# BIOCHEMISTRY, BA (L&S)

Biochemistry is a very broad science that studies the molecules and chemistry of life. Biochemistry focuses on the structure, properties, and interactions of molecules such as proteins, nucleic acids, sugars and lipids. Biochemistry's aim is to understand how these molecules participate in the processes that support the various functions of the living cell. These studies are therefore essential for understanding disease and finding cures, for improving agriculture and the production of food and biofuels, and to produce innovation in biotechnology.

Whereas other biological science majors may focus on cellular, organismal, or population-level biology, biochemistry focuses on processes that occur at the molecular to cellular levels. Therefore, this major has a greater focus on basic and quantitative sciences, such as math and, particularly, on chemistry.

Biochemistry graduates go on to a variety of careers in science and science-related fields. The major is designed to fit the needs of the student who wishes to achieve bachelor's-level training as well as those planning to pursue graduate or professional study. The degree serves as an excellent background for medical school or veterinary school admission, as well as for graduate study in biochemistry or other allied fields (biology, bacteriology, genetics, molecular biology, or oncology).

## HOW TO GET IN

## HOW TO GET IN

Students may declare the major via an appointment with the undergraduate advisor at any time.

The Biochemistry major is offered through either CALS or the College of Letters & Science (L&S). Students interested in the differences or transferring between CALS and L&S should meet with the advisor to discuss this in more detail.

Students who attend Student Orientation, Advising, and Registration (SOAR) with the College of Agricultural and Life Sciences (CALS) have the option to declare biochemistry at SOAR. Students may otherwise declare after they have begun their undergraduate studies.

Students who intend to major in Biochemistry may not combine this major ("double major") with the Molecular and Cell Biology major.

## REQUIREMENTS

## UNIVERSITY GENERAL EDUCATION REQUIREMENTS

All undergraduate students at the University of Wisconsin-Madison are required to fulfill a minimum set of common university general education requirements to ensure that every graduate acquires the essential core of an undergraduate education. This core establishes a foundation for living a productive life, being a citizen of the world, appreciating aesthetic values, and engaging in lifelong learning in a continually changing world. Various schools and colleges will have requirements in addition to the requirements listed below. Consult your advisor for assistance, as needed. For additional information, see the university Undergraduate General Education Requirements (https://guide.wisc.edu/undergraduate/#requirementsforundergraduatestudytext) section of the Guide.

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|---|---|
| General Education | • Breadth—Humanities/Literature/Arts: 6 credits<br>• Breadth—Natural Science: 4 to 6 credits, consisting of one 4- or 5-credit course with a laboratory component; or two courses providing a total of 6 credits<br>• Breadth—Social Studies: 3 credits<br>• Communication Part A & Part B *<br>• Ethnic Studies *<br>• Quantitative Reasoning Part A & Part B * |

* The mortarboard symbol appears before the title of any course that fulfills one of the Communication Part A or Part B, Ethnic Studies, or Quantitative Reasoning Part A or Part B requirements.

## COLLEGE OF LETTERS & SCIENCE DEGREE REQUIREMENTS: BACHELOR OF ARTS (BA)

Students pursuing a bachelor of arts degree in the College of Letters & Science must complete all of the requirements below. The College of Letters & Science allows this major to be paired with either a bachelor of arts or a bachelor of science curriculum.

### BACHELOR OF ARTS DEGREE REQUIREMENTS

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|---|---|
| Mathematics | Complete the University General Education Requirements for Quantitative Reasoning A (QR-A) and Quantitative Reasoning B (QR-B) coursework. |
| Language | • Complete the fourth unit of a language other than English; OR<br>• Complete the third unit of a language and the second unit of an additional language other than English. |
| L&S Breadth | • 12 credits of Humanities, which must include 6 credits of literature; and<br>• 12 credits of Social Science; and<br>• 12 credits of Natural Science, which must include one 3+ credit Biological Science course and one 3+ credit Physical Science course. |
| Liberal Arts and Science Coursework | Complete at least 108 credits. |
| Depth of Intermediate/Advanced work | Complete at least 60 credits at the intermediate or advanced level. |
| Major | Declare and complete at least one major. |
| Total Credits | Complete at least 120 credits. |
| UW-Madison Experience | • 30 credits in residence, overall; and<br>• 30 credits in residence after the 86th credit. |

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|---|---|
| Quality of Work | • 2.000 in all coursework at UW–Madison<br>• 2.000 in Intermediate/Advanced level coursework at UW–Madison |

## NON–L&S STUDENTS PURSUING AN L&S MAJOR

Non–L&S students who have permission from their school/college to pursue an additional major within L&S only need to fulfill the major requirements. They do not need to complete the L&S Degree Requirements above.

# REQUIREMENTS FOR THE MAJOR

## MATHEMATICS

### Mathematics Requirements

| Code | Title | Credits |
|---|---|---|
| Complete one of the following options: | | |
| MATH 221 & MATH 222 | Calculus and Analytic Geometry 1 and Calculus and Analytic Geometry 2 | 9 |
| MATH 171 & MATH 217 & MATH 222 | Calculus with Algebra and Trigonometry I and Calculus with Algebra and Trigonometry II and Calculus and Analytic Geometry 2 | 14 |

## CHEMISTRY

### General Chemistry

| Code | Title | Credits |
|---|---|---|
| Complete one sequence: | | |
| CHEM 103 & CHEM 104 | General Chemistry I and General Chemistry II | 9 |
| CHEM 109 | Advanced General Chemistry | 5 |
| CHEM 115 & CHEM 116 | Chemical Principles I and Chemical Principles II (satisfies both general and analytical chemistry requirements) | 10 |

### Organic Chemistry

| Code | Title | Credits |
|---|---|---|
| Complete All: | | |
| CHEM 343 | Organic Chemistry I | 3 |
| CHEM 344 | Introductory Organic Chemistry Laboratory | 2 |
| CHEM 345 | Organic Chemistry II | 3 |

### Analytical Chemistry

| Code | Title | Credits |
|---|---|---|
| Complete one: | | |
| CHEM 327 | Fundamentals of Analytical Science | 4 |
| CHEM 329 | Fundamentals of Analytical Science | 4 |
| CHEM 116 | Chemical Principles II (satisfies both general and analytical chemistry requirements) | 5 |

### Physical Chemistry

| Code | Title | Credits |
|---|---|---|
| Complete one: | | |
| CHEM 665 | Biophysical Chemistry (Recommended) | 3 |
| CHEM 561 | Physical Chemistry I | 3 |

## BIOLOGY

Students must complete either Option A (introductory + upper-level biology), or Option B (biocore), for 16 total credits of biological science coursework.

### Option A (Introductory and Upper-Level Biology)

#### Option A Introductory Biology

| Code | Title | Credits |
|---|---|---|
| Complete one of the following introductory biology options: | | |
| BIOLOGY/BOTANY/ ZOOLOGY 151 & BIOLOGY/ BOTANY/ ZOOLOGY 152 | Introductory Biology and Introductory Biology (recommended) | 10 |
| BIOLOGY/ ZOOLOGY 101 & BIOLOGY/ ZOOLOGY 102 & BOTANY/ BIOLOGY 130 | Animal Biology and Animal Biology Laboratory and General Botany | 10 |

#### And Option A Upper-Level Biology

At least 6 credits of upper-level biological science coursework are required (to achieve 16 total credits—more than 6 credits may be required if introductory biology totals less than 10 credits due to transfer credits). Select from the course list below. To see courses offered in specific upcoming semesters, please see the biochemistry website (https://biochem.wisc.edu/undergraduate_program/advanced-biology-courses-undergraduate-program/).

**Important**: A course may not double count in both the "upper-level biology" and the "biochemistry" requirements for the major. Biochemistry courses on this list can count only for "upper-level biology" if they are above-and-beyond what is needed to fulfill the "biochemistry" portion of the major. For example, if students have taken BIOCHEM 501 (http://guide.wisc.edu/search/?P=BIOCHEM%20501), they will need one advanced biochemistry elective to fulfill the biochemistry requirement, and then any additional biochemistry courses taken can count for upper-level biology.

| Code | Title | Credits |
|---|---|---|
| AGROECOL 370 | Grassland Ecology | 3 |
| AGROECOL 377 | Global Food Production and Health | 3 |
| ANAT&PHY 335 | Physiology | 5 |
| ANAT&PHY 337 | Human Anatomy | 3 |
| ANAT&PHY 435 | Fundamentals of Human Physiology | 5 |
| AN SCI/ FOOD SCI 305 | Introduction to Meat Science and Technology | 4 |
| AN SCI/DY SCI/ NUTR SCI 311 | Comparative Animal Nutrition | 3 |

| | | |
|---|---|---|
| AN SCI 314 | | 3 |
| AN SCI/DY SCI 320 | Animal Health and Disease | 3 |
| AN SCI/DY SCI 361 | Introduction to Animal and Veterinary Genetics | 2 |
| AN SCI/DY SCI 362 | Veterinary Genetics | 2 |
| AN SCI/DY SCI 363 | Principles of Animal Breeding | 2 |
| AN SCI/DY SCI 370 | Livestock Production and Health in Agricultural Development | 3 |
| AN SCI/DY SCI 414 | Ruminant Nutrition & Metabolism | 3 |
| AN SCI 415 | Application of Monogastric Nutrition Principles | 2 |
| AN SCI 431 | Beef Cattle Production | 3 |
| AN SCI 432 | Swine Production | 3 |
| AN SCI/DY SCI 434 | Reproductive Physiology | 3 |
| AN SCI 503 | | 3 |
| AN SCI 508 | | 3 |
| AN SCI 511 | | 3 |
| AN SCI 512 | | 3 |
| AN SCI/ FOOD SCI 515 | Commercial Meat Processing | 2 |
| AN SCI/F&W ECOL/ ZOOLOGY 520 | Ornithology | 3 |
| AN SCI/F&W ECOL/ ZOOLOGY 521 | Birds of Southern Wisconsin | 3 |
| AN SCI 610 | Quantitative Genetics | 3 |
| AN SCI/ NUTR SCI 626 | Experimental Diet Design | 1 |
| B M E/MED PHYS/ PHMCOL-M/PHYSICS/ RADIOL 619 | Microscopy of Life | 3 |
| BIOCHEM/ NUTR SCI 510 | Nutritional Biochemistry and Metabolism | 3 |
| BIOCHEM/ NUTR SCI 560 | Principles of Human Disease and Biotechnology | 2 |
| BIOCHEM/ M M & I 575 | Biology of Viruses | 2 |
| BIOCHEM 601 | Protein and Enzyme Structure and Function | 2 |
| BIOCHEM/B M I/ BMOLCHEM/ MATH 609 | Mathematical Methods for Systems Biology | 3 |
| BIOCHEM/ GENETICS/ MICROBIO 612 | Prokaryotic Molecular Biology | 3 |
| BIOCHEM/ GENETICS/ MD GENET 620 | Eukaryotic Molecular Biology | 3 |
| BIOCHEM/ BOTANY 621 | Plant Biochemistry | 3 |
| BIOCHEM 625 | Mechanisms of Action of Vitamins and Minerals | 2 |
| BIOCHEM/ GENETICS 631 | Plant Genetics and Development | 3 |
| BIOCHEM/ NUTR SCI 645 | Molecular Control of Metabolism and Metabolic Disease | 3 |
| BSE 349 | Quantitative Techniques for Biological Systems | 3 |
| BSE 364 | Engineering Properties of Food and Biological Materials | 3 |
| BSE 365 | Measurements and Instrumentation for Biological Systems | 3 |
| BSE/ENVIR ST 367 | Renewable Energy Systems | 3 |
| BSE 460 | Biorefining: Energy and Products from Renewable Resources | 3 |
| BSE 461 | Food and Bioprocessing Operations | 3 |
| BSE 472 | Sediment and Bio-Nutrient Engineering and Management | 3 |
| BMOLCHEM/ MICROBIO 668 | Microbiology at Atomic Resolution | 3 |
| B M I/STAT 541 | Introduction to Biostatistics | 3 |
| B M I/ COMP SCI 576 | Introduction to Bioinformatics | 3 |
| BOTANY 300 | Plant Anatomy | 4 |
| BOTANY 305 | Plant Morphology and Evolution | 4 |
| BOTANY 330 | Algae | 3 |
| BOTANY/ PL PATH 332 | Fungi | 4 |
| BOTANY 400 | Plant Systematics | 4 |
| BOTANY 401 | Vascular Flora of Wisconsin | 4 |
| BOTANY/ F&W ECOL 402 | Dendrology: Woody Plant Identification and Ecology | 3 |
| BOTANY/ANTHRO/ ZOOLOGY 410 | Evolutionary Biology | 3 |
| BOTANY 422 | Plant Geography | 3 |
| BOTANY 455 | The Vegetation of Wisconsin | 4 |
| BOTANY/ F&W ECOL/ ZOOLOGY 460 | General Ecology | 4 |
| BOTANY/ENTOM/ ZOOLOGY 473 | Plant-Insect Interactions | 3 |
| BOTANY/AMER IND/ ANTHRO 474 | Ethnobotany | 3-4 |
| BOTANY 500 | Plant Physiology | 3-4 |
| BOTANY/ENTOM/ PL PATH 505 | Plant-Microbe Interactions: Molecular and Ecological Aspects | 3 |
| BOTANY/ENVIR ST/ F&W ECOL/ ZOOLOGY 516 | Conservation Biology | 3 |
| BOTANY/ PL PATH 563 | Phylogenetic Analysis of Molecular Data | 3 |
| BOTANY/ GENETICS/M M & I/ PL PATH 655 | Biology and Genetics of Fungi | 3 |
| CHEM 575 | Advanced Topics in Chemistry (Topics in Chemical Biology) | 1-4 |
| CRB 625 | Stem Cell Seminar | 1 |
| CRB 640 | Fundamentals of Stem Cell and Regenerative Biology | 3 |
| CRB 675 | Topics in Cell and Regenerative Biology | 1-3 |
| DY SCI 378 | Lactation Physiology | 3 |

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|---|---|---|
| DY SCI 535 | Dairy Farm Management Practicum | 3 |
| ENTOM/ ZOOLOGY 302 | Introduction to Entomology | 4 |
| ENTOM 321 | Physiology of Insects | 3 |
| ENTOM 331 | Taxonomy of Mature Insects | 4 |
| ENTOM 351 | Principles of Economic Entomology | 3 |
| ENTOM/ ZOOLOGY 371 | Medical Entomology: Biology of Vector and Vector-borne Diseases | 3 |
| ENTOM 432 | Taxonomy and Bionomics of Immature Insects | 4 |
| ENTOM/ ZOOLOGY 540 | Theoretical Ecology | 3 |
| ENTOM/GENETICS/ ZOOLOGY 624 | Molecular Ecology | 3 |
| ENVIR ST/ LAND ARC 361 | Wetlands Ecology | 3 |
| ENVIR ST/ POP HLTH 471 | Introduction to Environmental Health | 3 |
| ENVIR ST/ POP HLTH 502 | Air Pollution and Human Health | 3 |
| ENVIR ST/ F&W ECOL 515 | Natural Resources Policy | 3 |
| ENVIR ST/ ATM OCN 520 | Bioclimatology | 3 |
| FOOD SCI/ MICROBIO 324 | Food Microbiology Laboratory | 2 |
| FOOD SCI/ MICROBIO 325 | Food Microbiology | 3 |
| FOOD SCI 410 | Food Chemistry | 3 |
| FOOD SCI 440 | Principles of Food Engineering | 3 |
| FOOD SCI 511 | Chemistry and Technology of Dairy Products | 3 |
| FOOD SCI 514 | Integrated Food Functionality | 4 |
| FOOD SCI 550 | Fermented Foods and Beverages | 2 |
| FOOD SCI 611 | Chemistry and Technology of Dairy Products | 3 |
| F&W ECOL 300 | Forest Measurements | 4 |
| F&W ECOL 306 | Terrestrial Vertebrates: Life History and Ecology | 4 |
| F&W ECOL 318 | Principles of Wildlife Ecology | 3 |
| F&W ECOL 335 | | 3 |
| F&W ECOL/ ENVIR ST/ ZOOLOGY 360 | Extinction of Species | 3 |
| F&W ECOL 379 | Principles of Wildlife Management | 3 |
| F&W ECOL 401 | | 3 |
| F&W ECOL 410 | Silviculture: Applied Forest Ecology | 3 |
| F&W ECOL/ A A E 430 | Decision Methods for Natural Resource Managers | 3 |
| F&W ECOL/ SURG SCI 548 | Diseases of Wildlife | 3 |
| F&W ECOL 550 | Forest Ecology | 3 |
| F&W ECOL 561 | Wildlife Management Techniques | 3 |
| F&W ECOL/ LAND ARC/ ZOOLOGY 565 | Principles of Landscape Ecology | 2 |
| F&W ECOL 590 | Integrated Resource Management | 3 |
| F&W ECOL 655 | Animal Population Dynamics | 3 |
| GEN&WS 533 | Special Topics in Gender and Biology | 3 |
| GENETICS 466 | Principles of Genetics | 3 |
| GENETICS 467 | General Genetics 1 | 3 |
| GENETICS 468 | General Genetics 2 | 3 |
| GENETICS 525 | Epigenetics | 3 |
| GENETICS 545 | Genetics Laboratory | 2 |
| GENETICS/ MD GENET 565 | Human Genetics | 3 |
| GENETICS 566 | Advanced Genetics | 3 |
| M M & I 301 | Pathogenic Bacteriology | 2 |
| M M & I 341 | Immunology | 3 |
| M M & I/ENTOM/ PATH-BIO/ ZOOLOGY 350 | Parasitology | 3 |
| M M & I/PATH-BIO 528 | Immunology | 3 |
| M M & I 554 | Emerging Infectious Diseases and Bioterrorism | 2 |
| MED PHYS/ H ONCOL 410 | Radiobiology | 2-3 |
| MED PHYS/ B M E/H ONCOL/ PHYSICS 501 | Radiation Physics and Dosimetry | 3 |
| MICROBIO 303 | Biology of Microorganisms | 3 |
| MICROBIO 304 | Biology of Microorganisms Laboratory | 2 |
| MICROBIO 305 | Critical Analyses in Microbiology | 1 |
| MICROBIO/AN SCI/ BOTANY 335 | The Microbiome of Plants, Animals, and Humans | 3 |
| MICROBIO 345 | Introduction to Disease Biology | 3 |
| MICROBIO 357 | General Bioinformatics for Microbiologists | 3 |
| MICROBIO/ SOIL SCI 425 | Environmental Microbiology | 3 |
| MICROBIO 450 | Diversity, Ecology and Evolution of Microorganisms | 3 |
| MICROBIO 470 | Microbial Genetics & Molecular Machines | 3 |
| MICROBIO 520 | Planetary Microbiology: What Life Here Tells Us About Life Out There | 3 |
| MICROBIO/ SOIL SCI 523 | Soil Microbiology and Biochemistry | 3 |
| MICROBIO 525 | Field Studies of Planetary Microbiology and Life in the Universe | 3 |
| MICROBIO 526 | Physiology of Microorganisms | 3 |
| MICROBIO 527 | Advanced Laboratory Techniques in Microbiology | 2 |
| MICROBIO 551 | Capstone Research Project in Microbiology | 2 |

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|---|---|---|
| MICROBIO 626 | Microbial and Cellular Metabolomics | 3 |
| NEURODPT 629 | Molecular and Cellular Mechanisms of Memory | 3 |
| NTP/ NEURODPT 610 | Cellular and Molecular Neuroscience | 4 |
| NTP/NEURODPT/ PSYCH 611 | Systems Neuroscience | 4 |
| NUTR SCI 332 | Human Nutritional Needs | 3 |
| NUTR SCI/ A A E 350 | World Hunger and Malnutrition | 3 |
| NUTR SCI 379 | Introduction to Epidemiology | 3 |
| NUTR SCI 431 | Nutrition in the Life Span | 3 |
| ONCOLOGY 401 | Introduction to Experimental Oncology | 2 |
| ONCOLOGY/ M&ENVTOX/ PHM SCI/PHMCOL-M/POP HLTH 625 | Toxicology I | 3 |
| PHM SCI 310 | Drugs and Their Actions | 2 |
| PHM SCI/B M E 430 | Biological Interactions with Materials | 3 |
| PHYSICS/B M E/ MED PHYS/ PHMCOL-M/ RADIOL 619 | Microscopy of Life | 3 |
| PL PATH 300 | Introduction to Plant Pathology | 4 |
| PL PATH 517 | Plant Disease Resistance | 2-3 |
| PL PATH 559 | Diseases of Economic Plants | 3 |
| PL PATH 602 | Ecology, Epidemiology and Control of Plant Diseases | 3 |
| PL PATH 622 | Plant-Bacterial Interactions | 2-3 |
| PL PATH/M M & I/ ONCOLOGY 640 | General Virology-Multiplication of Viruses | 3 |
| PLANTSCI 300 | Cropping Systems | 3 |
| PLANTSCI 302 | Forage Management and Utilization | 3 |
| PLANTSCI 320 | Environment of Cultivated Plants | 3 |
| PLANTSCI 338 | Plant Breeding and Biotechnology | 3 |
| PLANTSCI 340 | Plant Genome Engineering and Editing | 3 |
| PLANTSCI 501 | Principles of Plant Breeding | 3 |
| PLANTSCI/ ATM OCN 532 | Environmental Biophysics | 3 |
| PLANTSCI 550 | Molecular Approaches for Crop Improvement | 3 |
| PSYCH 454 | Behavioral Neuroscience | 3 |
| PSYCH 513 | Hormones, Brain, and Behavior | 4 |
| PSYCH 612 | Neuropharmacology | 3 |
| SOIL SCI 323 | Soil Biology | 3 |
| SOIL SCI 326 | Plant Nutrition Management | 3 |
| SOIL SCI/ F&W ECOL 451 | Environmental Biogeochemistry | 3 |
| SOIL SCI/ CIV ENGR/ M&ENVTOX 631 | Toxicants in the Environment: Sources, Distribution, Fate, & Effects | 3 |
| ZOOLOGY 300 | Invertebrate Biology and Evolution | 3 |
| ZOOLOGY 301 | Invertebrate Biology and Evolution Lab | 2 |
| ZOOLOGY 304 | Marine Biology | 2 |
| ZOOLOGY/ ENVIR ST 315 | Limnology-Conservation of Aquatic Resources | 2 |
| ZOOLOGY 316 | Laboratory for Limnology-Conservation of Aquatic Resources | 2-3 |
| ZOOLOGY 425 | Behavioral Ecology | 3 |
| ZOOLOGY 430 | Comparative Anatomy of Vertebrates | 5 |
| ZOOLOGY 470 | Introduction to Animal Development | 3 |
| ZOOLOGY/ ENVIR ST 510 | Ecology of Fishes | 3 |
| ZOOLOGY/ ENVIR ST 511 | Ecology of Fishes Lab | 2 |
| ZOOLOGY/ PSYCH 523 | Neurobiology | 3 |
| ZOOLOGY/ GEOSCI 542 | Invertebrate Paleontology | 3 |
| ZOOLOGY 555 | Laboratory in Developmental Biology | 3 |
| ZOOLOGY 570 | Cell Biology | 3 |
| ZOOLOGY 603 | Endocrinology | 3-4 |
| ZOOLOGY 611 | Comparative and Evolutionary Physiology | 3 |
| ZOOLOGY 612 | Comparative Physiology Laboratory | 2 |
| ZOOLOGY/ ANTHRO/ PSYCH 619 | Biology of Mind | 3 |

### Option B (Biocore)

Biocore is an honors-level, integrated sequence of lecture and lab courses that covers introductory and intermediate biology topics. Students must apply and be accepted to the program to take BIOCORE classes.

| Code | Title | Credits |
|---|---|---|
| Complete these lecture courses: | | |
| BIOCORE 381 | Evolution, Ecology, and Genetics | 3 |
| BIOCORE 383 | Cellular Biology | 3 |
| BIOCORE 485 | Principles of Physiology | 3 |
| BIOCORE 587 | Biological Interactions | 3 |
| Complete two of these lab classes: | | 4 |
| BIOCORE 382 | Evolution, Ecology, and Genetics Laboratory | |
| BIOCORE 384 | Cellular Biology Laboratory | |
| BIOCORE 486 | Principles of Physiology Laboratory | |
| **Total Credits** | | **16** |

## PHYSICS (CALCULUS-BASED)

### Physics Requirements

| Code | Title | Credits |
|---|---|---|
| Complete one of the following options: [1] | | |
| PHYSICS 207 & PHYSICS 208 | General Physics and General Physics (recommended) | 10 |

| | | |
|---|---|---|
| PHYSICS 201 & PHYSICS 202 | General Physics and General Physics | 10 |

## BIOCHEMISTRY

One set of introductory coursework and the capstone course are required, for a total of three BIOCHEM courses.

### Introductory Courses

| Code | Title | Credits |
|---|---|---|
| **Select one of the following options:** | | |
| BIOCHEM 507 & BIOCHEM 508 | General Biochemistry I and General Biochemistry II (recommended) | 6-7 |
| **OR** | | |
| BIOCHEM 501 | Introduction to Biochemistry | 3 |
| And one of the following advanced biochemistry electives: | | |
| BIOCHEM/ NUTR SCI 510 | Nutritional Biochemistry and Metabolism | |
| BIOCHEM/ NUTR SCI 560 | Principles of Human Disease and Biotechnology | |
| BIOCHEM/ M M & I 575 | Biology of Viruses | |
| BIOCHEM 601 | Protein and Enzyme Structure and Function | |
| BIOCHEM/B M I/ BMOLCHEM/ MATH 609 | Mathematical Methods for Systems Biology | |
| BIOCHEM/ GENETICS/ MICROBIO 612 | Prokaryotic Molecular Biology | |
| BIOCHEM/ GENETICS/ MD GENET 620 | Eukaryotic Molecular Biology | |
| BIOCHEM/ BOTANY 621 | Plant Biochemistry | |
| BIOCHEM 625 | Mechanisms of Action of Vitamins and Minerals | |
| BIOCHEM/ GENETICS 631 | Plant Genetics and Development | |
| BIOCHEM/ NUTR SCI 645 | Molecular Control of Metabolism and Metabolic Disease | |

### Capstone

| Code | Title | Credits |
|---|---|---|
| BIOCHEM 551 | Biochemical Methods | 4 |
| **Total Credits** | | **4** |

# RESIDENCE AND QUALITY OF WORK

- 2.000 GPA in all BIOCHEM and major courses
- 2.000 GPA on at least 15 upper-level major credits in Residence. [2]
- 15 credits in BIOCHEM, taken on campus

[1] Students should consult with their advisor to discuss options if they have credit for PHYSICS 103 (http://guide.wisc.edu/search/?P=PHYSICS%20103) and PHYSICS 104 (http://guide.wisc.edu/search/?P=PHYSICS%20104).

[2] Major courses numbered 300-699 are considered Upper-Level in the major for purposes of this requirement.

# HONORS IN THE MAJOR

Students may declare Honors in the Biochemistry Major in consultation with their Biochemistry undergraduate advisor. To be admitted to Honors in the Major in Biochemistry, students must have declared a major in Biochemistry and have a 3.300 overall university GPA.

## HONORS IN THE MAJOR IN BIOCHEMISTRY: REQUIREMENTS

To earn honors in the major in biochemistry, students must satisfy the requirements for the major (above) as well as the following requirements. All courses used for honors in the major requirements must receive "B" or better grades to fulfill requirements.

- Earn a 3.300 University GPA
- Earn a 3.300 GPA for all BIOCHEM courses, and all courses accepted in the major
- Complete BIOCHEM 507 and BIOCHEM 508 for Honors
- Complete a two-semester Senior Honors Thesis for 6 credits total
- Complete at least 14 credits of any combination of the following coursework:
  - Honors courses that would fulfill the Biology or Biochemistry requirements in the major (see above)
  - Statistics coursework (does not need to be taken for honors): STAT 301, STAT 371, or STAT/B M I 541
  - Biochemistry elective coursework beyond the major requirements (does not need to be taken for honors): NUTR SCI/ BIOCHEM 510, BIOCHEM/NUTR SCI 560, M M & I/ BIOCHEM 575, BIOCHEM 601, MATH/B M I/ BIOCHEM/BMOLCHEM 609, MICROBIO/BIOCHEM/ GENETICS 612, MD GENET/BIOCHEM/GENETICS 620, BOTANY/BIOCHEM 621, BIOCHEM 625, BIOCHEM/ GENETICS 631, BIOCHEM/NUTR SCI 645
  - Honors coursework in MATH, CHEM, or PHYSICS, from the list below:

### Math

| Code | Title | Credits |
|---|---|---|
| MATH 341 | Linear Algebra | 3 |
| MATH 375 | Topics in Multi-Variable Calculus and Linear Algebra | 5 |
| MATH 376 | Topics in Multi-Variable Calculus and Differential Equations | 5 |
| MATH 521 | Analysis I | 3 |
| MATH 522 | Analysis II | 3 |
| MATH 541 | Modern Algebra | 3 |
| MATH 542 | Modern Algebra | 3 |

### Chemistry

| Code | Title | Credits |
|---|---|---|
| CHEM 109 | Advanced General Chemistry | 5 |
| CHEM 115 | Chemical Principles I | 5 |
| CHEM 116 | Chemical Principles II | 5 |

| | | |
|---|---|---|
| CHEM 343 | Organic Chemistry I | 3 |
| CHEM 345 | Organic Chemistry II | 3 |
| CHEM 344 | Introductory Organic Chemistry Laboratory | 2 |
| CHEM 329 | Fundamentals of Analytical Science | 4 |
| CHEM 547 | Advanced Organic Chemistry | 3 |
| CHEM 561 | Physical Chemistry I | 3 |
| CHEM 563 | Physical Chemistry Laboratory I | 1 |
| CHEM 562 | Physical Chemistry II | 3 |
| CHEM 564 | Physical Chemistry Laboratory II | 1 |
| CHEM 665 | Biophysical Chemistry | 3 |

### Physics

| Code | Title | Credits |
|---|---|---|
| PHYSICS 201 | General Physics | 5 |
| PHYSICS 202 | General Physics | 5 |
| PHYSICS 207 | General Physics | 5 |
| PHYSICS 208 | General Physics | 5 |
| PHYSICS 241 | Introduction to Modern Physics | 3 |
| PHYSICS 247 | A Modern Introduction to Physics | 5 |
| PHYSICS 248 | A Modern Introduction to Physics | 5 |
| PHYSICS 249 | A Modern Introduction to Physics | 4 |

# UNIVERSITY DEGREE REQUIREMENTS

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|---|---|
| Total Degree | To receive a bachelor's degree from UW–Madison, students must earn a minimum of 120 degree credits. The requirements for some programs may exceed 120 degree credits. Students should consult with their college or department advisor for information on specific credit requirements. |
| Residency | Degree candidates are required to earn a minimum of 30 credits in residence at UW–Madison. "In residence" means on the UW–Madison campus with an undergraduate degree classification. "In residence" credit also includes UW–Madison courses offered in distance or online formats and credits earned in UW–Madison Study Abroad/Study Away programs. |
| Quality of Work | Undergraduate students must maintain the minimum grade point average specified by the school, college, or academic program to remain in good academic standing. Students whose academic performance drops below these minimum thresholds will be placed on academic probation. |

## LEARNING OUTCOMES

# LEARNING OUTCOMES

1. Identify the fundamental biochemical principles that underlie all biological processes.
2. Communicate biochemical knowledge in both written reports and oral presentations to scientists and non-scientists.
3. Evaluate how biochemistry relates to other scientific disciplines and to contemporary issues in our society.
4. Demonstrate professional and ethical responsibility in scientific research.
5. Design and conduct quantitative experiments and/or interpret data to address a scientific question.

## FOUR-YEAR PLAN

# FOUR-YEAR PLAN

This Four-Year Plan is only one way a student may complete an L&S degree with this major. Many factors can affect student degree planning, including placement scores, credit for transferred courses, credits earned by examination, and individual scholarly interests. In addition, many students have commitments (e.g., athletics, honors, research, student organizations, study abroad, work and volunteer experiences) that necessitate they adjust their plans accordingly. Informed students engage in their own unique Wisconsin Experience by consulting their academic advisors, Guide, DARS, and Course Search & Enroll for assistance making and adjusting their plan.

## SAMPLE BIOCHEMISTRY FOUR-YEAR PLAN

**Freshman**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| CHEM 103 or 109 | 4-5 | CHEM 104 (if needed) | 5 |
| MATH 221 | 5 | MATH 222 | 4 |
| Communications Part A | 3 | BIOCHEM 207 (recommended elective) | 2 |
| BIOCHEM 100[1] | 1 | Social Science Breadth | 3 |
| | **13** | | **14** |

**Sophomore**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| ZOOLOGY/BIOLOGY/ BOTANY 151[2] | 5 | ZOOLOGY/BIOLOGY/ BOTANY 152 | 5 |
| CHEM 343 | 3 | CHEM 344 | 2 |
| Literature Breadth | 3 | CHEM 345 | 3 |
| Social Science Breadth | 3 | Ethnic Studies | 3 |
| INTER-LS 210 | 1 | Social Science Breadth | 3 |
| | **15** | | **16** |

**Junior**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| BIOCHEM 507 | 3 | BIOCHEM 508 | 3-4 |
| PHYSICS 207 or 201 | 5 | PHYSICS 208 or 202 | 5 |
| Humanities Breadth | 3 | CHEM 327 | 4 |
| Electives | 4 | Literature Breadth | 3 |
| | **15** | | **15** |

**Senior**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| CHEM 665 or BIOCHEM 551 | 3-4 | BIOCHEM 551 or CHEM 665 | 3-4 |
| Upper-Level Biology for major | 3 | Upper-Level Biology for major | 3 |
| Social Science Breadth | 3 | Humanities Breadth | 3 |
| Electives | 3 | Electives | 3 |
| BIOCHEM 691 or 681 (if needed)[3] | 3 | BIOCHEM 692 or 682 (if needed) | 3 |
| | **16** | | **16** |

**Total Credits 120**

[1] First-year students interested in exploring the major can enroll in BIOCHEM 100.

[2] Students may wish to consider pursuing the Biology Core Curriculum (Biocore) Honors certificate. For more details about how BIOCORE coursework can help them meet requirements for this major, see the Requirements page (https://guide.wisc.edu/undergraduate/letters-science/college-wide/biochemistry-bs/#requirementstext). Students should consult with their advisor to identify the biological science sequence that best suits their academic and personal goals.

[3] Senior Thesis, Directed Study, or work experience in laboratory are recommended, but are not required for the major. However, a Senior Honors Thesis is required to earn Honors in the Major.

## ADVISING AND CAREERS

# ADVISING AND CAREERS

### DECLARE OR CANCEL THIS MAJOR

Contact the academic advisor assigned to your last name: biochemmicrobio.wisc.edu/advising (https://biochemmicrobio.wisc.edu/advising/)

### HOW TO SEEK ADVISING

- To schedule an appointment with the advisor, use Starfish (https://advising.wisc.edu/facstaff/starfish/starfish-student-resources/).
- Send an email with brief questions to biochemmicrobio-advisor@wisc.edu.
- Drop-in advising hours for quick (10–15 minute) questions, on a first-come, first-serve basis, are posted on the Biochemistry / Microbiology Undergraduate Advising Hub website (https://biochemmicrobio.wisc.edu/) each semester.

### CAREER EXAMPLES

- Take your skills to a rewarding career in product development, quality control, hospitals, biotechnology, university labs, pharmaceuticals, forensics, and more. Possibilities at top organizations and leading companies include positions such as protein purification scientist, lab manager, medical scribe, clinical research coordinator, and food safety and quality chemist.
- Pursue a professional degree in medical, dental, or veterinary school, using your background in biochemistry to aid your admission and success.
- Build on your research experience and continue graduate studies in biochemistry or a related field to shape a career in academia as a professor or in industry.
- Use your science background to inform patent law, science policy and ethics, sales and marketing for science and technology companies, scientific article publishing, and related fields.

### SUCCESSWORKS

SuccessWorks (https://successworks.wisc.edu/) at the College of Letters & Science helps you turn the academic skills learned in your classes into a fulfilling life, guiding you every step of the way to securing jobs, internships, or admission to graduate school.

Through one-on-one career advising, events, and resources, you can explore career options, build valuable internship and research experience, and connect with supportive alumni and employers who open doors of opportunity.

- What you can do with your major (https://successworks.wisc.edu/what-you-can-do-with-your-major/) (Major Skills & Outcomes Sheets)
- Make a career advising appointment (https://successworks.wisc.edu/make-an-appointment/)
- Learn about internships and internship funding (https://successworks.wisc.edu/finding-a-job-or-internship/)
- Try "Jobs, Internships, & How to Get Them," (https://successworks.wisc.edu/canvas/) an interactive guide in Canvas for enrolled UW–Madison students

## WISCONSIN EXPERIENCE

# WISCONSIN EXPERIENCE

The following opportunities can help students connect with other students interested in biochemistry, build relationships with faculty and staff, and contribute to out-of-classroom learning:

- The American Society for Biochemistry and Molecular Biology (ASBMB) UW–Madison Student Chapter (https://win.wisc.edu/organization/ASBMB/) is a student organization for students interested in biochemistry. ASBMB provides information about careers and job opportunities, how to get involved in research, and volunteer and outreach opportunities.
- Several biochemistry faculty members offer experiential study abroad programs, where students can immerse themselves in research or global health field experiences. Students can review the Biochemistry Major Advising Page (https://studyabroad.wisc.edu/academics/major-advising-pages-maps/biochemistry/) on the International Academic Programs website for information on these and other programs, as well as requirements that can typically be fulfilled abroad and things to consider when fitting study abroad into an academic plan.
- Students are encouraged to get involved in research, whether in the biochemistry department or through other life science or chemistry-related departments. Research can be performed for either course credit or pay, depending on the opportunity. The Biochemistry website (https://biochem.wisc.edu/academics/undergraduate-major-programs/) and the advisors can provide more information on finding research opportunities. Summer funding awards for research are available through the department.