

# BS in Biological Sciences

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71-75 units

Biology is the study of life and living organisms, and is important to a variety of disciplines including medicine, pharmacology, ecology, botany, cytology, immunology, biochemistry, and biotechnology.

The Bachelor of Science in Biological Sciences (<https://www.apu.edu/clas/programs/biology-major/>) focuses on utilizing scientific knowledge to better understand living organisms and the wonders of God's world, providing a rigorous curriculum and strong foundation in core biology courses such as general biology, microbiology, and cell biology. Additional course requirements provide a foundation in related fields (chemistry, physics, and mathematics), and provide breadth to the study of biology. Students then use upper-division courses to specialize in ecological, biological systems, or cellular and molecular concentrations.

The BS in Biological Sciences degree provides excellent preparation for careers such as biomedical/pharmaceutical sales; elementary or secondary science teachers; technicians in conservation, agriculture, or food or health sciences; and university or hospital research. The program is also excellent preparation for graduate and professional degrees in medicine, dentistry, optometry, veterinary science, pharmacology, biotechnology, biomedical research, or university teaching positions. Students interested in a professional medical career may also consider APU's premedical/pre dental track (<http://catalog.apu.edu/academics/college-liberal-arts-sciences/preprofessional-programs/>), and students desiring to matriculate into a physical therapy or physician assistant program should explore the BS in Allied Health (<http://catalog.apu.edu/academics/college-liberal-arts-sciences/biology-chemistry/allied-health-bs/>).

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

*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.*

## Au Sable Institute of Environmental Studies

The Au Sable Institute (<https://ausable.org/>) serves evangelical Christian colleges by offering environmental studies in a natural environment at multiple sites in the United States and other countries. Azusa Pacific University students may attend the institute as part of APU's involvement with the Council for Christian Colleges & Universities (CCCU) (<https://www.cccu.org>) and receive credit for courses taken there with prior approval. Contact the Department of Biology and Chemistry for more information.

## Requirements

- 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>Biology</b>		
BIOL 151	General Biology I <sup>1</sup>	4
BIOL 152	General Biology II	4
BIOL 240	Biology of Microorganisms	4
BIOL 280	Cell Biology	4
BIOL 300	Genetics <sup>2</sup>	4
BIOL 396	Topics in Biology and Christian Thought <sup>3</sup>	1
BIOL 496	Writing 3: Ethics and the Sciences <sup>4</sup>	3
<b>Chemistry</b>		
CHEM 151	General Chemistry I <sup>1,5</sup>	4
CHEM 152	General Chemistry II	4
CHEM 251 & CHEM 261	Organic Chemistry: Theory I and Organic Chemistry - Lab	4

CHEM 252 & CHEM 262	Organic Chemistry: Theory II and Organic Chemistry - Lab	4
<b>Mathematics</b>		
MATH 165	Calculus I <sup>5</sup>	3
MATH 166	Calculus II <sup>5</sup>	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, 5</sup>	
PHYC 161 & PHYC 162	Physics for Science and Engineering I and Physics for Science and Engineering II <sup>1, 5</sup>	
<b>Additional Upper-Division Courses (See Below)</b>		<b>17-19</b>
<b>Total Units</b>		<b>71-75</b>

<sup>1</sup> Meets the General Education Natural Sciences requirement (BIOL 151, CHEM 151, PHYC 151, and PHYC 161).

<sup>2</sup> Meets the General Education Integrative and Applied Learning requirement.

<sup>3</sup> BIOL 152 meets this requirement if taken at APU.

<sup>4</sup> Meets the General Education Writing 3 requirement.

<sup>5</sup> This course may be waived with an appropriate Advanced Placement test score.

Select 17-18 additional units of upper-division courses (at least three 4-unit courses must be included) from the following course list OR select one of the following concentrations to complete upper-division course units.

Code	Title	Units
BIOC 360 or BIOC 270	Principles of Biochemistry <sup>1</sup> Biomolecular Chemistry	
BIOC 370	Biomolecular Metabolism <sup>1</sup>	
BIOL 311	Teaching and Learning in STEM <sup>2</sup>	
BIOL 312	STEM Education Research Seminar <sup>2</sup>	
BIOL 313	STEM Teaching Practicum <sup>2</sup>	
BIOL 320	Ecology <sup>3</sup>	
BIOL 326	Neurobiology <sup>4</sup>	
BIOL 342	Medical Microbiology	
BIOL 346	Regional Human Anatomy	
BIOL 350	Mammalian Physiology	
BIOL 365	Plant Biology	
BIOL 390	Pre-health Seminar <sup>2</sup>	
BIOL 394	Directed Research Internship <sup>2</sup>	
BIOL 395	Biological Science Internship <sup>2</sup>	
BIOL 410	Molecular Biology	
BIOL 420	Cancer Biology	
BIOL 425	Immunology	
BIOL 430	Global Change Biology	
BIOL 435	Stewardship Ecology	
BIOL 440	Developmental Biology	
BIOL 490	Biology Seminar <sup>2</sup>	
BIOL 494	Advanced Topics in Biology	
BIOL 495	Advanced Topics in Biology	

<sup>1</sup> Students should take BIOC 360 if taking only one semester of biochemistry. For a two-semester sequence, BIOC 270 and BIOC 370 should be taken. Credit will not be given for both BIOC 360 and BIOC 270, nor for both BIOC 360 and BIOC 370.

<sup>2</sup> Students may take a maximum of 3 units total from these courses for elective credit.

<sup>3</sup> Meets the General Education Civic Knowledge and Engagement requirement.

<sup>4</sup> Meets the General Education Integrative and Applied Learning requirement.

## Ecological Concentration (Additional Upper-Division Courses)

Select 17-18 additional units of 300- or 400-level courses, as follows:

Code	Title	Units
BIOL 320	Ecology <sup>1</sup>	4
PHIL 366	Environmental Ethics	3
BIOL 430	Global Change Biology	3
Units from field-study program <sup>2</sup>		4
<b>Select 3-4 additional units from the following:</b>		<b>3-4</b>
Additional units from field-study program <sup>3</sup>		
BIOL 311	Teaching and Learning in STEM <sup>4</sup>	
BIOL 312	STEM Education Research Seminar <sup>4</sup>	
BIOL 313	STEM Teaching Practicum <sup>4</sup>	
BIOL 350	Mammalian Physiology	
BIOL 365	Plant Biology	
BIOL 394	Directed Research Internship <sup>4</sup>	
BIOL 395	Biological Science Internship <sup>4</sup>	
BIOL 435	Stewardship Ecology	
<b>Total Units</b>		<b>17-18</b>

<sup>1</sup> Meets the General Education Civic Knowledge and Engagement requirement.

<sup>2</sup> Four units from an approved, off-campus field-study program such as the Au Sable Institute. An approved internship experience could be petitioned for these units as needed.

<sup>3</sup> Up to 4 additional units from an approved, off-campus field-study program.

<sup>4</sup> Students may take a maximum of 3 units total from these courses for elective credit.

## Biological Systems Concentration (Additional Upper-Division Courses)

Select 18-19 additional units of 300- or 400-level BIOC and BIOL courses, as follows:

Code	Title	Units
BIOL 326	Neurobiology <sup>1</sup>	4
BIOL 346	Regional Human Anatomy	4
BIOL 350	Mammalian Physiology	4
<b>Select 6-7 additional units from the following: <sup>2</sup></b>		<b>6-7</b>
BIOC 360	Principles of Biochemistry <sup>3</sup>	
BIOL 311	Teaching and Learning in STEM <sup>4</sup>	
BIOL 312	STEM Education Research Seminar <sup>4</sup>	
BIOL 313	STEM Teaching Practicum <sup>4</sup>	
BIOL 342	Medical Microbiology	
BIOL 390	Pre-health Seminar <sup>4</sup>	
BIOL 394	Directed Research Internship <sup>4</sup>	
BIOL 395	Biological Science Internship <sup>4</sup>	
BIOL 420	Cancer Biology	
BIOL 425	Immunology	
BIOL 440	Developmental Biology	
BIOL 490	Biology Seminar <sup>4</sup>	
BIOL 494	Advanced Topics in Biology	
BIOL 495	Advanced Topics in Biology	
<b>Total Units</b>		<b>18-19</b>

<sup>1</sup> Meets the General Education Integrative and Applied Learning requirement.

<sup>2</sup> If a student takes a 4-unit course, an additional 3 units of upper-division elective must be taken.

<sup>3</sup> Students interested in premed should take this course as one of their elective courses.

<sup>4</sup> Students may take a maximum of 3 units total from these courses for elective credit.

## Cellular and Molecular Concentration (Additional Upper-Division Courses)

Select 18 additional units of 300- or 400-level BIOC and BIOL courses, as follows:

Code	Title	Units
BIOL 410	Molecular Biology	4
Select one of the following:		4
BIOC 270	Biomolecular Chemistry <sup>1</sup>	
BIOC 360	Principles of Biochemistry <sup>1</sup>	
<b>Select 10 additional units from the following (must include at least one additional 4-unit course):</b>		<b>10</b>
BIOC 370	Biomolecular Metabolism <sup>1</sup>	
BIOL 311	Teaching and Learning in STEM <sup>2</sup>	
BIOL 312	STEM Education Research Seminar <sup>2</sup>	
BIOL 313	STEM Teaching Practicum <sup>2</sup>	
BIOL 326	Neurobiology <sup>3</sup>	
BIOL 350	Mammalian Physiology	
BIOL 390	Pre-health Seminar <sup>2</sup>	
BIOL 394	Directed Research Internship <sup>2</sup>	
BIOL 395	Biological Science Internship <sup>2</sup>	
BIOL 420	Cancer Biology	
BIOL 425	Immunology	
BIOL 440	Developmental Biology	
BIOL 490	Biology Seminar <sup>2</sup>	
BIOL 494	Advanced Topics in Biology	
BIOL 495	Advanced Topics in Biology	
<b>Total Units</b>		<b>18</b>

<sup>1</sup> Students should take BIOC 360 if taking only one semester of biochemistry. For a two-semester sequence, BIOC 270 and BIOC 370 should be taken. Credit will not be given for both BIOC 360 and BIOC 270, nor for both BIOC 360 and BIOC 370.

<sup>2</sup> Students may take a maximum of 3 units total from these courses for elective credit.

<sup>3</sup> Meets the General Education Integrative and Applied Learning requirement.

## Program Learning Outcomes

### Program Learning Outcomes

Students who successfully complete this program shall be able to:

1. Demonstrate a broad knowledge base in the field of biology.
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 biology vocation.