

# Biochemistry Major

University of Michigan - Department of Chemistry

Biochemistry is the chemistry of life. Biochemists seek to understand the chemical principles that underpin all living organisms. Biochemistry is central to medical science as almost all diseases and drugs act to change the body’s chemistry. Advances in biochemistry directly affect the fields of biotechnology, pharmaceutical science, agriculture and environmental science, among many others. The Biochemistry major is for those interested in learning about life from a chemical perspective. Students will be well equipped for graduate studies in biochemistry, chemical biology, and many other fields of inquiry in the life sciences. The major will also provide excellent preparation for students intending to pursue professional careers in industry and medicine.

### Prerequisites:

- AP credit for Physics (125/127 or 139) & (126/128 or 239) will fulfill the Physics requirement.
- AP credit for Math (120 & 121) will fulfill the Math requirement.
- AP credit for Biology (195) will fulfill the Biology 171 & 172 requirement.

Course #	Course Description	Typically Offered	Credits
*CHEM 125/126	General Chemistry Laboratory I and II	<i>F, W, Su</i>	2
* CHEM 130	General Chemistry: Macroscopic Investigation and Reaction Principles	<i>F, W, Su</i>	3
CHEM 210	Structure and Reactivity I	<i>F, W, Sp</i>	3
CHEM 211	Investigations in Chemistry: Laboratory	<i>F, W, Sp</i>	2
CHEM 215	Structure and Reactivity II	<i>F, W, Sp</i>	3
BIO 171	Introductory Biology: Ecology and Evolution	<i>F, W, Sp, Su</i>	4
BIO 172	Introductory Biology: Molecular Cellular and Developmental	<i>F, W, Sp</i>	4
MATH 115	Calculus I	<i>F, W, Sp, Su</i>	4
MATH 116	Calculus II	<i>F, W, Sp, Su</i>	4
<b>One of the Following:</b>			
CHEM 262 OR MATH 215	Mathematical Methods for Chemists	<i>F, W</i>	4
	Calculus III	<i>F, W, Sp, Su</i>	4

Prerequisite Courses: continue from page 1.		Typically Offered	Credits
<b>One of the following groups; 150/151 or 140/141:</b>			
PHYS 150/151 OR PHYS 140/141	Fundamental Physics for the Life Sciences I/ Lab	<i>F, W, Sp</i>	4/1
	General Physics I/Elementary Laboratory I	<i>F, W, Sp</i>	4/1
<b>One of the following groups; 250/251 or 240/241:</b>			
PHYS 250/251 OR PHYS 240/241	Fundamental Physics for the Life Sciences II/ Lab	<i>F, W, Sp</i>	4/1
	General Physics II/ Elementary Laboratory II	<i>F, W, Sp</i>	4/1

**The Biochemistry Program must include the following:**

**Core courses: minimum 37 credits.**

Course #	Course Description	Typically Offered	Credits
CHEM 260 OR CHEM 230 & 261	Chemical Principles	<i>F, W</i>	3
	Physical Chemical Principles and Applications AND Introduction to Quantum Chemistry	<i>F, W</i>	3/1
** CHEM 351	Fundamentals of Biochemistry	<i>F, W</i>	4
CHEM 352 OR CHEM 353	Introduction to Biochemical Research Techniques: Laboratory	<i>F, W</i>	2
	Introduction to Biochemical Research Techniques and Scientific Writing: Laboratory (ULWR)	<i>F, W</i>	3
CHEM 451	Advanced Biochemistry I Macromolecular Structure and Function	<i>F, W</i>	4
CHEM 452	Advanced Biochemistry II Cellular Processes	<i>W</i>	4
CHEM 453	Biophysical Chemistry	<i>F</i>	3
BIO 305	Genetics	<i>F, W, Sp, Su</i>	4
<b>One of the following; 241, 245, 302, OR 303:</b>			
CHEM 241	Chemical Analysis	<i>F</i>	2
CHEM 245	Biomedical Analytical Chemistry	<i>W</i>	2
CHEM 302	Inorganic Chemistry	<i>F, W</i>	3
CHEM 303	Introductory Bioinorganic Chemistry: the Role of Metals in Life	<i>F, W</i>	3
<b>One of the following; 216, 242, OR 246/247:</b>			
CHEM 216	Structure and Reactivity II: Laboratory	<i>F, W, Sp</i>	2
CHEM 242	Chemical Analysis: Laboratory	<i>F</i>	2
CHEM 246/247	Biomedical Analytical Chemistry Laboratory I and II	<i>W</i>	2

**Elective Courses:** at least 6 credit hours from the courses listed below. Electives should be selected in consultation with a departmental advisor.

- If term column is not listed with a term, please check the course guide. These courses are not consistently offered during the same term each year.

Course #	Course Description	Typically Offered	Credits
CHEM 417	Dynamic Biophysics	W	3
CHEM 419	Intermediate Physical Organic Chemistry	F	3
CHEM 420	Intermediate Organic Chemistry	W	3
CHEM 421	Organic Chemistry of Drug Design	W	3
CHEM 440	Biophysics of Disease	F	3
CHEM 447	Physical Methods of Analysis	W	3
CHEM 455	Special Topics in Biochemistry	F	3
CHEM 461	Physical Chemistry I	F	3
CHEM 474	Environmental Chemistry	F	3
CHEM 520	Methods of Biophysical Chemistry	F	3
CHEM 521	Biophysical Chemistry II	W	3
MCDB 408	Genomic Biology	W	3
MCDB 411	Protein Biochemistry	F,W	3
MCDB 417	Chromosome Structure and Function		3
MCDB 420	Struct Bio: Arc Life	W	3
MCDB 422	Brain Development	W	3
MCDB 427	Molecular Biology	F	4
MCDB 428	Cell Biology	W	4
MCDB 430	Molec Bio of Plants		3
MCDB 434	Protein Misfold Dis		3
MCDB 440	Cell Cyc Ctrl & Canc		3
MCDB 441	Cell Biology of Disease		3
MCDB 448	Telomerase Function		2
MCDB 462	Epigenetics		3
MCDB 472	Bld a Synthetic Cell		3
BIOPHYS 420	Structural Biology I	W	3
BIOPHYS 421	Struct Bio: Biop Con	F	3
BIOPHYS 430	Medical Physics	W	3
BIOPHYS 433	Biocomplexity		3
MICRBIOL 405	Med Microbio & ID	F,W	3
PHRMACOL310	Pharmacol & Therapeut	F	4
PHRMACOL425	New Medications	W	3
PHYSIOL 502	Human Physiology	F	4

An advanced laboratory or undergraduate research course, one of the following:

Course #	Course Description	Term Typically Offered	Credits
CHEM 482	Synthesis and Characterization- <i>ULWR</i>	<i>F</i>	3
CHEM 483	Physical and Instrumental Chemistry	<i>W</i>	3
BIOPHYS 450	Laboratory Techniques in Biophysics	<i>F</i>	3
MCDB 429	Laboratory in Cell and Molecular Biology	<i>W</i>	3
CHEM 398	Undergraduate Research in Biochemistry- taken over 2 semesters	<i>F, W, Sp, Su</i>	4
BIOLCHEM 398	Undergraduate Research in Biochemistry- taken over 2 semesters	<i>F, W, Sp, Su</i>	4

**Biochemistry honors:**

Qualified students may elect an Honors major. This program requires a thesis that describes and analyzes independent experimental work. The Honors advisor in Biochemistry must approve the research topic and advisor. Students in this program must maintain an overall GPA of 3.4 and at least a 3.4 in their major. CHEM 398 (4 credits) and the thesis course, CHEM 498, replaces the requirement for an upper-level laboratory course outlined above.

**Exclusions:** *Students who elect a major in Biochemistry may not elect the following majors: Biomolecular Science, Chemistry, Interdisciplinary Chemical Sciences, Biology; General Biology; Molecular, Cellular, and Developmental Biology (formerly known as Cell and Molecular Biology, or CMB); Cellular and Molecular Biomedical Science Major (formerly known as Cellular and Molecular Biology and Biomedical Engineering, or CMB:BME); Ecology and Evolutionary Biology; Microbiology; or Neuroscience. They may also not elect a minor in Biology, or any of the Chemistry minors.*

**Chemistry GPA requirement:**

A student must earn a cumulative grade point average (GPA) of at least 2.0 in all courses required for the Biochemistry major including prerequisites. Transfer courses are not calculated into the GPA.

**NOTES:**

\* Students with AP credit may waive the General Chemistry prerequisites

\*\* Students are strongly encouraged to take CHEM 351 but could substitute this course requirement with MCDB 310 or BIOLCHEM 415.