

Biochemistry, B.S.

Degree Offered

- Bachelor of Science

Students earning a B.S. in Biochemistry are not eligible to earn a B.S. or B.A. in Chemistry or Biology, a B.S. in Animal & Nutritional Sciences, or a minor in Biology.

Nature of the Program

The biochemistry curriculum prepares students for careers requiring a strong background in basic principles of the physical and life sciences. The program is a collaborative effort between the Divisions of Animal and Nutritional Sciences and Plant and Soil Sciences in the Davis College of Agriculture, Natural Resources and Design, and the Departments of Biology and Chemistry in the Eberly College of Arts and Sciences.

Students completing a biochemistry major are prepared for professional employment in the expanding fields of agricultural and environmental sciences, chemical industry, health-related industries and biotechnology-based industries. The curriculum provides students with the interdisciplinary background in biochemistry, biology, chemistry, mathematics, physics and molecular biology necessary as preparation for professional schools of human and veterinary medicine, dentistry, optometry, and pharmacy. It also provides strong preparation for graduate study in fields such as animal and plant agriculture, biochemistry, biology, molecular biology, genetics, biotechnology, chemistry, food science, nutrition and physiology. The curriculum is accredited by the American Society of Biochemistry and Molecular Biology. The degree requirements for a American Chemical Society certified degree can be met within the framework of the program.

Minors

All students have the possibility of earning one or more minors; list of all available minors and their requirements (<http://catalog.wvu.edu/undergraduate/minors/>). Please note that students may not earn a minor in their major field.

Admissions

- First Time Freshmen are admitted to the major directly. For the timely completion of the degree, it is recommended that students have a minimum MATH ACT of 22, a MATH SAT of 540, or an ALEKS score of 45.
- Students transferring from another major within WVU are admitted into the major if they meet the above criteria, or have completed CHEM 115, CHEM 115L, BIOL 115, and BIOL 115L with a C- or better in each, and have earned a minimum overall GPA of 2.0.
- Students transferring from another institution are admitted into the major if they meet the above criteria, or have completed CHEM 115, CHEM 115L, BIOL 115, and BIOL 115L with a C- or better in each, and have earned a minimum overall GPA of 2.0.

ADMISSION REQUIREMENTS 2024-2025

The Admission Requirements above will be the same for the 2024-2025 Academic Year.

Major Code: 1201

General Education Foundations

Please use this link to view a list of courses that meet each GEF requirement. (<http://registrar.wvu.edu/gef/>)

NOTE: Some major requirements will fulfill specific GEF requirements. Please see the curriculum requirements listed below for details on which GEFs you will need to select.

Code	Title	Hours
General Education Foundations		
F1 - Composition & Rhetoric		3-6
ENGL 101 & ENGL 102 or ENGL 103	Introduction to Composition and Rhetoric and Composition, Rhetoric, and Research Accelerated Academic Writing	
F2A/F2B - Science & Technology		4-6
F3 - Math & Quantitative Reasoning		3-4
F4 - Society & Connections		3
F5 - Human Inquiry & the Past		3
F6 - The Arts & Creativity		3

F7 - Global Studies & Diversity	3
F8 - Focus (may be satisfied by completion of a minor, double major, or dual degree)	9
Total Hours	31-37

Please note that not all of the GEF courses are offered at all campuses. Students should consult with their advisor or academic department regarding the GEF course offerings available at their campus.

Degree Requirements

- **Writing Requirement;** Biochemistry Bachelor of Science students fulfill the Writing and Communication Skills requirement by completing ENGL 101 and ENGL 102 (or ENGL 103), and at least two additional **SpeakWrite Certified Courses™** from: BIOL 115, BIOL 117, BIOL 219, BIOL 411L, CHEM 403.

Curriculum Requirements

Code	Title	Hours
University Requirements		30
Biochemistry Program Requirements		15
Biochemistry Major Requirements		75
Total Hours		120

University Requirements

Code	Title	Hours
General Education Foundations (GEF) 1, 2, 3, 4, 5, 6, 7, and 8 (31-37 Credits)		
Outstanding GEF Requirements 1, 4, 5, 6, and 7		18
ANRD 191	First-Year Seminar	1
General Electives		11
Total Hours		30

Biochemistry Program Requirements

Code	Title	Hours
STEM Foundations		15
MATH 155 or MATH 153 & MATH 154	Calculus 1 (Minimum grade of C-) Calculus 1a with Precalculus and Calculus 1b with Precalculus	
MATH 156	Calculus 2 (Minimum grade of C-)	
BIOL 115 & 115L	Principles of Biology and Principles of Biology Laboratory (Minimum grade of C-)	
STAT 211	Elementary Statistical Inference	
Total Hours		15

Biochemistry Major Requirements

Code	Title	Hours
Core Requirement		5
AGBI 199	Orientation to Biochemistry	
AGBI 410	Introductory Biochemistry (Minimum grade of C-)	
AGBI 410L	Introduction to Biochemistry Laboratory	
Biology Requirement		11
BIOL 117 & 117L	Introductory Physiology and Introductory Physiology Laboratory (Minimum grade of C-)	
BIOL 219 & 219L	The Living Cell and The Living Cell Laboratory (Minimum grade of C-)	
BIOL 310	Advanced Cellular/Molecular Biology	
Chemistry Requirement		28

CHEM 115 & 115L & CHEM 116 & CHEM 116L & CHEM 215 & CHEM 215L	Fundamentals of Chemistry 1 and Fundamentals of Chemistry 1 Laboratory and Fundamentals of Chemistry 2 and Fundamentals of Chemistry 2 Laboratory and Introductory Analytical Chemistry and Introductory Analytical Chemistry Laboratory (Minimum grade of C-)
CHEM 233	Organic Chemistry 1 (Minimum grade of C-)
CHEM 233L	Organic Chemistry 1 Laboratory (Minimum grade of C-)
CHEM 234	Organic Chemistry 2 (Minimum grade of C-)
CHEM 234L	Organic Chemistry 2 Laboratory (Minimum grade of C-)
CHEM 341	Physical Chemistry: Brief Course
CHEM 341L	Physical Chemistry: Brief Course Laboratory
CHEM 462	Biochemistry 2
CHEM 462L	Biochemistry 2 Laboratory

A track is required.**31**

Number of credits may vary depending on courses selected

Biochemistry Electives*

AEM 341 & 341L	General Microbiology and General Microbiology Laboratory
AEM 401 & 401L	Environmental Microbiology and Environmental Microbiology Laboratory
AEM 420	Soil Microbiology
AEM 445	Food Microbiology
AGBI 386	Undergraduate Research Experience 1
AGBI 403	Applied Biochemistry Literature
AGBI 486	Undergraduate Research Experience 2
AGBI 496	Senior Thesis
AGBI 497	Research
AGBI 498	Honors
ANPH 301	Introduction to Animal Physiology
ANPH 400	Growth and Lactation Physiology
ANPH 405L	Animal Physiology Laboratory
ANPH 424	Physiology of Reproduction
A&VS 402	Values and Ethics
A&VS 451	Current Literature in Animal Science
A&VS 496	Senior Thesis
A&VS 497	Research
BIOL 302	Biometry
BIOL 312	Introduction to Virology
BIOL 313	Molecular Basis of Cellular Growth
BIOL 324	Molecular Genetics
BIOL 324L	Molecular Genetics Laboratory
BIOL 335	Cell Physiology
BIOL 348	Neuroscience 1
BIOL 349	Neuroscience 2
BIOL 350 & 350L	Plant Physiology and Plant Physiology Laboratory
BIOL 386	Undergraduate Research
BIOL 410	Cell and Molecular Biology Methods
BIOL 411L	Introduction to Recombinant DNA Laboratory
BIOL 413	Molecular Endocrinology
BIOL 415	Epigenetics
BIOL 420	Genomics

BIOL 421	Experimental Biochemistry
BIOL 423	Biochemistry of Nucleic Acids and Proteins
BIOL 424	Protein Structure and Function
BIOL 425	Developmental Genetics
BIOL 426	Molecular Biology of Cancer
BIOL 436	General Animal Physiology
BIOL 440	Comparative Anatomy
BIOL 453	Molecular Basis of Disease
BIOL 454	Immunology
BIOL 455	Evolution of Infectious Diseases
BIOL 479	Principles of Systems Neuroscience
BIOL 486	Honors Investigation and Thesis
BIOL 496	Senior Thesis
BIOL 497	Research
CHEM 310 & 310L	Instrumental Analysis and Instrumental Analysis Laboratory
CHEM 312	Environmental Chemistry
CHEM 322	Inorganic Chemistry 1
CHEM 339L	Organic Syntheses Laboratory
CHEM 422	Inorganic Chemistry 2
CHEM 460 & 460L	Forensic Chemistry and Forensic Chemistry Laboratory
CHEM 496	Senior Thesis
CHEM 497	Research
ENTO 404 & 404L	Principles of Entomology and Principles of Entomology Laboratory
ENTO 412	Pest Management
FDST 445	Food Microbiology
FDST 445L	Food Microbiology Laboratory
FIS 432 & 432L	Forensic Biology and Forensic Biology Laboratory
GEN 371 & 371L	Principles of Genetics and Principles of Genetics Laboratory
GEN 440	Genetic Engineering Technologies
GEN 450	Applied Developmental Genetics
HN&F 460	Advanced Nutrition
HN&F 473	Medical Nutrition Therapy 1
HN&F 474	Medical Nutrition Therapy 2
HORT 330 & 330L	Plant Propagation and Plant Propagation Laboratory
PLSC 460	Plant Biochemistry
PLSC 497	Research
PPTH 401 & 401L	General Plant Pathology and General Plant Pathology Laboratory
VETS 302	Animal Pathology
VETS 401	Veterinary Anatomy
VETS 401L	Veterinary Anatomy Laboratory
VETS 405 & 405L	Parasitology and Parasitology Laboratory

Capstone Requirement

ASBMB Track, select one of the following options:

AGBI 386 & AGBI 486	Undergraduate Research Experience 1 and Undergraduate Research Experience 2
AGBI 403	Applied Biochemistry Literature

ACS Track, complete the following:

CHEM 402	Chemistry Capstone: Chemical Literature	
Total Hours		75

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Qualified Seniors interested in taking 500-level courses as part of their electives should contact their adviser.

AMERICAN CHEMICAL SOCIETY (ACS) TRACK

Code	Title	Hours
CHEM 310 & 310L	Instrumental Analysis and Instrumental Analysis Laboratory	4
CHEM 402	Chemistry Capstone: Chemical Literature	2
CHEM 322	Inorganic Chemistry 1	3
CHEM 497	Research	3
PHYS 111 & 111L	General Physics 1 and General Physics 1 Laboratory (Minimum grade of C-)	4
PHYS 112 & 112L	General Physics 2 and General Physics 2 Laboratory (Minimum grade of C-)	4
Biochemistry Electives (See list above)		11
Total Hours		31

SUGGESTED PLAN OF STUDY FOR THE AMERICAN CHEMICAL SOCIETY (ACS) TRACK

First Year

Fall	Hours	Spring	Hours
ANRD 191		1 AGBI 199	1
ENGL 101 (GEF 1)		3 BIOL 117 & 117L (GEF 8)	4
BIOL 115 & 115L (GEF 2)		4 CHEM 116 & 116L (GEF 8)*	4
CHEM 115 & 115L (GEF 8)*		4 MATH 156	4
MATH 155 (GEF 3)		4 GEF 4	3
		16	16

Second Year

Fall	Hours	Spring	Hours
BIOL 219 & 219L		4 CHEM 234 & 234L	4
CHEM 233 & 233L		4 STAT 211	3
PHYS 111 & 111L		4 PHYS 112 & 112L	4
ENGL 102		3 Biochemistry Elective 1 GEF 5	3
		15	17

Third Year

Fall	Hours	Spring	Hours
AGBI 410 & 410L		4 CHEM 462 & 462L	4
CHEM 215 & 215L		4 CHEM 322	3
BIOL 310		3 General Elective	3
GEF 6		3 GEF 7	3
		14	13

Fourth Year

Fall	Hours	Spring	Hours
CHEM 497		3 CHEM 310 & 310L	4
Biochemistry Elective 2		3 CHEM 402	2
CHEM 341 & 341L		4 Biochemistry Elective 3	3
General Elective		3 Biochemistry Elective 4	2
General Elective		2 General Elective	3
		15	14

Total credit hours: 120

AMERICAN SOCIETY OF BIOCHEMISTRY AND MOLECULAR BIOLOGY (ASBMB) TRACK

Code	Title	Hours
BIOL 313 or BIOL 410	Molecular Basis of Cellular Growth Cell and Molecular Biology Methods	3
BIOL 423	Biochemistry of Nucleic Acids and Proteins	3
Choose one of the following:		3
AGBI 386 & AGBI 486	Undergraduate Research Experience 1 and Undergraduate Research Experience 2	
AGBI 403	Applied Biochemistry Literature	
Select one of the following sequences:		8
PHYS 101 & 101L & PHYS 102 & PHYS 102L	Introductory Physics 1 and Introductory Physics 1 Laboratory and Introductory Physics 2 and Introductory Physics 2 Laboratory	
PHYS 111 & 111L & PHYS 112 & PHYS 112L	General Physics 1 and General Physics 1 Laboratory and General Physics 2 and General Physics 2 Laboratory	
Biochemistry Electives (see list above)		14
Total Hours		31

SUGGESTED PLAN OF STUDY FOR THE AMERICAN SOCIETY OF BIOCHEMISTRY AND MOLECULAR BIOLOGY (ASBMB) TRACK**First Year**

Fall	Hours	Spring	Hours
ANRD 191		1 BIOL 117 & 117L (GEF 8)	4
ENGL 101 (GEF 1)		3 CHEM 116 & 116L (GEF 8)*	4
BIOL 115 & 115L (GEF 2)		4 MATH 156	4
CHEM 115 & 115L (GEF 8)*		4 AGBI 199	1
MATH 155 (GEF 3)		4 GEF 4	3
		16	16

Second Year

Fall	Hours	Spring	Hours
BIOL 219 & 219L		4 CHEM 234 & 234L	4
CHEM 233 & 233L		4 STAT 211	3

PHYS 101 & 101L		4 PHYS 102 & 102L	4
ENGL 102		3 Biochemistry Elective 1 GEF 5	3 3
		15	17
Third Year			
Fall	Hours	Spring	Hours
AGBI 410 & 410L		4 BIOL 313 or 410	3
CHEM 215 & 215L		4 CHEM 341 & 341L	4
BIOL 310		3 CHEM 462 & 462L	4
GEF 6		3 GEF 7	3
		14	14
Fourth Year			
Fall	Hours	Spring	Hours
BIOL 423		3 Biochemistry Elective 4	4
Biochemistry Elective 2		4 Capstone	3
Biochemistry Elective 3		3 General Elective	3
General Elective		3 General Elective	3
General Elective		2	
		15	13

Total credit hours: 120

Degree Progress

- By the end of the second semester in the major (excluding summer), students must have, at minimum, completed MATH 126 with a minimum grade of C-.
- By the end of their third semester in the major students are expected to have completed BIOL 115, 116, 117, 118 and CHEM 115, 115L OR CHEM 115, 115L, 116, 116L, and BIOL 115, 116 with a minimum grade of C- in each course and an overall GPA of 2.0.
- Students must maintain a GPA of at least 2.0 in the major and overall.
- All majors must attend an advising session with their Biochemistry advisor each semester.

Students who do not meet those benchmarks may be removed from the major.

Major Learning Outcomes

BIOCHEMISTRY

Graduates will demonstrate a working knowledge in the following core concepts:

1. Energy is required by and transformed in biological systems.
2. Macromolecular structure determines function and regulation.
3. Information storage and flow are dynamic and interactive.
4. Discovery requires objective measurement, quantitative analysis, and clear communications.
5. The pervasive role evolution and homeostasis play in shaping the form and function of all biological molecules and organisms.