Biochemistry

Degree Offered
Bachelor of Science

Nature of 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 Division of Animal and Nutritional 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 modeled after the American Society of Biochemistry and Molecular Biologists guidelines. 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
• Robert L. Taylor - Ph.D. (Mississippi State University)
  Professor of Poultry Science, Animal physiology, Immunology

BIOLOGY CHAIR
• Richard B. Thomas
  Professor of Physiological plant ecology, Forest ecology, Global climate change

CHEMISTRY CHAIR
• Kung Wang - Ph.D. (Purdue University)
  Eberly Distinguished Professor of Chemistry, Organic chemistry, Stereoselective synthesis, Natural products

PROFESSORS
• Ashok P. Bidwai - Ph.D.
  Molecular genetic analysis of protein kinase, CK2 in Drosophila
• Kenneth P. Blemings - Ph.D. (University of Wisconsin)
  Nutritional Biochemistry, Protein and Amino Acid Metabolism, Curriculm Committee Chair, Intercollegiate Undergraduate Program in Biochemistry
• Jonathan R. Cumming - Ph.D. (Cornell University)
  Associate Provost for Graduate Academic Affairs. Environmental plant physiology, Ecophysiology of root-mycorrhizal-soil interactions, Urban ecology
• Robert A. Dailey - Ph.D. (University of Wisconsin)
  Reproductive physiology
• Harry O. Finklea - Ph.D. (California Institute of Technology)
  Analytical/physical chemistry, Electron transfer kinetics, Solid oxide fuel cells, Gas phase sensors
• Jorge A. Flores - Ph.D. (The George Washington)
  Animal physiology: endocrinology of reproduction
• Keith Garbutt - Ph.D. (University of Wales)
  Dean, University Honors College, Population genetics: Ecological genetics and population biology of weedy plants
• Terry Gullion - Ph.D. (William and Mary)
Physical chemistry, Solid State NMR, Biological Materials, Polymers

- E. Keith Inskeep - Ph.D. (University of Wisconsin)
  Reproductive physiology
- Jacek Jaczynski - Ph.D. (Oregon State University)
  Food Safety
- Charles Jaffe - Ph.D. (University of Colorado)
  Theoretical chemistry, Molecular dynamics, Chaotic systems
- Jeryl C. Jones - D.V.M., Ph.D. (Auburn University)
  Veterinary radiology
- Robert Jones - Ph.D. (SUNY College)
  Dean of the Eberly College of Arts and Sciences. Forest ecology.
- 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
- Gerald E. Lang
  Plant ecology, Biogeochemistry, Wetland ecology
- 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
- John H. Penn - Ph.D. (University of Wisconsin-Madison)
  Chemical education, On-line instruction methods in organic chemistry
- Jeffrey L. Petersen - Ph.D. (University of Wisconsin-Madison)
  Associate Chairperson, Physical inorganic chemistry, Electrophilic transition metal complexes, X-ray crystallography
- Kenneth Showalter - Ph.D. (University of Colorado)
  Bennett Distinguished Professor, physical chemistry, Chemical kinetics, Multi-stability and oscillating chemical systems
- Bjorn Soderberg - Ph.D. (Royal Institute of Technology, Sweden)
  Organic synthesis using transition metals
- Michele Wheatly
  Provost. Comparative physiology.

ASSOCIATE PROFESSORS

- Jim H. Belanger
  Neuroethology adaptive behavior, Comparative physiology
- Suzanne Bell - Ph.D. (University New Mexico)
  Analytical chemistry, Forensic science
- Clifton P. Bishop - Ph.D. (University of Virginia)
  Molecular genetics, Developmental biology, Forensic biology
- Kevin C. 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
- 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
- Lisa A. Holland - Ph.D. (University of North Carolina-Chapel Hill)
  Analytical chemistry, Micro-separations, High-throughout drug screening
- Glen Jackson - Ph.D. (West Virginia University)
  Mass spectrometry, forensic chemistry
- Philip E. Keeting
  Molecular endocrinology, Cancer biology
- Marlon Knights - Ph.D. (West Virginia University)
  Reproductive physiology
• K. Marie Krause - Ph.D. (University of Wisconsin)
  Dairy science nutrition
• Kristen Mata - Ph.D. (Virginia Tech)
  Food science and human nutrition
• Susan N. Partington - Ph.D., R.D. (University of Wisconsin)
  Nutrition environment
• William T. Peterjohn
  Ecosystem ecology: Effects of global change on ecosystem dynamics, Nitrogen cycling in natural ecosystems.
• Michelle Richards-Babb - Ph.D. (Lehigh University)
  Chemical education
• Rita V.M. Rio - Ph.D. (Yale University)
  Symbioses
• X. Michael Shi - Ph.D. (University of Maryland)
  Organic synthesis, Bioorganic chemistry
• Ronald B. Smart - Ph.D. (University of Michigan)
  Environmental analytical chemistry, Electrochemistry, Trace metals, Coal chemistry
• Alan M. Stolzenberg - Ph.D. (Stanford University)
  Inorganic chemistry, Bio-inorganic chemistry, Organometallic chemistry
• Janet C. L. Tou - Ph.D. (University of Toronto)
  Human nutrition and foods
• Michelle D. Withers - Ph.D. (University of Arizona)
  Biology education, Neurobiology
• Jianbo Yao - Ph.D. (McGill University)
  Functional genomics

CLINICAL ASSOCIATE PROFESSORS
• Donna Ford-Werntz - Ph.D. (Washington University/Missouri Botanical Garden)
  Plant systematics: Portulacaceae, West Virginia flora
• Margaret A. Minch - D.V.M. (The Ohio State University)
  Veterinary medicine

ASSISTANT PROFESSORS
• Kimberly M. Barnes - Ph.D. (University of Nebraska)
  Lipid metabolism
• Scott Bowdridge - Ph.D. (Virginia Tech)
  Veterinary immunology
• Jonathan Boyd - Ph.D. (Texas Tech University)
  Analytical biochemistry and toxicology
• Fabien Goulay - Ph.D. (University of Rennes, France)
  Physical chemistry, Laser spectroscopy
• Jennifer Hawkins
  Plant comparative genomics, Molecular evolution
• Jessica Hoover - Ph.D. (University of Washington)
  Organometallics chemistry, Catalysis
• Justin Legleiter - Ph.D. (Carnegie Mellon University)
  Biophysical chemistry, Atomic force microscopy
• Melissa Marra - Ph.D., R.D. (Florida International University)
  Healthy aging and nutritional prevention of chronic disease
• Joseph W. McFadden - Ph.D. (Virginia Tech)
  Lipid metabolism and metabolomics
• Blake Mertz - Ph.D. (Iowa State University)
  Computational biophysics and chemistry
• Melissa Olfert - Ph.D., M.S., R.D. (Loma Linda University)
  Health and wellness
• Brian Popp - Ph.D. (University of Wisconsin-Madison)
  Organic and organometallic chemistry, Catalysis
• Stephen Valentine - Ph.D. (Indiana University)
Mass spectrometric analysis of biomolecules

TEACHING ASSISTANT PROFESSORS
• Erin Battin - Ph.D. (Clemson University)
  Bio-inorganic chemistry
• Tabitha Chigwada - Ph.D. (West Virginia University)
  Physical chemistry
• Megan Govidan - M.P.H., M.S., R.D. (West Virginia University)
  Human nutrition and foods
• Dana Huebert-Lima - Ph.D. (University of Wisconsin-Madison)
  Epigenetics
• Kevin Lee
  Virology, Cell and molecular biology methods
• Catherine Merovich - Ph.D. (Western Michigan University)
  Amphibian conservation
• Joshua Osbourn - Ph.D. (University of Pittsburgh)
  Organic chemistry
• Betsy Ratcliff - Ph.D. (University of Binghamton-SUNY)
  Physical chemistry
• Jennifer Robertson-Honecker - Ph.D. (West Virginia University)
  Analytical chemistry, Science education
• Valerie Smith - Ph.D. (Clemson University)
  Organic chemistry
• 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

SENIOR LECTURERS
• Sue Raylman - Ph.D.
  Animal behavior
• Mark Schraf - M.S. (West Virginia University)
  Analytical chemistry
• Susan Studiar
  Bryology and botany
• Beth Thomas - M.S. (Clemson University)
  Invertebrate zoology

PROFESSORS EMERITI
• Charles H. Baer
• David F. Blaydes
• Roy B. Clarkson
• William E. Collins
• Dorothy C. Dunning
• Ramsey H. Frist
• Roland B. Guthrie
• Denis W. H. MacDowell - Ph.D. (Massachusetts Institute of Technology)
  Organic chemistry
• Joseph A. Marshall
• Ethel C. Montiegel
• Robert S. Nakon - Ph.D. (Texas A&M University)
  Inorganic chemistry
• Richard P. Sutter
• Leah A. Williams
• Anthony Winston - Ph.D. (Duke University)
  Polymer chemistry

GENERAL EDUCATION CURRICULUM

Please use this link to view a list of courses that meet each GEC requirement. (http://registrar.wvu.edu/current_students/general_education_curriculum)

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

<table>
<thead>
<tr>
<th>General Education Curriculum</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ENGL 101 &amp; ENGL 102 or ENGL 103</td>
<td>Composition and Rhetoric and Composition and Rhetoric or Accelerated Academic Writing</td>
</tr>
<tr>
<td>GEC 2A - Mathematics</td>
<td>3-4</td>
</tr>
<tr>
<td>GEC 2B - Natural and Physical Science</td>
<td>7-8</td>
</tr>
<tr>
<td>GEC 2C - Additional GEC 2A, B or C</td>
<td>3</td>
</tr>
<tr>
<td>GEC 3 - The Past and Its Traditions</td>
<td>3</td>
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<tr>
<td>GEC 4 - Issues of Contemporary Society</td>
<td>3</td>
</tr>
<tr>
<td>GEC 5 - Artistic Expression</td>
<td>3</td>
</tr>
<tr>
<td>GEC 6 - The Individual in Society</td>
<td>3</td>
</tr>
<tr>
<td>GEC 6F - First Year Seminar</td>
<td>1-3</td>
</tr>
<tr>
<td>GEC 7 - American Culture</td>
<td>3</td>
</tr>
<tr>
<td>GEC 8 - Western Culture</td>
<td>3</td>
</tr>
<tr>
<td>GEC 9 - Non-Western Culture</td>
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<td><strong>Total Hours</strong></td>
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CURRICULUM REQUIREMENTS

University Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>WVUE 191</td>
<td>First Year Seminar</td>
</tr>
<tr>
<td>GEC Requirements: number of credits will vary depending on overlap</td>
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Writing Course

Program Core Requirements

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<tr>
<th>Course</th>
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<tbody>
<tr>
<td>AGBI 199</td>
<td>Orientation to Biochemistry</td>
</tr>
<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>
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</table>

Biology Requirement

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BIOL 115</td>
<td>Principles of Biology (Minimum grade of C. May substitute BIOL 101-104)</td>
</tr>
<tr>
<td>BIOL 117</td>
<td>Introductory Physiology (Minimum grade of C)</td>
</tr>
<tr>
<td>BIOL 219</td>
<td>The Living Cell (Minimum grade of C)</td>
</tr>
<tr>
<td>BIOL 310</td>
<td>Advanced Cellular/Molecular Biology</td>
</tr>
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</table>

Chemistry Requirement

Select 1 group (Minimum grade of C)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CHEM 115 &amp; CHEM 116 &amp; CHEM 215 or CHEM 117 &amp; CHEM 118</td>
<td>Fundamentals of Chemistry and Fundamentals of Chemistry and Introductory Analytical Chemistry Principles of Chemistry and Principles of Chemistry</td>
</tr>
<tr>
<td>CHEM 233</td>
<td>Organic Chemistry (Minimum grade of C)</td>
</tr>
<tr>
<td>CHEM 234</td>
<td>Organic Chemistry (Minimum grade of C)</td>
</tr>
<tr>
<td>CHEM 235</td>
<td>Organic Chemistry Laboratory (Minimum grade of C)</td>
</tr>
<tr>
<td>CHEM 236</td>
<td>Organic Chemistry Laboratory (Minimum grade of C)</td>
</tr>
<tr>
<td>CHEM 341</td>
<td>Physical Chemistry: Brief Course</td>
</tr>
<tr>
<td>CHEM 342</td>
<td>Experimental Physical Chemistry</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Name</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>CHEM 462</td>
<td>Biochemistry 2</td>
</tr>
<tr>
<td>CHEM 464</td>
<td>Biochemistry 2 Laboratory</td>
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**Mathematics and Statistics Requirement**

Select 1 group (Minimum grade of C)  

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MATH 155</td>
<td>Calculus 1</td>
<td>4</td>
</tr>
<tr>
<td>or MATH 153</td>
<td>Calculus 1a with Precalculus</td>
<td>8</td>
</tr>
<tr>
<td>&amp; MATH 154</td>
<td>Calculus 1b with Precalculus</td>
<td></td>
</tr>
<tr>
<td>MATH 156</td>
<td>Calculus 2 (Minimum grade of C)</td>
<td>4</td>
</tr>
<tr>
<td>STAT 211</td>
<td>Elementary Statistical Inference</td>
<td>3</td>
</tr>
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*Note: A track is required. Please see course options below. 30-36*

**Biochemistry Electives**

**Animal Area**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
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<tbody>
<tr>
<td>AGBI 512</td>
<td>Nutritional Biochemistry</td>
</tr>
<tr>
<td>&amp; AGBI 513</td>
<td>Nutritional Biochemistry Laboratory</td>
</tr>
<tr>
<td>AGBI 514</td>
<td>Animal Biotechnology</td>
</tr>
<tr>
<td>ANPH 301</td>
<td>Introduction to Animal Physiology</td>
</tr>
<tr>
<td>ANPH 400</td>
<td>Growth and Lactation Physiology</td>
</tr>
<tr>
<td>ANPH 405</td>
<td>Animal Physiology Laboratory</td>
</tr>
<tr>
<td>ANPH 424</td>
<td>Physiology of Reproduction</td>
</tr>
<tr>
<td>BIOL 348</td>
<td>Neuroscience 1</td>
</tr>
<tr>
<td>BIOL 436</td>
<td>General Animal Physiology</td>
</tr>
<tr>
<td>BIOL 441</td>
<td>Vertebrate Microanatomy</td>
</tr>
<tr>
<td>ENTO 404</td>
<td>Principles of Entomology</td>
</tr>
<tr>
<td>ENTO 412</td>
<td>Pest Management</td>
</tr>
<tr>
<td>HN&amp;F 460</td>
<td>Advanced Nutrition</td>
</tr>
<tr>
<td>HN&amp;F 474</td>
<td>Medical Nutrition Therapy 2</td>
</tr>
<tr>
<td>VETS 302</td>
<td>Animal Pathology</td>
</tr>
<tr>
<td>VETS 401</td>
<td>Veterinary Anatomy</td>
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<tr>
<td>VETS 405</td>
<td>Parasitology</td>
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**Cell and Molecular Biology**

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<th>Course Name</th>
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<tbody>
<tr>
<td>BIOL 312</td>
<td>Introduction to Virology</td>
</tr>
<tr>
<td>BIOL 313</td>
<td>Molecular Basis of Cellular Growth</td>
</tr>
<tr>
<td>BIOL 335</td>
<td>Cell Physiology</td>
</tr>
<tr>
<td>BIOL 413</td>
<td>Molecular Endocrinology</td>
</tr>
<tr>
<td>BIOL 432</td>
<td>Forensic Biology</td>
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</tbody>
</table>

**Chemistry**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
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<tbody>
<tr>
<td>CHEM 310</td>
<td>Instrumental Analysis</td>
</tr>
<tr>
<td>CHEM 312</td>
<td>Environmental Chemistry</td>
</tr>
<tr>
<td>CHEM 422</td>
<td>Intermediate Inorganic Chemistry</td>
</tr>
<tr>
<td>CHEM 460</td>
<td>Forensic Chemistry</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>
<tr>
<td>CHEM 552</td>
<td>Biochemical Toxicology</td>
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**Genetics**

<table>
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<th>Course Code</th>
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<tbody>
<tr>
<td>BIOL 324</td>
<td>Molecular Genetics</td>
</tr>
<tr>
<td>&amp; BIOL 325</td>
<td>Molecular Genetics Laboratory</td>
</tr>
<tr>
<td>BIOL 411</td>
<td>Introduction to Recombinant DNA</td>
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<tr>
<td>BIOL 425</td>
<td>Developmental Genetics</td>
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<tr>
<td>GEN 371</td>
<td>Principles of Genetics</td>
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</table>

**Microbiology**

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>AEM 341</td>
<td>General Microbiology</td>
</tr>
<tr>
<td>AEM 401</td>
<td>Environmental Microbiology</td>
</tr>
<tr>
<td>AEM 408</td>
<td>Applied Water Microbiology</td>
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<tr>
<td>Course Code</td>
<td>Course Name</td>
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</tr>
<tr>
<td>AEM 420</td>
<td>Soil Microbiology</td>
</tr>
<tr>
<td>FDST 445</td>
<td>Food Microbiology</td>
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<td>&amp; FDST 449</td>
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### Plant

<table>
<thead>
<tr>
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<th>Course Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>BIOL 350</td>
<td>Plant Physiology</td>
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<tr>
<td>HORT 420</td>
<td>Plant Propagation</td>
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<tr>
<td>PPTH 401</td>
<td>General Plant Pathology</td>
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### Other

<table>
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<tr>
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<tbody>
<tr>
<td>A&amp;VS 402</td>
<td>Values and Ethics</td>
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<tr>
<td>A&amp;VS 451</td>
<td>Current Literature in Animal Science</td>
<td></td>
</tr>
<tr>
<td>BIOL 301</td>
<td>History of Biology</td>
<td></td>
</tr>
<tr>
<td>BIOL 424</td>
<td>Protein Structure and Function</td>
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### Capstone Requirement

Select one of the following: 3

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Description</th>
<th>Hours</th>
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<tbody>
<tr>
<td>A&amp;VS 496</td>
<td>Senior Thesis</td>
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<tr>
<td>A&amp;VS 497</td>
<td>Research</td>
<td></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 496</td>
<td>Senior Thesis</td>
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<tr>
<td>CHEM 497</td>
<td>Research</td>
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### General Electives

15

### Total Hours

132-144

### AMERICAN CHEMICAL SOCIETY (ACS) TRACK

<table>
<thead>
<tr>
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<th>Hours</th>
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<tbody>
<tr>
<td>CHEM 310</td>
<td>Instrumental Analysis</td>
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</tr>
<tr>
<td>CHEM 401</td>
<td>Chemical Literature (Minimum grade of C)</td>
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<tr>
<td>CHEM 403</td>
<td>Undergraduate Seminar</td>
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<tr>
<td>CHEM 422</td>
<td>Intermediate Inorganic Chemistry</td>
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<tr>
<td>CHEM 497</td>
<td>Research</td>
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<tr>
<td>PHYS 111</td>
<td>General Physics (Minimum grade of C)</td>
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<td>PHYS 112</td>
<td>General Physics (Minimum grade of C)</td>
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<td>-</td>
<td>Biochemistry Electives (See list above)</td>
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<td>Total Hours</td>
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### SUGGESTED PLAN OF STUDY FOR THE AMERICAN CHEMICAL SOCIETY (ACS) TRACK

#### First Year

<table>
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#### Second Year

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Total credit hours: 128

* Students may substitute CHEM 117 and 118 for CHEM 115, 116, and 215.
** STAT 211 may be used to fulfill GEC 4
*** Students could take BIOL 313, BIOL 410, or another upper-level biology class as a biology elective or a general elective.
**** The Biochemistry Capstone will consist of Capstone sections of CHEM 401 and 403, with a biochemistry orientation.

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

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<th>BIOL 493V</th>
<th>Special Topics</th>
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<td>or BIOL 410</td>
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Total Hours: 31

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

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Total: 17 15
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Total credit hours: 128

* Chem 117 and 118 may be substituted for Chem 115, 116, and 215.

** STAT 211 may satisfy GEC 4