

# BS in Biochemistry

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70-75 units

Biochemistry is an interdisciplinary field of study that includes topics within chemistry and biology, with a focus on understanding chemical processes in living systems.

The Bachelor of Science in Biochemistry (<https://www.apu.edu/clas/programs/biochemistry-major/>) provides a rigorous curriculum and strong foundation in core chemistry and biology courses, with the option of the Pre-Health Professions Emphasis or the Research Emphasis. Additional course requirements provide a foundation in related fields (physics and mathematics), as well as breadth to the study of biochemistry.

The Pre-Health Professions Emphasis involves additional focus on genetics and physiology, with options to study anatomy, neurobiology, and advanced chemistry topics. This emphasis provides excellent preparation for graduate and professional studies in a variety of health fields, including but not limited to medicine, dentistry, optometry, chiropractic medicine, veterinary science, and pharmacy.

The Research Emphasis involves additional focus on physical chemistry and molecular biology, with options to study other advanced chemistry and biology topics. This emphasis provides excellent preparation for entry-level positions as a researcher or laboratory technician, and for graduate studies in fields such as, but not limited to, biochemistry, molecular biology, pharmacology, biotechnology, food science, forensic science, and environmental science. Students who attend graduate school and obtain a master's or doctoral degree may find employment at a university or in the private or government sectors.

Students in the BS in Biochemistry major are strongly encouraged to collaborate with science faculty in a research project or participate in an off-campus internship.

## Five-Year BS in Biochemistry Plus MS in Biotechnology Pathway

Undergraduate students can complete a Bachelor of Science in Biochemistry (Research Emphasis) and Master of Science in Biotechnology (<http://catalog.apu.edu/academics/college-liberal-arts-sciences/biology-chemistry/biotechnology-ms/>) in just five years. The combination of these two degrees prepares graduates for success in biotechnology careers. Biochemistry majors admitted to the MS in Biotechnology program can take up to 9 units of 500-level graduate coursework during their senior year, finishing the remaining 30 units for the master's degree over the next year (e.g., 6 units in the summer term, 9 units in the fall term, and 15 units in the spring term).

Students interested in completing this five-year pathway should apply to APU as a biochemistry major and by the end of their sophomore year declare the research emphasis. During their junior year (after completing BIOL 280 with C- or better), students must apply to the MS in Biotechnology program. The graduate application fee will be waived. Students must maintain a 3.0 GPA or higher to be considered for the MS program and five-year pathway.

Once a student has been accepted into the MS program, they can begin their graduate coursework in their senior year, according to the course requirements indicated in the catalog. For more information about this pathway, contact [biologyandchemistry@apu.edu](mailto:biologyandchemistry@apu.edu).

*Note: Entry requirements differ among graduate schools and jobs. Students are responsible for researching the requirements of graduate programs and professions in which they are interested.*

## BS in Biochemistry Requirements

All of the following requirements must be met to continue as an allied health, biological sciences, biochemistry, or chemistry major. A student's failure to maintain these requirements will result in him or her being dropped from the major. Reentry to the major is by petition only.

- Must maintain a minimum cumulative GPA of 2.0 in all biology, chemistry, biochemistry, math, and physics courses required for the major.
- Must complete each course required for the major with a C- or higher for the course to meet a degree requirement in the Department of Biology and Chemistry.
- Any single course within the major can be taken only two times at APU; students must change to a major outside the department after two unsuccessful (below C-) attempts in a single required course.
- Only two courses total within the major can be repeated; students must change to a major outside the department after unsuccessful (below C-) attempts in any three required courses.

Code	Title	Units
<b>Biochemistry</b>		
BIOC 270	Biomolecular Chemistry	4
BIOC 370	Biomolecular Metabolism	4
<b>Biology</b>		
BIOL 151	General Biology I <sup>1</sup>	4
BIOL 280	Cell Biology	4

BIOL 496	Writing 3: Ethics and the Sciences <sup>2</sup>	3
<b>Chemistry</b>		
CHEM 151	General Chemistry I <sup>1, 3</sup>	4
CHEM 152	General Chemistry II <sup>3</sup>	4
CHEM 251	Organic Chemistry: Theory I	3
CHEM 261	Organic Chemistry - Lab	1
CHEM 252	Organic Chemistry: Theory II	3
CHEM 262	Organic Chemistry - Lab	1
CHEM 300	Quantitative Chemical Analysis - Theory	2
CHEM 310	Quantitative Chemical Analysis - Laboratory	2
<b>Math</b>		
MATH 165	Calculus I	3
MATH 166	Calculus II	3
<b>Physics</b>		
Select one of the following:		8-10
PHYC 151 & PHYC 152	Physics for Life Sciences I and Physics for Life Sciences II <sup>1, 3</sup>	
PHYC 161 & PHYC 162	Physics for Science and Engineering I and Physics for Science and Engineering II <sup>1, 3</sup>	
<b>Research Emphasis: Additional Required Courses</b>		
BIOC 390 or CHEM 401	Physical Biochemistry Physical Chemistry I	3
BIOL 410	Molecular Biology	4
<b>Pre-Health Professions Emphasis: Additional Required Courses</b>		
BIOL 152	General Biology II	4
BIOL 300	Genetics <sup>4</sup>	4
BIOL 350	Mammalian Physiology	4
BIOL 396	Topics in Biology and Christian Thought <sup>5</sup>	1
<b>Required Elective Courses (see lists below)</b>		<b>7-10</b>
<b>Total Units</b>		<b>70-75</b>
<b>Code</b>	<b>Title</b>	<b>Units</b>
<b>Upper-Division Electives for the Biochemistry Major</b>		
Research Emphasis: Select 10+ elective units from below (must include at least one 4-unit course and at least one CHEM course):		
BIOL 300	Genetics <sup>4</sup>	
CHEM 320 & CHEM 330	Instrumental Analysis: Theory and Instrumental Analysis - Lab (Theory/Lab) <sup>4</sup>	
CHEM 402 & CHEM 412	Physical Chemistry II and Physical Chemistry II Lab	
CHEM 411	Physical Chemistry I Lab	
CHEM 451	Advanced Organic Chemistry	
CHEM 461	Inorganic Chemistry	
CHEM 495	Advanced Topics in Chemistry	
Select no more than one of the following:		
BIOL 326	Neurobiology <sup>4</sup>	
BIOL 346	Regional Human Anatomy	
BIOL 350	Mammalian Physiology	
Up to 3 units combined of BIOL 311, BIOL 312, BIOL 313, BIOL 394, BIOL 395, CHEM 311, CHEM 312, CHEM 313, CHEM 394, or CHEM 395 may count toward major elective units:		
BIOL/CHEM 311	Teaching and Learning in STEM	
BIOL/CHEM 312	STEM Education Research Seminar	
BIOL/CHEM 313	STEM Teaching Practicum	
BIOL 394	Directed Research Internship	

BIOL 395	Biological Science Internship
CHEM 394	Directed Research Internship
CHEM 395	Chemical Science Internship
Pre-Health Professions Emphasis: Select 7+ elective units from below (must include at least one 4-unit course):	
BIOC 390 or CHEM 401	Physical Biochemistry Physical Chemistry I
CHEM 320 & CHEM 330	Instrumental Analysis: Theory and Instrumental Analysis - Lab <sup>4</sup>
CHEM 402	Physical Chemistry II
CHEM 411	Physical Chemistry I Lab
CHEM 451	Advanced Organic Chemistry
CHEM 461	Inorganic Chemistry
CHEM 495	Advanced Topics in Chemistry
Only one of the following courses may count toward major elective units:	
BIOL 326	Neurobiology <sup>4</sup>
BIOL 336	Vertebrate Biology
BIOL 346	Regional Human Anatomy
BIOL 410	Molecular Biology
Up to 3 units combined of either BIOL 311, BIOL 312, BIOL 313, BIOL 394, BIOL 395, CHEM 311, CHEM 312, CHEM 313, CHEM 394, or CHEM 395 may count toward major elective units:	
BIOL/CHEM 311	Teaching and Learning in STEM
BIOL/CHEM 312	STEM Education Research Seminar
BIOL/CHEM 313	STEM Teaching Practicum
BIOL 394	Directed Research Internship
BIOL 395	Biological Science Internship
CHEM 394	Directed Research Internship
CHEM 395	Chemical Science Internship

- <sup>1</sup> Meets the General Education Natural Sciences requirement.  
<sup>2</sup> Meets the General Education Writing 3 requirement.  
<sup>3</sup> This course may be waived with an appropriate Advanced Placement test score.  
<sup>4</sup> Meets the General Education Integrative and Applied Learning requirement.  
<sup>5</sup> BIOL 152 meets this requirement if taken at APU.

## Program Learning Outcomes

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Students who successfully complete this program shall be able to:

1. Demonstrate a broad knowledge base in their chosen field.
2. Effectively communicate scientific ideas and research orally.
3. Effectively communicate scientific ideas and research in writing.
4. Demonstrate proficiency in problem solving and applying the scientific method to scientific questions.
5. Demonstrate laboratory skills and techniques.
6. Demonstrate knowledge of relevant laboratory instrumentation.
7. Express a Christian worldview that integrates faith with their vocation.