Biochemistry

Degree Offered

• Bachelor of Science

Students earning a BS in Biochemistry are NOT eligible to earn a BS or BA in Chemistry or Biology, a BS 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.

Performance Requirements

To maintain biochemistry major status and to graduate, students must maintain at least a 2.0 overall GPA and a 2.0 cumulative GPA in coursework in biology, chemistry, and biochemistry.

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.

FACULTY

ANIMAL AND NUTRITIONAL SCIENCES DIRECTOR

• Peter V. Schaeffer - PhD (University of Southern California)
  Professor of Regional science, Applied microeconomics

BIOLOGY CHAIR

• Richard B. Thomas - Ph.D.
  Professor of Physiological plant ecology, Forest ecology, Global climate change

CHEMISTRY CHAIR

• Gregory Dudley - Ph.D. (Massachusetts Institute of Technology)
  Eberly Family Distinguished Professor and Department Chair, Natural Product Synthesis, Organic Chemistry

PLANT AND SOIL SCIENCES DIRECTOR

• Sven Verlinden - PhD (Purdue University)
  Associate Professor of Horticulture, Post Harvest Physiology, Molecular Biology

PROFESSORS

• Ashok P. Bidwai - Ph.D.
  Molecular genetic analysis of protein kinase, CK2 in Drosophila

• Kenneth P. Blemings - Ph.D. (University of Wisconsin)
  Dean of the Honors College, Protein and Amino Acid Metabolism

• Mirjana Bulatovic-Danilovich - PhD (University of Ljubljana, Slovenia)
  Extension Specialist, Consumer Horticulture, Master Gardener Program Coordinator

• Rakesh Chandran - PhD (Virginia Tech)
  Weed management in horticultural systems, IPM, Innovative strategies for weed control
Biochemistry

- Jonathan R. Cumming - Ph.D. (Cornell University)
  Environmental plant physiology, Ecophysiology of root-mycorrhizal-soil interactions, Urban ecology
- Robert A. Dailey - Ph.D. (University of Wisconsin)
  Reproductive physiology
- Kevin Daly - Ph.D. (University of Arizona)
  Sensory neurobiology, Neural coding, Brain-behavior interactions, Comparative psycho-biology
- Stephen DiFazio - Ph.D. (Oregon State University)
  Plant genomics, Molecular ecology, Plant population genetics, Biotechnology risk assessment
- Terry Gullion - Ph.D. (William and Mary)
  Physical chemistry, Solid State NMR, Biological Materials, Polymers
- Lisa A. Holland - Ph.D. (University of North Carolina-Chapel Hill)
  Analytical chemistry, Micro-separations, High-throughput drug screening
- Jason Hubbart - PhD (University of Idaho-Moscow)
  Fresh water supply regimes, Biogeochemical cycling, Ecohydrology
- Jacek Jaczynski - Ph.D. (Oregon State University)
  Food Safety
- Charles Jaffe - Ph.D. (University of Colorado)
  Theoretical chemistry, Molecular dynamics, Chaotic systems
- P. Brett Kenney - Ph.D. (Kansas State University)
  Muscle protein functionality
- Fred L. King - Ph.D. (University of Virginia)
  Analytical chemistry, Mass spectrometry, Trace elements, Gas-phase chemistry
- Hillar Klandorf - Ph.D. (British Council for National Academic Awards)
  Oxidative stress and aging
- Kristen Matak - Ph.D. (Virginia Tech)
  Food science and human nutrition
- Louis M. McDonald - PhD (University of Kentucky)
  Soil Science, Soil Chemistry
- James B. McGraw
  Plant ecology: Evolutionary ecology of perennial plants, Conservation biology, Demography, Forest remote sensing
- Joseph S. Moritz - Ph.D. (Kansas State University)
  Effect of feed form on animal performance
- Daniel Panaccione - PhD (Purdue University)
  Plant Pathology, Mycology, Mycotoxins, Molecular Biology
- Yong-Lak Park - PhD (Iowa State University)
  Entomology, Geospatial Ecology of Insects, Integrated Pest Management, Spatial Interaction between Insect and Plant Diseases
- William T. Peterjohn - Ph.D.
  Ecosystem ecology
- Michelle Richards-Babb - PhD (Lehigh University)
  Director of the Office of Undergraduate Research, Chemical education
- Kenneth Showalter - Ph.D. (University of Colorado)
  Bennett Distinguished Professor, physical chemistry, Chemical kinetics, Multi-stability and oscillating chemical systems
- Jeffrey Skousen - Ph.D (Texas A&M University)
  Soil Science, Land Reclamation, Soil and Water Conservation, Watershed Restoration
- Bjorn Soderberg - Ph.D. (Royal Institute of Technology, Sweden)
  Organic synthesis using transition metals
- Robert L. Taylor - PhD (Mississippi State University)
  Poultry science, Immunology
- James A. Thompson - PhD (University of Minnesota)
  Soil Science, Pedology, Land Use
- Janet C. L. Tou - Ph.D. (University of Toronto)
  Human nutrition and foods
- Kung Wang - Ph.D. (Purdue University)
  Eberly Distinguished Professor of Chemistry, Organic chemistry
- Matthew Wilson - Ph.D. (Iowa State University)
  Reproductive physiology
• Jianbo Yao - Ph.D. (McGill University)
  Functional genomics

TEACHING PROFESSORS
• Margaret A. Minch - DVM (Ohio State University)
  Veterinary Medicine

ASSOCIATE PROFESSORS
• Kimberly M. Barnes - Ph.D. (University of Nebraska)
  Coordinator, Intercollegiate Undergraduate Program in Biochemistry; Lipid metabolism
• Vagner Benedito - PhD (Wageningen University, The Netherlands)
  Genetics and developmental biology, Plant genomics, Functional genetics and plant physiology
• Clifton P. Bishop - Ph.D. (University of Virginia)
  Molecular genetics, Developmental biology, Forensic biology
• Scott Bowdridge - Ph.D. (Virginia Tech)
  Veterinary immunology
• Sarah M. Farris - Ph.D. (University of Illinois at Urbana-Champaign)
  Evolution and development of the insect brain, Neuroanatomy
• Eugene E. Felton - Ph.D. (University of Missouri)
  Ruminant nutrition
• Fabien Goulay - Ph.D. (University of Rennes)
  Physical chemistry, Laser spectroscopy
• Thomas Griggs - PhD (Texas Tech University)
  Agronomy
• Jennifer Hawkins - Ph.D.
  Plant comparative genomics, Molecular evolution
• Jessica Hoover - PhD (University of Washington)
  Organometallics chemistry, Catalysis
• Marlon Knights - Ph.D. (West Virginia University)
  Reproductive physiology
• James B. Kotcon - PhD (University of Wisconsin)
  Plant Pathology, Agroecology, Nematology, Organic farming practices
• K. Marie Krause - Ph.D. (University of Wisconsin)
  Dairy science nutrition
• Justin Legleiter - Ph.D. (Carnegie Mellon University)
  Biophysical chemistry, Atomic force microscopy
• Melissa Olfert - Dr.P.H., M.S., R.D. (Loma Linda University)
  Human nutrition and foods
• Eugenia M. Pena-Yewtuhiw - PhD (University of Kentucky)
  Soil Science
• Rita V.M. Rio - Ph.D. (Yale University)
  Symbioses
• Stephen Valentine - Ph.D. (Indiana University)
  Mass spectrometric analysis of biomolecules
• Nicole Waterland - PhD (Ohio State University)
  Horticulture, Flower Senescence

CLINICAL ASSOCIATE PROFESSORS
• Donna Ford-Werntz - Ph.D. (Washington University/Missouri Botanical Garden)
  Plant systematics: Portulacaceae, West Virginia flora

TEACHING ASSOCIATE PROFESSORS
• Erin Battin - PhD (Clemson University)
  Bio-inorganic chemistry
• Dana Huebert-Lima - PhD (University of Wisconsin-Madison)
  Biology, Epigenetics
• Youyouun Moon - PhD (Ohio State University)
Horticulture
• Joshua Osbourn - Ph.D. (University of Pittsburgh)
  Organic chemistry
• Betsy Ratcliff - Ph.D. (University of Binghamton-SUNY)
  Physical chemistry
• Tabitha R. Razunguzwa - Ph.D. (West Virginia University)
  General chemistry
• Crystal Smith - Ed.D. (West Virginia University)
  Equine studies
• Jennifer Stueckle - Ph.D. (West Virginia University)
  Aquatic toxicology
• Mingming Xu - Ph.D. (Ohio University)
  Analytical chemistry
• Stephanie T. Young - Ph.D (West Virginia University)
  Molecular and Forensic Biology

ASSISTANT PROFESSORS
• Craig Barrett - Ph.D.
  Evolutionary biology
• Sadie Bergeron - Ph.D. (University of Massachusetts - Amherst)
  Developmental genetics
• Edward Brzostek - Ph.D.
  Forest ecology and Ecosystem modeling
• Andrew Dacks - Ph.D. (University of Arizona)
  Neurobiology
• Tim Driscoll - Ph.D. (Virginia Tech)
  Microbial metagenomics
• Daniel L. Frank - PhD (Virginia Tech)
  Extension specialist, horticulture
• Zachary Freedman - PhD (Rutgers University)
  Environmental Microbiology
• Jennifer Gallagher - Ph.D. (Yale University)
  Genetics
• Michael Gutensohn - PhD (University of Cologne, Germany)
  Plant biochemistry and genetics, Metabolic engineering, Plant-insect interactions
• Matthew Kasson - PhD (Pennsylvania State University)
  Forest pathology, fungal-insect interactions, fungal phylogenetics
• Teiya Kijimoto - PhD (Tokyo Institute of Technology)
  Evolutionary developmental biology of morphological diversification
• Nik Kovinich - PhD (Carleton University)
  Metabolic engineering, Metabolite transport, Plant metabolic response to stress
• Peng Li - Ph.D. (Texas Tech University)
  Micro-nano systems
• Melissa Marra - Ph.D., R.D. (Florida International University)
  Healthy aging and nutritional prevention of chronic disease
• Gary Marsat - Ph.D. (McGill University)
  Neuroscience
• Blake Mertz - Ph.D. (Iowa State University)
  Computational biophysics and chemistry
• Carsten Milsmann - Ph.D. (Ruhr University Bochum)
  Inorganic synthesis and spectroscopy
• Ember Morrissey - PhD (Virginia Commonwealth University)
  Environmental Microbiology
• Brian Popp - Ph.D. (University of Wisconsin-Madison)
  Organic and organometallic chemistry, Catalysis
• Kevin Shaffer - Ph.D. (West Virginia University)
  Extension livestock specialist
• Cangliang Shen - Ph.D. (Colorado State University)
  Food system and human health

**CLINICAL ASSISTANT PROFESSOR**

• Zach Fowler - Ph.D.
  Arboretum Director

**TEACHING ASSISTANT PROFESSORS**

• Kevin Barry - Ph.D. (University of Maryland)
  General biology
• David Davis - PhD (Virginia Tech)
  Landscape, turf, specialty crops
• Melissa Ely - Ph.D. (West Virginia University)
  General chemistry
• Amaris Guardiola - Ph.D.
  General biology
• John Navaratnam - Ph.D.
  General biology
• Mark R. Tinsley - Ph.D. (Leeds University)
  General chemistry, Physical chemistry

**SENIOR LECTURERS**

• Sue Raylman - Ph.D.
  Animal behavior
• Mark Schraf - M.S. (West Virginia University)
  Analytical chemistry
• Elizabeth Thomas - M.S. (Clemson University)
  Invertebrate zoology

**LECTURER**

• Sydha Salihu - Ph.D.
  Plant physiology

**PROFESSORS EMERITI**

• Barton Baker
• John Balasko
• Alan Biggs
• Gary Bissonnette
• William Bryan
• Harry O. Findlea
• Mannon Gallegly
• E. Keith Inskeep
• Paul Lewis
• William MacDonald
• Joseph Morton
• Robert S. Nakon
• John H. Penn
• Jeffrey L. Petersen
• Alan Sexstone
• Ronald B. Smart
• Anthony Winston

**Admissions**

Entering freshman are admitted directly into the major.

Students coming from another major can be admitted with a minimum overall GPA of 2.0.
Biochemistry

Benchmark Expectations

By the end of their third semester in the major students are expected to have completed BIOL 115, BIOL 117, and CHEM 115 OR CHEM 115, CHEM 116, and BIOL 115 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.

Click the appropriate link below to view the corresponding Biochemistry Track Requirements and Suggested Plans of Study.

- American Chemical Society (ACS) (p. 9)
- American Society of Biochemistry and Molecular Biology (ASBMB) (p. 10)

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.

**General Education Foundations**

<table>
<thead>
<tr>
<th>F1 - Composition &amp; Rhetoric</th>
<th>3-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 101 &amp; ENGL 102 or ENGL 103</td>
<td>Introduction to Composition and Rhetoric and Composition, Rhetoric, and Research Accelerated Academic Writing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>F2A/F2B - Science &amp; Technology</th>
<th>4-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>F3 - Math &amp; Quantitative Reasoning</td>
<td>3-4</td>
</tr>
<tr>
<td>F4 - Society &amp; Connections</td>
<td>3</td>
</tr>
<tr>
<td>F5 - Human Inquiry &amp; the Past</td>
<td>3</td>
</tr>
<tr>
<td>F6 - The Arts &amp; Creativity</td>
<td>3</td>
</tr>
<tr>
<td>F7 - Global Studies &amp; Diversity</td>
<td>3</td>
</tr>
<tr>
<td>F8 - Focus (may be satisfied by completion of a minor, double major, or dual degree)</td>
<td>9</td>
</tr>
</tbody>
</table>

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.

CURRICULUM 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 411, CHEM 403.

**University Requirements**

| ANRD 191 | First-Year Seminar |

GEF Requirements: number of credits will vary depending on overlap

**Program Core Requirements**

<table>
<thead>
<tr>
<th>AGBI 199</th>
<th>Orientation to Biochemistry</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGBI 410</td>
<td>Introductory Biochemistry (Minimum grade of C-)</td>
</tr>
<tr>
<td>AGBI 412</td>
<td>Introduction to Biochemistry Wet Laboratory (Minimum grade of C-)</td>
</tr>
</tbody>
</table>

**Biology Requirement**

<table>
<thead>
<tr>
<th>BIOL 115 &amp; BIOL 116</th>
<th>Principles of Biology and Principles of Biology Laboratory (Minimum grade of C-. May substitute BIOL 101-104)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 117 &amp; BIOL 118</td>
<td>Introductory Physiology and Introductory Physiology Laboratory (Minimum grade of C-)</td>
</tr>
<tr>
<td>BIOL 219 &amp; BIOL 220</td>
<td>The Living Cell and The Living Cell Laboratory (Minimum grade of C-)</td>
</tr>
<tr>
<td>BIOL 310</td>
<td>Advanced Cellular/Molecular Biology</td>
</tr>
</tbody>
</table>

**Chemistry Requirement**

Select one set (Minimum grade of C-):
CHEM 115 & 115L & CHEM 116 & CHEM 116L & CHEM 215 & CHEM 215L

Fundamentals of Chemistry and Fundamentals of Chemistry 1 - Laboratory
and Fundamentals of Chemistry and Fundamentals of Chemistry 2 - Laboratory
and Introductory Analytical Chemistry and Introductory Analytical Chemistry Laboratory

or:

CHEM 117 & 117L & CHEM 118 & CHEM 118L

Principles of Chemistry 1 and Principles of Chemistry 1 - Laboratory
and Principles of Chemistry 2 and Principles of Chemistry 2 - Laboratory

and all of the following:

CHEM 233 & CHEM 234 & CHEM 235 & CHEM 236 & CHEM 341 & CHEM 342 & CHEM 462 & CHEM 464

Organic Chemistry (Minimum grade of C-)
Organic Chemistry (Minimum grade of C-)
Organic Chemistry Laboratory (Minimum grade of C-)
Organic Chemistry Laboratory (Minimum grade of C-)
Physical Chemistry: Brief Course
Experimental Physical Chemistry
Biochemistry 2
Biochemistry 2 Laboratory

**Mathematics and Statistics Requirement**

- Minimum grade of C-
- MATH 155 or MATH 153 & MATH 154
- MATH 156
- STAT 211

**A track is required.**

Number of credits may vary depending on courses selected

**Biochemistry Electives**

- AEM 341: General Microbiology
- AEM 401: Environmental Microbiology
- 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
- AGBI 512: Nutritional Biochemistry
- AGBI 513: Nutritional Biochemistry Laboratory
- AGBI 514: Animal Biotechnology
- ANPH 301: Introduction to Animal Physiology
- ANPH 400: Growth and Lactation Physiology
- ANPH 405: 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
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>BIOL 324</td>
<td>Molecular Genetics &amp; Molecular Genetics Laboratory</td>
</tr>
<tr>
<td>BIOL 335</td>
<td>Cell Physiology</td>
</tr>
<tr>
<td>BIOL 348</td>
<td>Neuroscience 1</td>
</tr>
<tr>
<td>BIOL 349</td>
<td>Neuroscience 2</td>
</tr>
<tr>
<td>BIOL 350</td>
<td>Plant Physiology</td>
</tr>
<tr>
<td>BIOL 386</td>
<td>Undergraduate Research</td>
</tr>
<tr>
<td>BIOL 410</td>
<td>Cell and Molecular Biology Methods</td>
</tr>
<tr>
<td>BIOL 411</td>
<td>Introduction to Recombinant DNA</td>
</tr>
<tr>
<td>BIOL 413</td>
<td>Molecular Endocrinology</td>
</tr>
<tr>
<td>BIOL 414</td>
<td>Molecular Endocrinology-Laboratory</td>
</tr>
<tr>
<td>BIOL 415</td>
<td>Epigenetics</td>
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<tr>
<td>BIOL 420</td>
<td>Genomics</td>
</tr>
<tr>
<td>BIOL 423</td>
<td>Biochemistry of Nucleic Acids and Proteins</td>
</tr>
<tr>
<td>BIOL 424</td>
<td>Protein Structure and Function</td>
</tr>
<tr>
<td>BIOL 425</td>
<td>Developmental Genetics</td>
</tr>
<tr>
<td>BIOL 426</td>
<td>Molecular Biology of Cancer</td>
</tr>
<tr>
<td>BIOL 432</td>
<td>Forensic Biology</td>
</tr>
<tr>
<td>BIOL 436</td>
<td>General Animal Physiology</td>
</tr>
<tr>
<td>BIOL 440</td>
<td>Comparative Anatomy</td>
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<tr>
<td>BIOL 441</td>
<td>Vertebrate Microanatomy</td>
</tr>
<tr>
<td>BIOL 453</td>
<td>Molecular Basis of Disease</td>
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<tr>
<td>BIOL 454</td>
<td>Immunology</td>
</tr>
<tr>
<td>BIOL 479</td>
<td>Principles of Systems Neuroscience</td>
</tr>
<tr>
<td>BIOL 486</td>
<td>Honors Investigation and Thesis</td>
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<tr>
<td>BIOL 496</td>
<td>Senior Thesis</td>
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<tr>
<td>BIOL 497</td>
<td>Research</td>
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<tr>
<td>CHEM 310</td>
<td>Instrumental Analysis</td>
</tr>
<tr>
<td>CHEM 312</td>
<td>Environmental Chemistry</td>
</tr>
<tr>
<td>CHEM 339</td>
<td>Organic Syntheses</td>
</tr>
<tr>
<td>CHEM 422</td>
<td>Intermediate Inorganic Chemistry</td>
</tr>
<tr>
<td>CHEM 460</td>
<td>Forensic Chemistry</td>
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<tr>
<td>CHEM 496</td>
<td>Senior Thesis</td>
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<tr>
<td>CHEM 497</td>
<td>Research</td>
</tr>
<tr>
<td>CHEM 514</td>
<td>Mass Spectrometry Principles and Practices</td>
</tr>
<tr>
<td>CHEM 516</td>
<td>Bioanalytical Chemistry</td>
</tr>
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<td>CHEM 548</td>
<td>Biophysical Chemistry</td>
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<tr>
<td>CHEM 552</td>
<td>Biochemical Toxicology</td>
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<tr>
<td>ENTO 404</td>
<td>Principles of Entomology</td>
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<tr>
<td>ENTO 412</td>
<td>Pest Management</td>
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<tr>
<td>FDST 445</td>
<td>Food Microbiology</td>
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<tr>
<td>FDST 449</td>
<td>Food Microbiology Lab</td>
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<tr>
<td>GEN 371</td>
<td>Principles of Genetics</td>
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<tr>
<td>HN&amp;F 460</td>
<td>Advanced Nutrition</td>
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<tr>
<td>HN&amp;F 473</td>
<td>Medical Nutrition Therapy 1</td>
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<tr>
<td>HN&amp;F 474</td>
<td>Medical Nutrition Therapy 2</td>
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<tr>
<td>HORT 330</td>
<td>Plant Propagation</td>
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<tr>
<td>PLSG 497</td>
<td>Research</td>
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<tr>
<td>PPTH 401</td>
<td>General Plant Pathology</td>
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<tr>
<td>VETS 302</td>
<td>Animal Pathology</td>
</tr>
<tr>
<td>VETS 401</td>
<td>Veterinary Anatomy</td>
</tr>
<tr>
<td>VETS 405</td>
<td>Parasitology</td>
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</tbody>
</table>
### Capstone Requirement

ASBMB Track, select one of the following options:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>AGBI 386</td>
<td>Undergraduate Research Experience 1</td>
</tr>
<tr>
<td>&amp; AGBI 486</td>
<td>and Undergraduate Research Experience 2</td>
</tr>
<tr>
<td>AGBI 403</td>
<td>Applied Biochemistry Literature</td>
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</table>

ACS Track, complete both of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>CHEM 401</td>
<td>Chemical Literature</td>
</tr>
<tr>
<td>&amp; CHEM 403</td>
<td>and Undergraduate Seminar</td>
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</tbody>
</table>

### General Electives

Number of electives may vary depending on course options selected

Total Hours 120

### AMERICAN CHEMICAL SOCIETY (ACS) TRACK

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>CHEM 310</td>
<td>Instrumental Analysis</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 401</td>
<td>Chemical Literature (Minimum grade of C-)</td>
<td>1</td>
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<tr>
<td>CHEM 403</td>
<td>Undergraduate Seminar</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 422</td>
<td>Intermediate Inorganic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 497</td>
<td>Research</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 111</td>
<td>General Physics (Minimum grade of C-)</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 112</td>
<td>General Physics (Minimum grade of C-)</td>
<td>4</td>
</tr>
</tbody>
</table>

Biochemistry Electives (See list above)

12

Total Hours 31

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

#### First Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours</th>
<th>Spring</th>
<th>Hours</th>
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<tbody>
<tr>
<td>ANRD 191</td>
<td>1</td>
<td>AGBI 199</td>
<td>1</td>
</tr>
<tr>
<td>ENGL 101 (GEF 1)</td>
<td>3</td>
<td>BIOL 117 &amp; BIOL 118 (GEF 8)</td>
<td>4</td>
</tr>
<tr>
<td>BIO 115 &amp; BIOL 116 (GEF 2)</td>
<td>4</td>
<td>CHEM 116 &amp; 116L (GEF 8) *</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 115 &amp; 115L (GEF 8) *</td>
<td>4</td>
<td>MATH 156</td>
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#### Second Year

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#### Third Year

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### Fourth Year

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<td>CHEM 422</td>
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<td>CHEM 403 (Capstone)</td>
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Total credit hours: 120

* CHEM 117/117L and 118/118L may be substituted for CHEM 115/115L, 116/116L, and 215/215L.

### AMERICAN SOCIETY OF BIOCHEMISTRY AND MOLECULAR BIOLOGY (ASBMB) TRACK

**BIOL 313** Molecular Basis of Cellular Growth 3

or **BIOL 410** Cell and Molecular Biology Methods

**BIOL 423** Biochemistry of Nucleic Acids and Proteins 3

Choose one of the following: 3

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

Choose one of the following: 8

- PHYS 101 Introductory Physics 1
- PHYS 102 and Introductory Physics 2
- PHYS 101 Introductory Physics 1
- PHYS 112 and General Physics
- PHYS 111 General Physics
- PHYS 112 and General Physics
- PHYS 111 General Physics
- PHYS 102 and Introductory Physics 2

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

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<th>Fall</th>
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<th>Spring</th>
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<tr>
<td>BIOL 219</td>
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CHEM 233 & CHEM 235 4 CHEM 234 & CHEM 236
PHYS 101 or 111 4 PHYS 102 or 112
STAT 211 3 Biochemistry Elective 1

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Third Year

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<th>Hours</th>
<th>Spring</th>
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<tr>
<td>AGBI 410 &amp; AGBI 412</td>
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Fourth Year

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15 13

Total credit hours: 120

* CHEM 117/117L and 118/118L may be substituted for CHEM 115/115L, 116/116L, and 215/215L.

**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.

**AGBI 191. First-Year Seminar. 1-3 Hours.**

Engages students in active learning strategies that enable effective transition to college life at WVU. Students will explore school, college and university programs, policies and services relevant to academic success. Provides active learning activities that enable effective transition to the academic environment. Students examine school, college and university programs, policies and services.

**AGBI 199. Orientation to Biochemistry. 1,2 Hour.**

Orientation to degree programs and requirements, departmental resources, curriculum options, student responsibilities and opportunities.

**AGBI 293. Special Topics. 1-6 Hours.**

PR: Consent. Investigation of topics not covered in regularly scheduled courses.

**AGBI 298. Honors. 1-3 Hours.**

PR: Students in Honors Program and consent by the honors director. Independent reading, study, or research.

**AGBI 386. Undergraduate Research Experience 1. 1,2 Hour.**

PR: At least sophomore standing and faculty permission. Students will write a research proposal, conduct supervised research, and write a progress report. This course is the first of a two-course sequence that leads to a research-based capstone experience. Students must also complete AGBI 486 for this to serve as the Biochemistry Capstone course.

**AGBI 393. Special Topics. 1-6 Hours.**

PR: Consent. Investigation of topics not covered in regularly scheduled courses.
AGBI 401. Senior Seminar in Biochemistry. 1 Hour.
PR: Senior standing in biochemistry. Students select a topic at the forefront of biochemistry and gather information on the subject. Students then read, critically evaluate, write about the subject and present the topic in a seminar.

AGBI 403. Applied Biochemistry Literature. 3 Hours.
PR: Senior standing. Biochemistry Capstone Experience involving literature review, grant writing, and orally defending a proposal.

AGBI 410. Introductory Biochemistry. 3 Hours.
PR: CHEM 231 or (CHEM 233 and CHEM 235). Introduction to chemistry of cellular constituents (proteins, amino acids, carbohydrates, lipids, nucleic acids, enzymes and coenzymes) and their metabolism in animals and plants.

AGBI 411. Introductory Biochemistry Laboratory. 1 Hour.
PR or CONC: AGBI 410. Experiments to demonstrate certain principles and properties of animal and plant biochemicals.

AGBI 412. Introduction to Biochemistry Wet Laboratory. 1 Hour.
PR or CONC: AGBI 410 or Consent. Classic and modern techniques in biochemistry.

AGBI 480. Assigned Topics. 1-4 Hours.

AGBI 486. Undergraduate Research Experience 2. 2-4 Hours.
PR: AGBI 386 and faculty permission. Continuation of a research-based Capstone Experience where students will conduct supervised research, present their research, and prepare a final report. This course is the second of a two-course research-based sequence and must be completed after AGBI 386 to count as the capstone experience.

AGBI 490. Teaching Practicum. 1-3 Hours.
PR: Consent. Teaching practice as a tutor or assistant.

AGBI 491. Professional Field Experience. 1-18 Hours.
PR: Consent. (May be repeated up to a maximum of 18 hours.) Prearranged experiential learning program, to be planned, supervised, and evaluated for credit by faculty and field supervisors. Involves temporary placement with public or private enterprise for professional competence development.

AGBI 492. Directed Study. 1-3 Hours.
Directed study, reading, and or research.

AGBI 493. Special Topics. 1-6 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

AGBI 494. Seminar. 1-3 Hours.
PR: Consent. Presentation and discussion of topics of mutual concern to students and faculty.

AGBI 495. Independent Study. 1-6 Hours.
Faculty-supervised study of topics not available through regular course offerings.

AGBI 496. Senior Thesis. 1-3 Hours.
PR: Consent.

AGBI 497. Research. 1-6 Hours.
Independent research projects.

AGBI 498. Honors. 1-3 Hours.
PR: Students in honors program and consent by the honors director. Independent reading, study or research.