

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 section (<https://catalog.biola.edu/general-information/#UniversityLearningOutcomes>) of this catalog.

Program 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 115, CHEM 116, 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 4653 Integration Seminar: Christianity and the Natural Sciences, or another approved Integration Seminar topic (see advisor).

Code	Title	Credits
Biochemistry majors meet the Core Curriculum requirement of 9 credits in integration seminar, science, and mathematics within the major. The foreign language requirement is met by two years of high school study in the same language or four credits of college foreign language.		

Program Courses

Required lower-division courses (25-28 credits) include:

BIOS 111 & BIOS 113	Fundamentals of Cellular and Molecular Biology and Fundamentals of Cellular and Molecular Biology Laboratory	4
CHEM 107	Introduction to Chemistry ¹	3
CHEM 105 & CHEM 115	General Chemistry I and General Chemistry I Lab	4
CHEM 106 & CHEM 116	General Chemistry II and General Chemistry II Lab	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 & PHSC 117 or PHSC 100 & PHSC 117	Physics I and Physics I Laboratory ² Physics I with Foundations and Physics I Laboratory	
PHSC 112 & PHSC 118	Physics II and Physics II Laboratory	

Option 2:

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

Required upper-division courses (36 credits) include:

BIOS 312	Cell and Molecular Biology	3
BIOS 332 & BIOS 334	Genetics and Laboratory in Genetics	4
CHEM 301 & CHEM 311	Organic Chemistry I and Laboratory in Organic Chemistry I	4
CHEM 302 & CHEM 312	Organic Chemistry II and Laboratory in Organic Chemistry II	4
CHEM 350 & CHEM 351	Analytical Chemistry and Analytical Chemistry Lab	4
CHEM 380 or CHEM 402	Introduction to Physical Chemistry Physical Chemistry I	3
CHEM 410	Instrumental Analysis	2

CHEM 411	General Biochemistry I	3
CHEM 412	General Biochemistry II	3
CHEM 413	Laboratory in General Biochemistry	2
PHSC 460	Capstone Seminar	1
BBST 4653	Integration Seminar: Christianity and the Natural Sciences ³	3
Select 9 credits of electives from the following: ^{4,5}		9
BIOS 112 & BIOS 114	Fundamentals of Organismal Biology and Fundamentals of Organismal Biology Laboratory	
BIOS 281	Physiology	
BIOS 282	Microbiology	
BIOS 311	Neurobiology	
BIOS 322	Laboratory in Cell and Molecular Biology	
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 430	Advanced Organic Chemistry	
CHEM 470	Seminar in Advanced Chemistry and Biochemistry	
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: 70-73 credits

Core Curriculum Requirements (<https://catalog.biola.edu/academic-policies/undergraduate-core-curriculum-program/>) 54-58

Total Credits 124-131

¹ CHEM 107 is waived for students who meet the qualifications to enter CHEM 105. See the current Placement Options for CHEM 105 (<https://www.biola.edu/academic-advising/incoming/placement-exams/chemistry-105/>) or the department for more information.

² All students who do not meet one of the Physics 111 Placement Options (<https://www.biola.edu/academic-advising/incoming/placement-exams/physics/>) must enroll in PHSC 100.

³ Fulfills the BBST 465 Biblical and Theological Studies Integration Seminar requirement.

⁴ 3 credits must be upper-division.

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

Concentration

Pre-Medical Studies

Code	Title	Credits
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Biochemistry majors with a concentration in Pre-Medical Studies meet the Core Curriculum requirement of 12 credits in integration seminar, science, mathematics, and behavioral science within the major. The foreign language requirement is met by two years of high school study in the same language or four credits of college foreign language.

Program Courses

Required lower-division courses (32-35 credits) include:

BIOS 111 & BIOS 113	Fundamentals of Cellular and Molecular Biology and Fundamentals of Cellular and Molecular Biology Laboratory	4
BIOS 112 & BIOS 114	Fundamentals of Organismal Biology and Fundamentals of Organismal Biology Laboratory	4
CHEM 107	Introduction to Chemistry ¹	3
CHEM 105 & CHEM 115	General Chemistry I and General Chemistry I Lab	4
CHEM 106 & CHEM 116	General Chemistry II and General Chemistry II Lab	4
MATH 150	Calculus I	4
PHSC 124	Data Analysis and Presentation	1
PSYC 200	Introduction to Psychology (waived for Torrey Honors students) ²	3

Select one of the following two options: 8

Option 1:

PHSC 111 & PHSC 117 or PHSC 100 & PHSC 117	Physics I and Physics I Laboratory ³ Physics I with Foundations and Physics I Laboratory	
PHSC 112 & PHSC 118	Physics II and Physics II Laboratory	

Option 2:

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

Required upper-division courses (38 credits) include:

BIOS 312	Cell and Molecular Biology	3
BIOS 322	Laboratory in Cell and Molecular Biology	1
BIOS 332 & BIOS 334	Genetics and Laboratory in Genetics	4
BIOS 381	Advanced Physiology	4
CHEM 301 & CHEM 311	Organic Chemistry I and Laboratory in Organic Chemistry I	4

CHEM 302 & CHEM 312	Organic Chemistry II and Laboratory in Organic Chemistry II	4
CHEM 350 & CHEM 351	Analytical Chemistry and Analytical Chemistry Lab	4
CHEM 410	Instrumental Analysis	2
CHEM 411	General Biochemistry I	3
CHEM 412	General Biochemistry II	3
CHEM 413	Laboratory in General Biochemistry	2
PHSC 460	Capstone Seminar	1
BBST 4653	Integration Seminar: Christianity and the Natural Sciences ⁴	3
Select 5 credits of electives from the following: ⁵		5
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 430	Advanced Organic Chemistry	
CHEM 470	Seminar in Advanced Chemistry and Biochemistry	
CHEM 480	Internship	
CHEM 490	Directed Research	
MATH 151	Calculus II	
MATH 318	Biostatistics	
PHSC 311	Computer Techniques in Science and Engineering	
PHSC 465	Special Topics in Physical Science	

Program Course Requirements: 75-78 credits

Core Curriculum Requirements (<https://catalog.biola.edu/academic-policies/undergraduate-core-curriculum-program/>) **51-55**

Total Credits **126-133**

¹ CHEM 107 is waived for students who meet the qualifications to enter CHEM 105. See the current Placement Options for (<https://www.biola.edu/academic-advising/incoming/placement-exams/chemistry-105/>)CHEM 105 or the department for more information.

² Fulfills the Behavioral Science Core Curriculum requirement.

³ All students who do not meet one of the Physics 111 Placement Options (<https://www.biola.edu/academic-advising/incoming/placement-exams/physics/>) must enroll in PHSC 100.

⁴ Fulfills the BBST 465 Biblical and Theological Studies Integration Seminar requirement.

⁵ 3 credits must be upper-division.

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 (<https://catalog.biola.edu/academic-policies/undergraduate-core-curriculum-program/>) for a list of approved Core Curriculum courses.

- **Biochemistry (p. 3)**
- **Pre-Medical Studies (p. 4)**

Biochemistry, B.S. (BCHM)

First Year		
Fall	Credits Spring	Credits
BBST 103 or 165	3 BBST 103 or 165	3
CHEM 105 & CHEM 115 (or CHEM 107 if needed per Department)	4 BIOS 111 & BIOS 113	4
ENGL 100 or 112	3 CHEM 106 & CHEM 116	4
GNST 102	1 HIST 200, 201, or POSC 225	3
MATH 150	4 KNES 107	1
PHSC 124	1	
	16	15
Second Year		
Fall	Credits Spring	Credits
BBST 209 or 210	3 BBST 209 or 210	3
CHEM 301 & CHEM 311	4 BBST 251	3
PHSC 111 & PHSC 117 (or PHSC 132 & 134)	4 CHEM 302 & CHEM 312	4
Fine Arts (see Core Curriculum)	3 PHSC 112 & PHSC 118 (or PHSC 233 & 237)	4
	14	14
Third Year		
Fall	Credits Spring	Credits
BBST 365	3 BBST 354	3
BIOS 312	3 CHEM 412	3
CHEM 380 or 402	3 CHEM 413	2
CHEM 411	3 CHEM, BIOS, MATH, or PHSC Elective (upper-division; see catalog for list)	3
CHEM, BIOS, MATH, or PHSC Elective (see catalog for list)	3 ENGL 313	3
Literature (see Core Curriculum)	3 Behavioral Science (see Core Curriculum)	3

Writing Competency Requirement (https://catalog.biola.edu/academic-policies/undergraduate-requirements-policies/#WritingCompetencyRequirement)		
	Graduation Application due in Registrar's Office	
	18	17
Fourth Year		
Fall	Credits Spring	Credits
BBST 300/400 Bible Elective	3 BBST 300/400 Bible Elective	3
BIOS 332 & BIOS 334	4 BBST 4653 (fulfills BBST 465 Integration Seminar requirement)	3
CHEM 350 & CHEM 351	4 CHEM 410	2
Communication (see Core Curriculum)	3 CHEM, BIOS, MATH, or PHSC Elective (see catalog for list)	3
KNES Activity (see Core Curriculum)	1 PHSC 460	1
	Philosophy (see Core Curriculum)	3
	15	15
Total Credits 124		

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 & CHEM 115 (or CHEM 107 if needed per Department)	4 BIOS 111 & BIOS 113	4
ENGL 100 or 112	3 CHEM 106 & CHEM 116	4
GNST 102	1 KNES 107	1
MATH 150	4 PSYC 200 (fulfills Behavioral Science Core Curriculum requirement)	3
PHSC 124	1	
	16	15
Second Year		
Fall	Credits Spring	Credits
BBST 209 or 210	3 BBST 209 or 210	3
BIOS 112 & BIOS 114	4 BBST 251	3
CHEM 301 & CHEM 311	4 CHEM 302 & CHEM 312	4
HIST 200, 201, or POSC 225	3 PHSC 112 & PHSC 118 (or PHSC 233 & 237)	4
PHSC 111 & PHSC 117 (or PHSC 132 & 134)	4 Fine Arts (see Core Curriculum)	3
	18	17
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
KNES Activity (see Core Curriculum)	1 Writing Competency Requirement (https://catalog.biola.edu/academic-policies/undergraduate-requirements-policies/#WritingCompetencyRequirement)	
Literature (see Core Curriculum)	3 Graduation Application due in Registrar's Office	
	17	15
Fourth Year		
Fall	Credits Spring	Credits
BBST 300/400 Bible Elective	3 BBST 300/400 Bible Elective	3
BIOS 332 & BIOS 334	4 BBST 4653 (fulfills BBST 465 Integration Seminar requirement)	3
CHEM 350 & CHEM 351	4 CHEM 410	2
Communication (see Core Curriculum)	3 CHEM, BIOS, MATH, or PHSC Elective (see catalog for list)	2
	PHSC 460	1
	Philosophy (see Core Curriculum)	3
	14	14
Total Credits 126		

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

- Biochemistry (p. 4)
- Pre-Medical Studies (p. 5)

Biochemistry, B.S. (BCHM)

First Year		
Fall	Credits Spring	Credits
HNRS 101	4 HNRS 105	4
HNRS 102	4 HNRS 106	4
CHEM 105 & CHEM 115 (or CHEM 107 if needed per Department)	4 BIOS 111 & BIOS 113	4
GNST 102	1 CHEM 106 & CHEM 116	4
MATH 150	4 KNES 107	1

PHSC 124	1		
	18		17
Second Year			
Fall	Credits	Spring	Credits
HNRS 210	4	HNRS 230	4
HNRS 215	4	HNRS 231	4
CHEM 301 & CHEM 311	4	CHEM 302 & CHEM 312	4
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 380 or 402	3	CHEM 413	2
CHEM 411	3	Major Elective (upper-division)	3
Writing Competency Requirement (https://catalog.biola.edu/academic-policies/undergraduate-requirements-policies/#WritingCompetencyRequiremer)			
	15		14
Fourth Year			
Fall	Credits	Spring	Credits
HNRS 443	4	HNRS 458	4
BIOS 332 & BIOS 334	4	BBST 4653 (fulfills BBST 465 Integration Seminar requirement)	3
CHEM 350 & CHEM 351	4	CHEM 410	2
Major Elective	3	PHSC 460	1
KNES Activity (see Core Curriculum)	1	Major Elective	3
	16		13

Total Credits 125

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 & CHEM 115 (or CHEM 107 if needed per Department)	4	BIOS 111 & BIOS 113	4
GNST 102	1	CHEM 106 & CHEM 116	4
MATH 150	4	KNES 107	1
PHSC 124	1		
	18		17
Second Year			
Fall	Credits	Spring	Credits
HNRS 210	4	HNRS 230	4
HNRS 215	4	HNRS 231	4

CHEM 301 & CHEM 311	4	CHEM 302 & CHEM 312	4
PHSC 111 & PHSC 117 (or PHSC 132 & PHSC 134)	4	PHSC 112 & PHSC 118 (or PHSC 233 & PHSC 237)	4
KNES Activity (see Core Curriculum)	1		
	17		16
Third Year			
Fall	Credits	Spring	Credits
HNRS 324	4	HNRS 337	4
HNRS 326	2	HNRS 339	2
BIOS 112 & BIOS 114	4	BIOS 381	4
BIOS 312	3	CHEM 412	3
CHEM 411	3	CHEM 413	2
Writing Competency Requirement (https://catalog.biola.edu/academic-policies/undergraduate-requirements-policies/#WritingCompetencyRequiremer)			
	16		15
Fourth Year			
Fall	Credits	Spring	Credits
HNRS 443	4	HNRS 458	4
BIOS 322	1	BBST 4653 (fulfills BBST 465 Integration Seminar requirement)	3
BIOS 332 & BIOS 334	4	CHEM 410	2
CHEM 350 & CHEM 351	4	PHSC 460	1
		Major Elective	2
		Major Elective (upper-division)	3
	13		15

Total Credits 127

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.