

# BIOCHEMISTRY, BS

for the degree of Bachelor of Science in Biochemistry (Specialized Curriculum)

Biochemistry is an interdisciplinary field that encompasses biological and chemical sciences. We investigate the many fascinating processes within living systems at a molecular level. As a biochemistry student, you will explore questions such as

- What chemical reactions occur within cells, their functions, and how are they regulated?
- What is the chemical mechanism of inheritance, growth, cell division, and differentiation?
- How does the body convert energy and nutrients to new cells or create movement?
- What chemical and physical properties of naturally occurring molecules enable them to carry out such highly specific functions?

As part of the School of Molecular & Cellular Biology community, you will also take courses and study with MCB majors and have the benefit of curricular enhancements available to all MCB undergraduates. These include research in available laboratories schoolwide, study abroad, and advanced teaching facilities.

A bachelor's degree in biochemistry will prepare you for graduate studies in biochemistry, chemistry, molecular biology, or medical school and other professional programs such as dental, pharmacy, or veterinary school. Our graduates have become leaders in medicine, pharmacology, agriculture, nutrition, microbiology, cell biology, food technology, pollution control, and biotechnology.

## Undergraduate degree programs in Molecular & Cellular Biology

- Biochemistry, BS (p. 1)
- Molecular & Cellular Biology, BSLAS (<http://catalog.illinois.edu/undergraduate/las/molecular-cellular-biology-bslas/>)
- Molecular & Cellular Biology Honors Concentration, BSLAS (<http://catalog.illinois.edu/undergraduate/las/molecular-cellular-biology-bslas/honors/>)
- Molecular & Cellular Biology + Data Science, BSLAS (<http://catalog.illinois.edu/undergraduate/las/molecular-cellular-biology-data-science-bslas/>)
- Neuroscience, BSLAS (<http://catalog.illinois.edu/undergraduate/las/neuroscience-bslas/>)

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The typical program of courses required to satisfy this degree totals 126-131 hours as outlined below including up to 12 hours of non-primary language (if not completed in high school); in no case will a program totaling less than 120 hours qualify for graduation. In addition, in order to graduate there is a minimum 2.0 cumulative academic grade point

average and student must attain a 2.5 academic grade point average in the chemistry, biochemistry, biology, mathematics, physics and advanced electives in science/engineering courses specified in this curriculum. All proposals for course substitutions must be approved by the academic advisor. This curriculum is intended for those students who desire a rigorous education in chemistry, biochemistry, and biology, who have definite research-oriented goals, and whose career objectives include graduate school, MD/PhD programs, or industry.

Students earning the Biochemistry degree automatically complete the Chemistry minor. Students earning a degree in the Specialized Curriculum in Biochemistry may not earn a second degree in the Science and Letters Curriculum in Molecular and Cellular Biology.

## Departmental distinction: A student seeking distinction must satisfy the following:

- Complete a minimum of 6 credit hours of undergraduate research (BIOC 290 and BIOC 492) with a minimum of 4 credit hours of BIOC 492.
- Earn at least a 3.25 grade-point average.
- Present a senior thesis to the department.

### Graduation Requirements

Minimum hours required for graduation: 120 hours.

### University Requirements

The university and residency requirements can be found in the Student Code (<https://studentcode.illinois.edu/article3/part8/3-801/>) (§ 3-801) and in the Academic Catalog (<http://catalog.illinois.edu/general-information/degree-general-education-requirements/>).

### General Education Requirements

Follows the campus General Education (Gen Ed) requirements (<https://courses.illinois.edu/gened/DEFAULT/DEFAULT/>). Some Gen Ed requirements may be met by courses required and/or electives in the program.

Code	Title	Hours
	Composition I	4-6
	Advanced Composition	3
	fulfilled by BIOC 460	
	Humanities & the Arts (6 hours)	6
	Natural Sciences & Technology (6 hours)	6
	fulfilled by MCB 150, CHEM 102 or CHEM 202, CHEM 104 or CHEM 204, PHYS 101 or PHYS 211, PHYS 102 or PHYS 212	
	Social & Behavioral Sciences (6 hours)	6
	Cultural Studies: Non-Western Cultures (1 course)	3
	Cultural Studies: US Minority Cultures (1 course)	3
	Cultural Studies: Western/Comparative Cultures (1 course)	3
	Quantitative Reasoning (2 courses, at least one course must be Quantitative Reasoning I)	6-10
	fulfilled by MATH 220 or MATH 221, MATH 231, MATH 241, STAT 212	
	Language Requirement (Completion of the third semester or equivalent of a language other than English is required)	0-15

## Major Requirements

Code	Title	Hours
Select one of the following:		8-10
CHEM 202 & CHEM 203 & CHEM 204 & CHEM 205	Accelerated Chemistry I and Accelerated Chemistry Lab I and Accelerated Chemistry II and Accelerated Chemistry Lab II (preferred sequence)	
CHEM 102 & CHEM 103 & CHEM 104 & CHEM 105	General Chemistry I and General Chemistry Lab I and General Chemistry II and General Chemistry Lab II (with advisor approval)	
Organic chemistry, select from:		9-10
CHEM 236 & CHEM 237 & CHEM 436	Fundamental Organic Chem I and Structure and Synthesis and Fundamental Organic Chem II (preferred sequence)	
CHEM 232 & CHEM 233 & CHEM 332	Elementary Organic Chemistry I and Elementary Organic Chem Lab I and Elementary Organic Chem II (with advisor approval)	
Molecular and Cellular Biology		17
MCB 150	Molecular & Cellular Basis of Life	
MCB 250	Molecular Genetics	
MCB 251	Exp Techniqs in Molecular Biol	
MCB 252	Cells, Tissues & Development	
MCB 253	Exp Techniqs in Cellular Biol	
MCB 354	Biochem & Phys Basis of Life	
or equivalent as approved by academic advisor		
Physical chemistry, select one group of courses:		7-8
CHEM 440	Physical Chemistry Principles (Biological Perspective Section)	
BIOC 446	Physical Biochemistry (preferred sequence)	
or		
CHEM 442	Physical Chemistry I	
CHEM 444	Physical Chemistry II (with advisor approval)	
Mathematics & Statistics		14-15
STAT 212	Biostatistics	
MATH 220	Calculus	
or MATH 221	Calculus I	
MATH 231	Calculus II	
MATH 241	Calculus III	
Physics, select from: <sup>3</sup>		10
PHYS 211 & PHYS 212 & PHYS 213	University Physics: Mechanics and University Physics: Elec & Mag and Univ Physics: Thermal Physics (preferred sequence)	
or		
PHYS 101 & PHYS 102	College Physics: Mech & Heat and College Physics: E&M & Modern (or equivalent as approved by academic advisor (with advisor approval)	
Biochemistry: <sup>4</sup>		13

BIOC 455	Technqs Biochem & Biotech
BIOC 460	Biochemistry Senior Seminar
BIOC 406	Gene Expression & Regulation
BIOP 401	Introduction to Biophysics

Select 10 hours of Advanced Science/Technical Electives (may include up to 7 hours of BIOC 492, Senior Thesis) from approved list.<sup>5</sup>

<sup>1</sup> Transfer credit must be approved by an advisor in biochemistry in order to be used to satisfy degree requirements.

<sup>2</sup> A more detailed description of the requirements is listed in the Biochemistry Curriculum Handbook, available in room 419A of Roger Adams Laboratory.

<sup>3</sup> PHYS 213 is not required if CHEM 442/CHEM 444 sequence is taken.

<sup>4</sup> Freshman orientation course is under development and will be required. See advisor for details.

<sup>5</sup> An approved list of current courses will be updated annually in January/February for the coming year. Contact advisor.

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## Sample Sequence

This sample sequence is intended to be used only as a guide for degree completion. All students should work individually with their academic advisors to decide the actual course selection and sequence that works best for them based on their academic preparation and goals. Enrichment programming such as study abroad, minors, internships, and so on may impact the structure of this four-year plan. Course availability is not guaranteed during the semester indicated in the sample sequence.

Students must fulfill their Language Other Than English requirement by successfully completing a third level of a language other than English. See the corresponding section on the Degree and General Education Requirements page (<http://catalog.illinois.edu/general-information/degree-general-education-requirements/>).

## First Year

First Semester	Hours
Free Elective course	1
BIOC 190	1
MCB 150	4
CHEM 102 or 202	3
CHEM 103 or 203	1
Composition I or General Education course	4
<b>14</b>	

## Total Hours 14

## First Year

Second Semester	Hours
CHEM 104 or 204	3
CHEM 105 or 205	1
MATH 220	5
General Education course or Composition I	3

Language Other Than English (3rd level)	4
	<b>16</b>

**Total Hours 16**
**Second Year**

First Semester	Hours
MCB 250	3
MCB 251	2
CHEM 232 or 236	4
CHEM 233 or 237	2
MATH 231	3
General Education course (choose a Humanities or Social/Behavioral Science course with Cultural Studies designation)	3
	<b>17</b>

**Total Hours 17**
**Second Year**

Second Semester	Hours
MCB 252	3
MCB 253	2
CHEM 332 or 436	4
MATH 241	4
PHYS 101 or 211	5
	<b>18</b>

**Total Hours 18**
**Third Year**

First Semester	Hours
MCB 354	3
PHYS 102 or 212	5
STAT 212	3
General Education course (choose a Humanities or Social/ Behavioral Science course with Cultural Studies designation)	3
	<b>14</b>

**Total Hours 14**
**Third Year**

Second Semester	Hours
BIOC 406	3
BIOC 455	4
PHYS 213 (or Advanced Technical Elective course)	2
Free Elective course	3
General Education course (choose a Humanities or Social/ Behavioral Science course with Cultural Studies designation)	3
	<b>15</b>

**Total Hours 15**
**Fourth Year**

First Semester	Hours
BIOC 460	3
BIOP 401	3
CHEM 440 or 442	4
Free Elective course	3
	<b>13</b>

**Total Hours 13**
**Fourth Year**

Second Semester	Hours
BIOC 446 or CHEM 444	3
Advanced Technical Elective course	3
Advanced Technical Elective course or Free Elective course	3
BIOC 492	4
	<b>13</b>

**Total Hours 13**
**Total Hours: 120**

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Upon successful completion of the Biochemistry Specialized Curriculum, students will be able to:

1. Understand and appreciate that the diversity of life evolved over time by biomolecular processes of mutation, selection, genetic change, and epigenetics.
2. Explain that molecular and macromolecular structure as well as supramolecular architecture determine function and regulation.
3. Explain that information storage and flow are molecular-based, dynamic, and interactive.
4. Understand and appreciate that biochemical mechanisms and kinetics ensure relative cellular stability and function under external or internal changing condition.
5. Explain that energy is required by and transformed in biochemical systems as governed by the laws of thermodynamics.
6. Illustrate that living organisms and biological systems interact via molecular connections.
7. Design a scientific process and employ the scientific method, demonstrating that biochemistry is evidence-based and grounded in the formal practices of observation, objective measurement, and hypothesis testing.
8. Execute quantitative analysis and mathematical reasoning to interpret biochemical data.
9. Construct and utilize predictive models and simulations that define chemical relationships, as well as molecular interactions of complex systems.
10. Apply concepts from other sciences that span biology, chemistry, physics, mathematics, computation, and engineering to interpret biochemical phenomena.
11. Communicate biochemical concepts and understanding to members of a diverse scientific community, as well as to the general public.

12. Identify social and health-related dimensions of biochemical investigations.

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## **Department of Biochemistry (<http://mcb.illinois.edu/departments/biochemistry/>)**

Biochemistry faculty (<https://mcb.illinois.edu/departments/biochemistry/directory/faculty/>)

Biochemistry email: [biocug@mcb.uiuc.edu](mailto:biocug@mcb.uiuc.edu)

School of Molecular & Cellular Biology website (<https://mcb.illinois.edu/undergrad/>)

## **College of Liberal Arts and Sciences (<https://las.illinois.edu/>)**

Overview of LAS Admissions & Requirements (<http://catalog.illinois.edu/schools/las/academic-units/>)