lower-division Written Communication)		3
	Credit Hours	15-16
Spring Semester		
CHEM 3451	Organic Chemistry for Chemistry and Biochemistry Majors	4
CHEM 3361	Laboratory in Organic Chemistry 1 for Chemistry Majors	2
MATH 2300 or APPM 1360	Calculus 2 or Calculus 2 for Engineers	4-5
Gen. Ed. Distribution/Diversity course (example: Arts & Humanities/US Perspective)		3
	Credit Hours	13-14
Year Two		
Fall Semester		
CHEM 3491	Organic Chemistry 2 for Biochemistry Majors	4
CHEM 3381	Laboratory in Organic Chemistry 2 for Chemistry Majors	2

PHYS 1110	General Physics 1 (Calculus-based)	4
Gen. Ed. Distribution course (example: Social Sciences)		3
Gen. Ed. Distribution course (example: Arts & Humanities)		3
	Credit Hours	16
Spring Semester		
CHEM 4400	Core Concepts in Physical Chemistry for Biochemists	4
PHYS 1120	General Physics 2	4
PHYS 1140	Experimental Physics 1	1
Gen. Ed. Distribution course (example: Social Sciences)		3
Elective or MAPS		3
	Credit Hours	15
Year Three		
Fall Semester		
CHEM 4700	Foundations of Biochemistry	4
EBIO 1210 or MCDB 1150 or MCDB 1111	General Biology 1 or Introduction to Cellular and Molecular Biology or Core Concepts in Biology I: Evolutionary, Molecular and Cell Biology	3
EBIO 1230 or MCDB 1161 or MCDB 1171	General Biology Laboratory 1 or From Dirt to DNA: Phage Genomics Laboratory I or Drug Discovery Through Hands-on Screens I	1-2
Gen. Ed. Distribution course (example: Social Sciences)		3
Free Elective		3
	Credit Hours	14-15
Spring Semester		
CHEM 4720	Metabolic Pathways and Human Disease	4
EBIO 1220 or MCDB 2150 or MCDB 2222	General Biology 2 or Principles of Genetics or Core Concepts in Biology II: Genes, Genetics and Phenotypes	3
EBIO 1240 or MCDB 2171	General Biology Laboratory 2 or Drug Discovery Through Hands-On Screens 2	1-2
Gen. Ed. Distribution/Diversity course (example: Social Sciences/Global Perspective)		3
Gen. Ed. Skills course (example: Upper-division Written Communication)		3
Elective/MAPS		3
	Credit Hours	17-18
Year Four		
Fall Semester		
CHEM 4761	Biochemistry Laboratory	4
CHEM 4740	Biochemistry of Gene Transmission, Expression and Regulation	4
Gen. Ed. Distribution (example: Arts & Humanities)		3
Advanced Major Elective		3
Elective		3
	Credit Hours	17
Spring Semester		
Advanced Major Elective		3
Advanced Major Elective		3
Gen. Ed. Distribution course (example: Arts & Humanities)		3
Elective		3
Elective		3
	Credit Hours	15
	Total Credit Hours	122-126