

BIOCHEMISTRY, B.S.

Mission

The mission of the Bachelor of Science in Biochemistry (<https://www.biola.edu/degrees/u/biochemistry-bs/>) is to train and mentor students to become skilled scientists who will glorify God and be good stewards of His creation as they serve others in research, health care, academia, and industry.

Degree Program

A Bachelor of Science degree in Biochemistry is offered upon completion of the University baccalaureate and major requirements. Biochemistry is the study of the chemistry of living systems; thus this interdisciplinary program requires upper-division course work both in biology and chemistry. The Bachelor of Science degree in Biochemistry offers two concentrations. The premedical concentration is designed especially for those students planning a career in health professions and the requirements for schools of medicine, pharmacy, dentistry and medical technology can be met within this major. The General Biochemistry concentration prepares one for graduate school and careers in a variety of bioscience programs. Biochemistry majors have excellent opportunities for employment in biotechnical, pharmaceutical and environmental businesses and governmental agencies.

Learning Outcomes

Program Learning Outcomes

Upon completion of the Bachelor of Science in Biochemistry, students will be able to:

1. Demonstrate an understanding of the foundational principles of biochemistry (ULO 1).
2. Demonstrate an ability to solve quantitative, mechanistic, and technical problems related to biochemistry (ULO 1).
3. Demonstrate safe laboratory technique, proper use of appropriate equipment, and suitable results and data analysis (ULO 1).
4. Obtain and use appropriate biochemical literature and resource materials (ULO 1).
5. Summarize the key issues in science and faith and recognize the harmony possible while studying God's creation (ULO 1, 2, and 3).

Each Program Learning Outcome (PLO) listed above references at least one of the University Learning Outcomes (ULO 1, 2, 3), which may be found in the General Information (<http://catalog.biola.edu/general-information/>) section of this catalog.

Requirements

GPA Requirements

To continue in the program a student is required to have a cumulative GPA of 2.5 or higher in their first year of chemistry, physics and/or math courses taken at Biola. Depending on the major, these courses may include: CHEM 105, CHEM 106, CHEM 301, CHEM 302, CHEM 311, and CHEM 312.

Curriculum Requirements

Integration Seminar Requirement

Students enrolled in the Bachelor of Science in Biochemistry degree program are required to take BBST 465 as Christianity and the Natural Sciences, or another approved Integration Seminar topic (see advisor).

Code	Title	Credits
Program-Specific Core Curriculum Courses		
Biochemistry majors automatically meet the Core Curriculum requirement of 6 credits in science and mathematics. The foreign language requirement is met by two years in high school or 4 credits of college foreign language.		
Program Courses		
Required lower-division courses (25 credits) include:		
BIOS 111	Fundamentals of Cellular and Molecular Biology	3
BIOS 113	Fundamentals of Cellular and Molecular Biology Laboratory	1
CHEM 105	General Chemistry I ¹	4
CHEM 106	General Chemistry II	4
MATH 150	Calculus I	4
PHSC 124	Data Analysis and Presentation	1
Select one of the following two options:		8
Option 1:		
PHSC 111	Physics I ²	
PHSC 117	Physics I Laboratory	
PHSC 112	Physics II	
PHSC 118	Physics II Laboratory	
Option 2:		
PHSC 132	General Physics I: Mechanics and Heat ³	
PHSC 134	General Physics I Laboratory	
PHSC 233	General Physics II: Electricity and Magnetism	
PHSC 237	General Physics II Laboratory	
Required upper-division courses (32 credits) include:		
BIOS 312	Cell and Molecular Biology	3
BIOS 332	Genetics	4
CHEM 301	Organic Chemistry I	3
CHEM 302	Organic Chemistry II	3
CHEM 311	Laboratory in Organic Chemistry I	1
CHEM 312	Laboratory in Organic Chemistry II	1
CHEM 350	Analytical Chemistry	5
CHEM 380	Introduction to Physical Chemistry	3
or CHEM 402	Physical Chemistry I	
CHEM 411	General Biochemistry I	3
CHEM 412	General Biochemistry II	3
CHEM 413	Laboratory in General Biochemistry	2
PHSC 460	Capstone Seminar	1
Select 10 credits of electives from the following: ^{4,5}		10
BIOS 112	Fundamentals of Organismal Biology	
BIOS 114	Fundamentals of Organismal Biology Laboratory	

BIOS 281	Physiology
BIOS 282	Microbiology
BIOS 311	Neurobiology
BIOS 322	Laboratory in Cell and Molecular Biology
BIOS 382	Vertebrate Physiology
BIOS 431	Developmental Biology
BIOS 445	Immunology
CHEM 332	Environmental Chemistry
CHEM 352	Fundamentals of Material Science
CHEM 360	Inorganic Chemistry
CHEM 405	Physical Chemistry II
CHEM 406	Physical Chemistry Lab
CHEM 420	Special Topics in Chemistry
CHEM 480	Internship
CHEM 490	Directed Research
MATH 151	Calculus II
MATH 318	Biostatistics
PHSC 234	General Physics III: Waves, Optics and Modern Physics
PHSC 311	Computer Techniques in Science and Engineering

Program Course Requirements: 67 credits

Core Curriculum Requirements⁶ 61

Total Credits 128

¹ The prerequisite for CHEM 105 is a passing score on the Chemistry Placement Exam or CHEM 107 with at least a "B-".

² The prerequisite for PHSC 111 is a passing score on the Physics Placement Exam or PHSC 092 with a grade of "C" or better or 3 or above on any Advanced Placement (AP) Physics.

³ The prerequisite for PHSC 132 is a passing score on the Physics Placement Exam or PHSC 092 with a grade of "B" or better or 4 or above on any Advanced Placement (AP) Physics.

⁴ 3 credits must be upper-division.

⁵ The following courses do not count as major electives: BIOS 100, BIOS 105, BIOS 110, BIOS 130.

⁶ See Core Curriculum Program section (<http://catalog.biola.edu/general-information/undergraduate-core-curriculum-program/>) for details.

Concentration

Pre-Medical Studies

Code	Title	Credits
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Program-Specific Core Curriculum Courses

Biochemistry majors automatically meet the Core Curriculum requirement of 6 credits in science and mathematics. The foreign language requirement is met by two years in high school or 4 credits of college foreign language.

The following Core Curriculum Behavioral Science course is required for this concentration:

PSYC 200	Introduction to Psychology (waived for Torrey Honors students)	
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Program Courses

Required lower-division courses (29 credits) include:

BIOS 111	Fundamentals of Cellular and Molecular Biology	3
BIOS 113	Fundamentals of Cellular and Molecular Biology Laboratory	1
BIOS 112	Fundamentals of Organismal Biology	3
BIOS 114	Fundamentals of Organismal Biology Laboratory	1
CHEM 105	General Chemistry I ¹	4
CHEM 106	General Chemistry II	4
MATH 150	Calculus I	4
PHSC 124	Data Analysis and Presentation	1

Select one of the following two options: 8

Option 1:

PHSC 111	Physics I ²	
PHSC 117	Physics I Laboratory	
PHSC 112	Physics II	
PHSC 118	Physics II Laboratory	

Option 2:

PHSC 132	General Physics I: Mechanics and Heat ³	
PHSC 134	General Physics I Laboratory	
PHSC 233	General Physics II: Electricity and Magnetism	
PHSC 237	General Physics II Laboratory	

Required upper-division courses (34 credits) include:

BIOS 312	Cell and Molecular Biology	3
BIOS 322	Laboratory in Cell and Molecular Biology	1
BIOS 332	Genetics	4
BIOS 381	Advanced Physiology	4
CHEM 301	Organic Chemistry I	3
CHEM 302	Organic Chemistry II	3
CHEM 311	Laboratory in Organic Chemistry I	1
CHEM 312	Laboratory in Organic Chemistry II	1
CHEM 350	Analytical Chemistry	5
CHEM 411	General Biochemistry I	3
CHEM 412	General Biochemistry II	3
CHEM 413	Laboratory in General Biochemistry	2
PHSC 460	Capstone Seminar	1

Select 6 credits of electives from the following:⁴ 6

BIOS 254	Human Anatomy	
BIOS 282	Microbiology	
BIOS 311	Neurobiology	
BIOS 315	Nutrition and Metabolism	
BIOS 316	Nutrition and Metabolism Lab	
BIOS 380	Advanced Microbiology	
BIOS 431	Developmental Biology	
BIOS 445	Immunology	
BIOS 455	General Virology	
CHEM 332	Environmental Chemistry	
CHEM 352	Fundamentals of Material Science	
CHEM 360	Inorganic Chemistry	

CHEM 380	Introduction to Physical Chemistry
CHEM 390	Introduction to Food Chemistry
CHEM 402	Physical Chemistry I
CHEM 405	Physical Chemistry II
CHEM 406	Physical Chemistry Lab
CHEM 420	Special Topics in Chemistry
CHEM 480	Internship
CHEM 490	Directed Research
MATH 151	Calculus II
MATH 318	Biostatistics
PHSC 311	Computer Techniques in Science and Engineering
PHSC 321	Circuits and Instrumentation I
PHSC 465	Special Topics in Physical Science

Program Course Requirements: 69 credits

Core Curriculum Requirements⁵ 61

Total Credits 130

¹ The prerequisite for CHEM 105 is a passing score on the Chemistry Placement Exam or CHEM 107 with at least a "B-".

² The prerequisite for PHSC 111 is a passing score on the Physics Placement Exam or PHSC 092 with a grade of "C" or better or 3 or above on any Advanced Placement (AP) Physics.

³ The prerequisite for PHSC 132 is a passing score on the Physics Placement Exam or PHSC 092 with a grade of "B" or better or 4 or above on any Advanced Placement (AP) Physics.

⁴ 3 credits must be upper-division.

⁵ See Core Curriculum Program section (<http://catalog.biola.edu/general-information/undergraduate-core-curriculum-program/>) for details.

Course Sequence

NOTE: The course sequence table is designed by the major department and is one way that the classes will work out properly in sequence for your major. However, there are alternative or flexible ways to rotate some of the classes within the same year/level and sometimes between year levels. Please contact your major department advisor to discuss flexible alternatives in scheduling the sequence of your classes.

Taking coursework during the summer session may also be an option to accelerate your degree path.

See Core Curriculum Program section (<http://catalog.biola.edu/general-information/undergraduate-core-curriculum-program/>) for a list of approved Core Curriculum courses.

- Biochemistry (p. 3)
- Pre-Medical Studies (p. 3)

Biochemistry, B.S. (BCHM)

First Year		
Fall	Credits Spring	Credits
BBST 103 or 165	3 BBST 103 or 165	3
CHEM 105	4 BIOS 111	3
ENGL 100 or 112	3 BIOS 113	1
GNST 102	1 CHEM 106	4
MATH 150	4 HIST 200, 201, or POSC 225	3

PHSC 124	1 KNES 107	1
		16

Total Credits 31

Second Year

Fall	Credits Spring	Credits
BBST 209 or 210	3 BBST 209 or 210	3
CHEM 301	3 BBST 251	3
CHEM 311	1 CHEM 302	3
PHSC 111 & PHSC 117 (or PHSC 132 & 134)	4 CHEM 312	1
Fine Arts (see Core Curriculum)	3 PHSC 112 & PHSC 118 (or PHSC 233 & 237)	4
		14

Total Credits 28

Third Year

Fall	Credits Spring	Credits
BBST 365	3 BBST 354	3
BIOS 312	3 CHEM 380 or 402	3
CHEM 411	3 CHEM 412	3
CHEM, BIOS, MATH, or PHSC Elective (see catalog for list)	3 CHEM 413	2
CHEM, BIOS, MATH, or PHSC Elective (upper-division) (see catalog for list)	3 ENGL 313	3
Literature (see Core Curriculum)	3 Behavioral Science (see Core Curriculum)	3
Writing Competency Requirement	Graduation Petition due in Registrar's Office	
		18

Total Credits 35

Fourth Year

Fall	Credits Spring	Credits
BBST 300/400 Bible Elective	3 BBST 300/400 Bible Elective	3
BIOS 332	4 BBST 465 (Christianity & Nat Sci - required)	3
CHEM 350	5 CHEM, BIOS, MATH, or PHSC Elective (see catalog for list)	4
Communication (see Core Curriculum)	3 PHSC 460	1
KNES Activity (see Core Curriculum)	1 Philosophy (see Core Curriculum)	3
		16

Total Credits 30

Note: If you have taken 2 years of the same language in high school, you have fulfilled your foreign language requirement. Otherwise, contact the Modern Language Department for placement test instructions.

Biochemistry, B.S. Pre-Medical Studies (BCPM)

First Year

Fall	Credits Spring	Credits
BBST 103 or 165	3 BBST 103 or 165	3
CHEM 105	4 BIOS 111	3
ENGL 100 or 112	3 BIOS 113	1
GNST 102	1 CHEM 106	4
MATH 150	4 PSYC 200 (required)	3
PHSC 124	1 KNES 107	1
		16

Total Credits 31

Second Year

Fall	Credits	Spring	Credits
BBST 209 or 210	3	BBST 209 or 210	3
BIOS 112	3	BBST 251	3
BIOS 114	1	CHEM 302	3
CHEM 301	3	CHEM 312	1
CHEM 311	1	PHSC 112 & PHSC 118 (or PHSC 233 & 237)	4
HIST 200, 201, or POSC 225	3	Fine Arts (see Core Curriculum)	3
PHSC 111 & PHSC 117 (or PHSC 132 & 134)	4		
	18		17

Total Credits 35**Third Year**

Fall	Credits	Spring	Credits
BBST 365	3	BBST 354	3
BIOS 312	3	BIOS 381	4
BIOS 322	1	CHEM 412	3
CHEM 411	3	CHEM 413	2
CHEM, BIOS, MATH, or PHSC Elective (upper-division) (see catalog for list)	3	ENGL 313	3
Literature (see Core Curriculum)	3	Graduation Petition due in Registrar's Office	
KNES Activity (see Core Curriculum)	1		
Writing Competency Requirement			
	17		15

Total Credits 32**Fourth Year**

Fall	Credits	Spring	Credits
BBST 300/400 Bible Elective	3	BBST 300/400 Bible Elective	3
BIOS 332	4	BBST 465 (Christianity & Nat Sci - required)	3
CHEM 350	5	CHEM, BIOS, MATH, or PHSC Elective (see catalog for list)	3
Communication (see Core Curriculum)	3	PHSC 460	1
		Philosophy (see Core Curriculum)	3
	15		13

Total Credits 28

Note: If you have taken 2 years of the same language in high school, you have fulfilled your foreign language requirement. Otherwise, contact the Modern Language Department for placement test instructions.

Torrey Hnrs Seq

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- Biochemistry (p. 4)
- Pre-Medical Studies (p. 4)

Biochemistry, B.S. (BCHM)

First Year

Fall	Credits	Spring	Credits
HNRS 101	4	HNRS 105	4
HNRS 102	4	HNRS 106	4
CHEM 105	4	BIOS 111	3
GNST 102	1	BIOS 113	1
MATH 150	4	CHEM 106	4
PHSC 124	1	KNES 107	1
	18		17

Second Year

Fall	Credits	Spring	Credits
HNRS 210	4	HNRS 230	4
HNRS 215	4	HNRS 231	4
CHEM 301	3	CHEM 302	3
CHEM 311	1	CHEM 312	1
PHSC 111 & PHSC 117 (or PHSC 132 & PHSC 134)	4	PHSC 112 & PHSC 118 (or PHSC 233 & PHSC 237)	4
	16		16

Third Year

Fall	Credits	Spring	Credits
HNRS 324	4	HNRS 337	4
HNRS 326	2	HNRS 339	2
BIOS 312	3	CHEM 412	3
CHEM 411	3	CHEM 413	2
Major Elective (upper-division)	3	CHEM 380 or 402	3
		ENGL 313	3
	15		17

Fourth Year

Fall	Credits	Spring	Credits
HNRS 443	4	HNRS 458	4
BIOS 332	4	BBST 465	3
CHEM 350	5	PHSC 460	1
KNES Activity (see Core Curriculum)	1	Major Elective	4
		Major Elective	3
	14		15

Total Credits 128

Note: If you have taken 2 years of the same language in high school, you have fulfilled your foreign language requirement. Otherwise, contact the Modern Language Department for placement test instructions.

Biochemistry, B.S. Pre-Medical Studies (BCPM)

First Year

Fall	Credits	Spring	Credits
HNRS 101	4	HNRS 105	4
HNRS 102	4	HNRS 106	4
CHEM 105	4	BIOS 111	3
GNST 102	1	BIOS 113	1
MATH 150	4	CHEM 106	4
PHSC 124	1	KNES 107	1
	18		17

Second Year

Fall	Credits	Spring	Credits
HNRS 210	4	HNRS 230	4
HNRS 215	4	HNRS 231	4

CHEM 301	3 CHEM 302	3
CHEM 311	1 CHEM 312	1
KNES Activity (see Core Curriculum)	1 PHSC 112 & PHSC 118 (or PHSC 233 & PHSC 237)	4
PHSC 111 & PHSC 117 (or PHSC 132 & PHSC 134)	4	
	17	16
Third Year		
Fall	Credits Spring	Credits
HNRS 324	4 HNRS 337	4
HNRS 326	2 HNRS 339	2
BIOS 112	3 BIOS 381	4
BIOS 114	1 CHEM 412	3
BIOS 312	3 CHEM 413	2
CHEM 411	3 ENGL 313	3
	16	18
Fourth Year		
Fall	Credits Spring	Credits
HNRS 443	4 HNRS 458	4
BIOS 322	1 BBST 465	3
BIOS 332	4 PHSC 460	1
CHEM 350	5 Major Elective	3
	Major Elective (upper-division)	3
	14	14
Total Credits 130		

Note: If you have taken 2 years of the same language in high school, you have fulfilled your foreign language requirement. Otherwise, contact the Modern Language Department for placement test instructions.