

# Biochemistry

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## 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.

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## 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)  
Dean of the Honors College, Protein and Amino Acid Metabolism
- 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
- Stephen DiFazio - Ph.D. (Oregon State University)  
Plant genomics, Molecular ecology, Plant population genetics, Biotechnology risk assessment
- Harry O. Finklea - Ph.D. (California Institute of Technology)  
Analytical/physical chemistry, Electron transfer kinetics, Solid oxide fuel cells, Gas phase sensors
- 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

- 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
- 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, Chemistry; 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
- Janet C. L. Tou - Ph.D. (University of Toronto)  
Human nutrition and foods
- Jianbo Yao - Ph.D. (McGill University)  
Functional genomics

## **ASSOCIATE PROFESSORS**

- Kimberly M. Barnes - Ph.D. (University of Nebraska)  
Curriculum committee chair, Intercollegiate Undergraduate Program in Biochemistry; Lipid metabolism
- 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
- Jonathan Boyd - Ph.D. (Texas Tech University)  
Analytical biochemistry and toxicology
- Kevin C. Daly - Ph.D. (University of Arizona)  
Associate Chair for Graduate Studies, Biology; Sensory neurobiology, Neural coding, Brain-behavior interactions, Comparative psycho-biology
- 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
- Glen Jackson - Ph.D. (West Virginia University)  
Mass spectrometry, forensic chemistry
- Marlon Knights - Ph.D. (West Virginia University)  
Reproductive physiology
- K. Marie Krause - Ph.D. (University of Wisconsin)  
Dairy science nutrition
- Justin Legleiter - Ph.D. (Carnegie Mellon University)  
Biophysical chemistry, Atomic force microscopy
- Kristen Matak - Ph.D. (Virginia Tech)  
Food science and human nutrition

- William T. Peterjohn  
Ecosystem ecology: Effects of global change on ecosystem dynamics, Nitrogen cycling in natural ecosystems.
- Michelle Richards-Babb - Ph.D. (Lehigh University)  
Office of Undergraduate Research; Chemical education
- Rita V.M. Rio - Ph.D. (Yale University)  
Symbioses
- Alan M. Stolzenberg - Ph.D. (Stanford University)  
Inorganic chemistry, Bio-inorganic chemistry, Organometallic chemistry
- Michelle D. Withers - Ph.D. (University of Arizona)  
Biology education, Neurobiology

## CLINICAL ASSOCIATE PROFESSORS

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

## TEACHING ASSOCIATE PROFESSORS

- Erin Battin - Ph.D. (Clemson University)  
Bio-inorganic chemistry
- Megan Govidan - M.P.H., M.S., R.D. (West Virginia University)  
Human nutrition and foods
- Margaret A. Minch - D.V.M. (The Ohio State University)  
Veterinary medicine
- Betsy Ratcliff - Ph.D. (University of Binghamton-SUNY)  
Physical chemistry
- Jennifer Stueckle - Ph.D. (West Virginia University)  
Aquatic toxicology
- Mingming Xu - Ph.D. (Ohio University)  
Analytical chemistry

## ASSISTANT PROFESSORS

- Scott Bowdridge - Ph.D. (Virginia Tech)  
Veterinary immunology
- Andrew Dacks - Ph.D. (University of Arizona)  
Neurobiology
- 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
- 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
- Shuo Wei - Ph.D. (University of Miami)  
Development of the nervous system

## TEACHING ASSISTANT PROFESSORS

- Kevin Barry - Ph.D. (University of Maryland)
- Laura Christian - Ph.D. (The University of Texas at Austin)
- Dana Huebert-Lima - Ph.D. (University of Wisconsin-Madison)  
Associate Chair for Undergraduate Studies, Biology; Epigenetics
- Kevin Lee  
Virology, Cell and molecular biology methods
- Joshua Osbourn - Ph.D. (University of Pittsburgh)  
Organic 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 Studlar  
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
- Jorge A. Flores - Ph.D. (The George Washington)  
Animal physiology, endocrinology of reproduction
- Ramsey H. Frist
- Roland B. Guthrie
- Philip E. Keeting  
Molecular endocrinology, Cancer biology
- 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

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

- American Chemical Society (ACS) (p. 7)
- American Society of Biochemistry and Molecular Biology (ASBMB) (p. 8)

## 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**

|  |   |       |
|--|---|-------|
| F1 - Composition & Rhetoric  |   | 3-6   |
| ENGL 101<br>& ENGL 102<br>or ENGL 103  | Introduction to Composition and Rhetoric<br>and Composition, Rhetoric, and Research<br>Accelerated Academic Writing |       |
| F2A/F2B - Science & Technology   |   | 4-6   |
| F3 - Math & Quantitative Skills  |   | 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.

**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** 19

|  |                    |
|--|--------------------|
| WVUE 191   | First Year Seminar |
| GEF Requirements: number of credits will vary depending on overlap |                    |

**Program Core Requirements** 5

|          |   |
|----------|---|
| AGBI 199 | Orientation to Biochemistry                                       |
| AGBI 410 | Introductory Biochemistry (Minimum grade of C-)                   |
| AGBI 412 | Introduction to Biochemistry Wet Laboratory (Minimum grade of C-) |

**Biology Requirement** 15

|          |  |
|----------|--|
| BIOL 115 | Principles of Biology (Minimum grade of C-. May substitute BIOL 101-104) |
| BIOL 117 | Introductory Physiology (Minimum grade of C-)                            |
| BIOL 219 | The Living Cell (Minimum grade of C-)                                    |
| BIOL 310 | Advanced Cellular/Molecular Biology                                      |

**Chemistry Requirement** 28

Select one set (Minimum grade of C-):

|                                      |   |
|--------------------------------------|---|
| CHEM 115<br>& CHEM 116<br>& CHEM 215 | Fundamentals of Chemistry<br>and Fundamentals of Chemistry<br>and Introductory Analytical Chemistry |
|--------------------------------------|---|

or:

|                        |  |
|------------------------|--|
| CHEM 117<br>& CHEM 118 | Principles of Chemistry<br>and Principles of Chemistry |
|------------------------|--|

and all of the following:

|          |  |
|----------|--|
| CHEM 233 | Organic Chemistry (Minimum grade of C-)            |
| CHEM 234 | Organic Chemistry (Minimum grade of C-)            |
| CHEM 235 | Organic Chemistry Laboratory (Minimum grade of C-) |
| CHEM 236 | Organic Chemistry Laboratory (Minimum grade of C-) |
| CHEM 341 | Physical Chemistry: Brief Course                   |
| CHEM 342 | Experimental Physical Chemistry                    |
| CHEM 462 | Biochemistry 2                                     |
| CHEM 464 | Biochemistry 2 Laboratory                          |

**Mathematics and Statistics Requirement** 8

|                     |            |
|---------------------|------------|
| Minimum grade of C- |            |
| MATH 155            | Calculus 1 |

|  |  |    |
|--|--|----|
| or MATH 153<br>& MATH 154                                | Calculus 1a with Precalculus<br>and Calculus 1b with Precalculus |    |
| MATH 156   | Calculus 2   |    |
| STAT 211   | Elementary Statistical Inference                                 | 3  |
| <b>A track is required.</b>                              |  | 31 |
| Number of credits may vary depending on courses selected |  |    |
| <b>Biochemistry Electives</b>                            |  |    |
| AEM 341  | General Microbiology   |    |
| AEM 401  | Environmental Microbiology                                       |    |
| AEM 408  | Applied Water Microbiology                                       |    |
| AEM 420  | Soil Microbiology  |    |
| AEM 445  | Food Microbiology  |    |
| AGBI 386   | Undergraduate Research Experience 1                              |    |
| 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                               |    |
| BIOL 324<br>& BIOL 325                                   | Molecular Genetics<br>and Molecular Genetics Laboratory          |    |
| BIOL 335   | Cell Physiology  |    |
| BIOL 348   | Neuroscience 1   |    |
| BIOL 350   | Plant Physiology   |    |
| BIOL 386   | Undergraduate Research   |    |
| BIOL 410   | Cell and Molecular Biology Methods                               |    |
| BIOL 411   | Introduction to Recombinant DNA                                  |    |
| BIOL 413   | Molecular Endocrinology  |    |
| BIOL 414   | Molecular Endocrinology-Laboratory                               |    |
| BIOL 415   | Epigenetics  |    |
| BIOL 420   | Genomics   |    |
| 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 432   | Forensic Biology   |    |
| BIOL 436   | General Animal Physiology  |    |
| BIOL 440   | Comparative Anatomy  |    |
| BIOL 441   | Vertebrate Microanatomy  |    |
| BIOL 453   | Molecular Basis of Disease                                       |    |

|          |  |
|----------|--|
| BIOL 454 | Immunology                                 |
| BIOL 496 | Senior Thesis                              |
| BIOL 497 | Research                                   |
| CHEM 310 | Instrumental Analysis                      |
| CHEM 312 | Environmental Chemistry                    |
| CHEM 339 | Organic Syntheses                          |
| CHEM 422 | Intermediate Inorganic Chemistry           |
| CHEM 460 | Forensic Chemistry                         |
| CHEM 496 | Senior Thesis                              |
| CHEM 497 | Research                                   |
| CHEM 514 | Mass Spectrometry Principles and Practices |
| CHEM 516 | Bioanalytical Chemistry                    |
| CHEM 552 | Biochemical Toxicology                     |
| ENTO 404 | Principles of Entomology                   |
| ENTO 412 | Pest Management                            |
| FDST 445 | Food Microbiology                          |
| FDST 449 | Food Microbiology Lab                      |
| GEN 371  | Principles of Genetics                     |
| HN&F 460 | Advanced Nutrition                         |
| HN&F 473 | Medical Nutrition Therapy 1                |
| HN&F 474 | Medical Nutrition Therapy 2                |
| HORT 330 | Plant Propagation                          |
| PPTH 401 | General Plant Pathology                    |
| VETS 302 | Animal Pathology                           |
| VETS 401 | Veterinary Anatomy                         |
| VETS 405 | Parasitology                               |

**Capstone Requirement**

ASBMB Track, select one of the following options:

|                        |  |
|------------------------|--|
| AGBI 386<br>& AGBI 486 | Undergraduate Research Experience 1<br>and Undergraduate Research Experience 2 |
| A&VS 402               | Values and Ethics  |

ACS Track, complete both of the following:

|                        |  |
|------------------------|--|
| CHEM 401<br>& CHEM 403 | Chemical Literature<br>and Undergraduate Seminar |
|------------------------|--|

**General Electives** 11

Number of electives may vary depending on course options selected

Total Hours 120

**AMERICAN CHEMICAL SOCIETY (ACS) TRACK**

|   |   |    |
|---|---|----|
| CHEM 310                                | Instrumental Analysis                     | 3  |
| CHEM 401                                | Chemical Literature (Minimum grade of C-) | 1  |
| CHEM 403                                | Undergraduate Seminar                     | 1  |
| CHEM 422                                | Intermediate Inorganic Chemistry          | 3  |
| CHEM 497                                | Research                                  | 3  |
| PHYS 111                                | General Physics (Minimum grade of C-)     | 4  |
| PHYS 112                                | General Physics (Minimum grade of C-)     | 4  |
| Biochemistry Electives (See list above) |   | 12 |
| Total Hours                             |   | 31 |

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

| <b>Fall</b>       | <b>Hours Spring</b> | <b>Hours</b> |
|-------------------|---------------------|--------------|
| WVUE 191          | 1 GEF 4             | 3            |
| ENGL 101 (GEF 1)  | 3 BIOL 117 (GEF 8)  | 4            |
| AGBI 199          | 1 CHEM 116 (GEF 8)* | 4            |
| BIOL 115 (GEF 2)  | 4 MATH 156          | 4            |
| CHEM 115 (GEF 8)* | 4                   |              |
| MATH 155 (GEF 3)  | 4                   |              |
|                   | 17                  | 15           |

**Second Year**

| <b>Fall</b>            | <b>Hours Spring</b>      | <b>Hours</b> |
|------------------------|--------------------------|--------------|
| BIOL 219               | 4 ENGL 102 (GEF 1)       | 3            |
| CHEM 233<br>& CHEM 235 | 4 GEF 5                  | 3            |
| PHYS 111               | 4 BIOL 310               | 3            |
| STAT 211               | 3 CHEM 234<br>& CHEM 236 | 4            |
|                        | PHYS 112                 | 4            |
|                        | 15                       | 17           |

**Third Year**

| <b>Fall</b>             | <b>Hours Spring</b>      | <b>Hours</b> |
|-------------------------|--------------------------|--------------|
| GEF 6                   | 3 F 7                    | 3            |
| AGBI 410<br>& AGBI 412  | 4 CHEM 341<br>& CHEM 342 | 4            |
| CHEM 215                | 4 CHEM 462<br>& CHEM 464 | 4            |
| Biochemistry Elective 1 | 3 General Elective       | 3            |
|                         | 14                       | 14           |

**Fourth Year**

| <b>Fall</b>             | <b>Hours Spring</b>       | <b>Hours</b> |
|-------------------------|---------------------------|--------------|
| CHEM 401 (Capstone)     | 1 CHEM 310                | 3            |
| CHEM 422                | 3 CHEM 403 (Capstone)     | 1            |
| CHEM 497                | 3 Biochemistry Elective 3 | 3            |
| Biochemistry Elective 2 | 3 Biochemistry Elective 4 | 3            |
| General Elective        | 3 General Elective        | 3            |
| General Elective        | 2                         |              |
|                         | 15                        | 13           |

Total credit hours: 120

\* Students may substitute CHEM 117 and 118 for CHEM 115, 116, and 215.

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

|                              |  |   |
|------------------------------|--|---|
| AGBI 401                     | Senior Seminar in Biochemistry   | 1 |
| BIOL 313<br>or BIOL 410      | Molecular Basis of Cellular Growth<br>Cell and Molecular Biology Methods       | 3 |
| Choose one of the following: |  | 3 |
| AGBI 386<br>& AGBI 486       | Undergraduate Research Experience 1<br>and Undergraduate Research Experience 2 |   |
| A&VS 402                     | Values and Ethics  |   |
| BIOL 423                     | Biochemistry of Nucleic Acids and Proteins                                     | 3 |
| Choose one of the following: |  | 8 |

|   |  |    |
|---|--|----|
| PHYS 101<br>& PHYS 102                  | Introductory Physics<br>and Introductory Physics |    |
| PHYS 101<br>& PHYS 112                  | Introductory Physics<br>and General Physics      |    |
| PHYS 111<br>& PHYS 112                  | General Physics<br>and General Physics           |    |
| Biochemistry Electives (see list above) |  | 13 |
| Total Hours                             |  | 31 |

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

### First Year

| Fall              | Hours Spring        | Hours |
|-------------------|---------------------|-------|
| WVUE 191          | 1 GEF 4             | 3     |
| ENGL 101 (GEF 1)  | 3 BIOL 117 (GEF 8)  | 4     |
| AGBI 199          | 1 CHEM 116 (GEF 8)* | 4     |
| BIOL 115 (GEF 2)  | 4 MATH 156          | 4     |
| CHEM 115 (GEF 8)* | 4                   |       |
| MATH 155 (GEF 3)  | 4                   |       |
|                   | 17                  | 15    |

### Second Year

| Fall                   | Hours Spring                         | Hours |
|------------------------|--------------------------------------|-------|
| BIOL 219               | 4 ENGL 102 (GEF 1)                   | 3     |
| CHEM 233<br>& CHEM 235 | 4 GEF 5                              | 3     |
| PHYS 101               | 4 BIOL 310                           | 3     |
| STAT 211               | 3 CHEM 234<br>& CHEM 236<br>PHYS 102 | 4     |
|                        | 15                                   | 17    |

### Third Year

| Fall                    | Hours Spring             | Hours |
|-------------------------|--------------------------|-------|
| GEF 6                   | 3 GEF 7                  | 3     |
| AGBI 410<br>& AGBI 412  | 4 BIOL 313 or 410        | 3     |
| CHEM 215*               | 4 CHEM 341<br>& CHEM 342 | 4     |
| Biochemistry Elective 1 | 3 CHEM 462<br>& CHEM 464 | 4     |
|                         | 14                       | 14    |

### Fourth Year

| Fall                    | Hours Spring              | Hours |
|-------------------------|---------------------------|-------|
| BIOL 423                | 3 AGBI 401                | 1     |
| Biochemistry Elective 2 | 4 Biochemistry Elective 4 | 3     |
| Biochemistry Elective 3 | 3 Capstone                | 3     |
| General Elective        | 3 General Elective        | 3     |
| General Elective        | 2 General Elective        | 3     |
|                         | 15                        | 13    |

Total credit hours: 120

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

## Major Learning Goals

### BIOCHEMISTRY

1. Graduates will demonstrate a working knowledge of the basic sciences of biology, chemistry, mathematics and scientific methods.
2. Graduates will demonstrate a working knowledge of biological mechanisms, including biochemistry, biotechnology, functional genomic, nutrition, physiology and reproduction necessary for understanding of the disciplines.
3. Graduates will demonstrate the ability to write and present scientific information.
4. Graduates will demonstrate the ability to integrate knowledge and possess problem solving/critical thinking skills necessary for professional and social development and life-long learning and civic engagement.

#### **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 or 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.