

# BIOCHEMISTRY, B.A. (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

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 (<http://guide.wisc.edu/undergraduate/#requirementsforundergraduatestudytext>) section of the *Guide*.

General Education	<ul style="list-style-type: none"> <li>• Breadth—Humanities/Literature/Arts: 6 credits</li> <li>• 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</li> <li>• Breadth—Social Studies: 3 credits</li> <li>• Communication Part A &amp; Part B *</li> <li>• Ethnic Studies *</li> <li>• Quantitative Reasoning Part A &amp; Part B *</li> </ul>
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\* 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 (B.A.)

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

**Mathematics** Complete the University General Education Requirements for Quantitative Reasoning A (QR-A) and Quantitative Reasoning B (QR-B) coursework.

**Foreign Language**

- Complete the fourth unit of a foreign language; OR
- Complete the third unit of a foreign language and the second unit of an additional foreign language.

**L&S Breadth**

- 12 credits of Humanities, which must include 6 credits of literature; and
- 12 credits of Social Science; and
- 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
- 30 credits in residence after the 86th credit.

Quality of Work	<ul style="list-style-type: none"> <li>• 2.000 in all coursework at UW–Madison</li> <li>• 2.000 in Intermediate/Advanced level coursework at UW–Madison</li> </ul>
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## 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
MATH 275 & MATH 276	Topics in Calculus I and Topics in Calculus II	10

### 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 565	Biophysical Chemistry (recommended)	4
CHEM 561 & CHEM 563	Physical Chemistry and Physical Chemistry Laboratory I	4

### 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

##### 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/](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
ANAT&PHY 335	Physiology	5
ANAT&PHY 337	Human Anatomy	3
ANAT&PHY 435	Fundamentals of Human Physiology	5
AGRONOMY 300	Cropping Systems	3
AGRONOMY 302	Forage Management and Utilization	3
AGRONOMY/HORT/ SOIL SCI 326	Plant Nutrition Management	3
AGRONOMY/ HORT 338	Plant Breeding and Biotechnology	3

AGRONOMY/ BOTANY/HORT 339	Plant Biotechnology: Principles and Techniques I	4	BIOCHEM 570	Computational Modeling of Biological Systems	3
AGRONOMY/ BOTANY/HORT 340	Plant Cell Culture and Genetic Engineering	3	BIOCHEM/ M M & I 575	Biology of Viruses	2
AGRONOMY/A A E/ NUTR SCI 350	World Hunger and Malnutrition	3	BIOCHEM 601	Protein and Enzyme Structure and Function	2
AGRONOMY/ BOTANY/ SOIL SCI 370	Grassland Ecology	3	BIOCHEM/B M I/ BMOLCHEM/ MATH 609	Mathematical Methods for Systems Biology	3
AGRONOMY 377	Global Food Production and Health	3	BIOCHEM/ GENETICS/ MICROBIO 612	Prokaryotic Molecular Biology	3
AGRONOMY/ HORT 501	Principles of Plant Breeding	3	BIOCHEM/ NUTR SCI 619	Advanced Nutrition: Intermediary Metabolism of Macronutrients	3
AGRONOMY/ ATM OCN/ SOIL SCI 532	Environmental Biophysics	3	BIOCHEM/ GENETICS/ MD GENET 620	Eukaryotic Molecular Biology	3
AN SCI/ FOOD SCI 305	Introduction to Meat Science and Technology	4	BIOCHEM/ BOTANY 621	Plant Biochemistry	3
AN SCI/DY SCI/ NUTR SCI 311	Comparative Animal Nutrition	3	BIOCHEM 625	Mechanisms of Action of Vitamins and Minerals	2
AN SCI 314	Poultry Nutrition	3	BIOCHEM/ PHMCOL-M/ ZOOLOGY 630	Cellular Signal Transduction Mechanisms	3
AN SCI/DY SCI 320	Animal Health and Disease	3	BIOCHEM/ NUTR SCI 645	Molecular Control of Metabolism and Metabolic Disease	3
AN SCI/DY SCI 361	Introduction to Animal and Veterinary Genetics	2	BSE 349	Quantitative Techniques for Biological Systems	3
AN SCI/DY SCI 362	Veterinary Genetics	2	BSE 364	Engineering Properties of Food and Biological Materials	3
AN SCI/DY SCI 363	Principles of Animal Breeding	2	BSE 365	Measurements and Instrumentation for Biological Systems	3
AN SCI/DY SCI 370	Livestock Production and Health in Agricultural Development	3	BSE/ENVIR ST 367	Renewable Energy Systems	3
AN SCI/DY SCI 414	Ruminant Nutrition & Metabolism	3	BSE 460	Biorefining: Energy and Products from Renewable Resources	3
AN SCI 415	Application of Monogastric Nutrition Principles	2	BSE 461	Food and Bioprocessing Operations	3
AN SCI 431	Beef Cattle Production	3	BSE 472	Sediment and Bio-Nutrient Engineering and Management	3
AN SCI 432	Swine Production	3	BMOLCHEM/ MICROBIO 668	Microbiology at Atomic Resolution	3
AN SCI/DY SCI 434	Reproductive Physiology	3	B M I/STAT 541	Introduction to Biostatistics	3
AN SCI 503	Avian Physiology	3	B M I/ COMP SCI 576	Introduction to Bioinformatics	3
AN SCI 508	Poultry Products Technology	3	BOTANY 300	Plant Anatomy	4
AN SCI 511	Breeder Flock and Hatchery Management	3	BOTANY 305	Plant Morphology and Evolution	4
AN SCI 512	Management for Avian Health	3	BOTANY 330	Algae	3
AN SCI/ FOOD SCI 515	Commercial Meat Processing	2	BOTANY/ PL PATH 332	Fungi	4
AN SCI/F&W ECOL/ ZOOLOGY 520	Ornithology	3	BOTANY/ AGRONOMY/ HORT 339	Plant Biotechnology: Principles and Techniques I	4
AN SCI/F&W ECOL/ ZOOLOGY 521	Birds of Southern Wisconsin	3	BOTANY 400	Plant Systematics	4
AN SCI 610	Quantitative Genetics	3	BOTANY 401	Vascular Flora of Wisconsin	4
AN SCI/ NUTR SCI 626	Experimental Diet Design	1	BOTANY/ F&W ECOL 402	Dendrology	2
B M E/MED PHYS/ PHMCOL- M/PHYSICS/ RADIOL 619	Microscopy of Life	3			
BIOCHEM/ NUTR SCI 510	Nutritional Biochemistry and Metabolism	3			
BIOCHEM 550	Principles of Human Disease and Biotechnology	2			

BOTANY/ANTHRO/ ZOOLOGY 410	Evolutionary Biology	3	ENVIR ST/ F&W ECOL 515	Natural Resources Policy	3
BOTANY 422	Plant Geography	3	ENVIR ST/ ATM OCN 520	Bioclimatology	3
BOTANY/ F&W ECOL 455	The Vegetation of Wisconsin	4	ENVIR ST/A A E/ F&W ECOL 652	Decision Methods for Natural Resource Managers	3-4
BOTANY/ F&W ECOL/ ZOOLOGY 460	General Ecology	4	FOOD SCI/ MICROBIO 324	Food Microbiology Laboratory	2
BOTANY/ENTOM/ ZOOLOGY 473	Plant-Insect Interactions	3	FOOD SCI/ MICROBIO 325	Food Microbiology	3
BOTANY/AMER IND/ ANTHRO 474	Ethnobotany	3-4	FOOD SCI 410	Food Chemistry	3
BOTANY 500	Plant Physiology	3-4	FOOD SCI 440	Principles of Food Engineering	3
BOTANY/ENTOM/ PL PATH 505	Plant-Microbe Interactions: Molecular and Ecological Aspects	3	FOOD SCI 511	Chemistry and Technology of Dairy Products	3
BOTANY/ PL PATH 563	Phylogenetic Analysis of Molecular Data	3	FOOD SCI 514	Integrated Food Functionality	4
BOTANY/HORT/ SOIL SCI 626	Mineral Nutrition of Plants	3	FOOD SCI 550	Fermented Foods and Beverages	2
BOTANY/ENVIR ST/ F&W ECOL/ ZOOLOGY 651	Conservation Biology	3	FOOD SCI 610	Food Proteins	2
BOTANY/ GENETICS/M M & I/ PL PATH 655	Biology and Genetics of Fungi	3	FOOD SCI 611	Chemistry and Technology of Dairy Products	3
BOTANY/ LAND ARC 670	Adaptive Restoration Lab	2	F&W ECOL 300	Forest Biometry	4
CHEM 575	Advanced Topics in Chemistry (Topics in Chemical Biology)	1-4	F&W ECOL 306	Terrestrial Vertebrates: Life History and Ecology	4
CRB 625	Stem Cell Seminar	1	F&W ECOL/ HORT/LAND ARC/ PL PATH 309	Diseases of Trees and Shrubs	3
CRB 650	Molecular and Cellular Organogenesis	3	F&W ECOL 318	Principles of Wildlife Ecology	3
DY SCI 378	Lactation Physiology	3	F&W ECOL/ ZOOLOGY 335	Human/Animal Relationships: Biological and Philosophical Issues	3
DY SCI 535	Dairy Farm Management Practicum	3	F&W ECOL/ ENVIR ST/ ZOOLOGY 360	Extinction of Species	3
ENTOM/ ZOOLOGY 302	Introduction to Entomology	4	F&W ECOL 379	Principles of Wildlife Management	3
ENTOM 321	Physiology of Insects	3	F&W ECOL 401	Physiological Animal Ecology	3
ENTOM 331	Taxonomy of Mature Insects	4	F&W ECOL 404	Wildlife Damage Management	3
ENTOM 351	Principles of Economic Entomology	3	F&W ECOL 410	Principles of Silviculture	3
ENTOM/ ZOOLOGY 371	Medical Entomology	3	F&W ECOL 415	Tree Physiology	3
ENTOM 432	Taxonomy and Bionomics of Immature Insects	4	F&W ECOL/ SURG SCI 548	Diseases of Wildlife	3
ENTOM/ F&W ECOL 500	Insects in Forest Ecosystem Function and Management	2	F&W ECOL 550	Forest Ecology	3
ENTOM/ ZOOLOGY 540	Theoretical Ecology	3	F&W ECOL 561	Wildlife Management Techniques	3
ENTOM/GENETICS/ ZOOLOGY 624	Molecular Ecology	3	F&W ECOL/ LAND ARC/ ZOOLOGY 565	Principles of Landscape Ecology	2
ENVIR ST/ LAND ARC 361	Wetlands Ecology	3	F&W ECOL 590	Integrated Resource Management	3
ENVIR ST/ POP HLTH 471	Introduction to Environmental Health	3	F&W ECOL/ AGRONOMY/ ENTOM/ M&ENVTOX 632	Ecotoxicology: The Chemical Players	1
ENVIR ST/ POP HLTH 502	Air Pollution and Human Health	3	F&W ECOL/ AGRONOMY/ ENTOM/ M&ENVTOX 633	Ecotoxicology: Impacts on Individuals	1
			F&W ECOL/ AGRONOMY/ ENTOM/ M&ENVTOX 634	Ecotoxicology: Impacts on Populations, Communities and Ecosystems	1

F&W ECOL 655	Animal Population Dynamics	3	MICROBIO 632	Industrial Microbiology/ Biotechnology	2
GENETICS 466	Principles of Genetics	3	NTP/ NEURODPT 610	Cellular and Molecular Neuroscience	4
GENETICS 467	General Genetics 1	3	NTP/NEURODPT/ PSYCH 611	Systems Neuroscience	4
GENETICS 468	General Genetics 2	3	NTP/ NEURODPT 629	Molecular and Cellular Mechanisms of Memory	3
GENETICS 525	Epigenetics	3	NUTR SCI 332	Human Nutritional Needs	3
GENETICS 545	Genetics Laboratory	2	NUTR SCI 431	Nutrition in the Life Span	3
GENETICS/ HORT 550	Molecular Approaches for Potential Crop Improvement	3	ONCOLOGY 401	Introduction to Experimental Oncology	2
GENETICS/ MD GENET 565	Human Genetics	3	ONCOLOGY/ M&ENVTOX/ PHM SCI/PHMCOL- M/POP HLTH 625	Toxicology I	3
GENETICS 566	Advanced Genetics	3	PHM SCI 310	Drugs and Their Actions	2
HORT 320	Environment of Horticultural Plants	3	PHM SCI/B M E 430	Biological Interactions with Materials	3
HORT/ AGRONOMY 501	Principles of Plant Breeding	3	PHYSICS/B M E/ MED PHYS/ PHMCOL-M/ RADIOL 619	Microscopy of Life	3
M M & I 301	Pathogenic Bacteriology	2	PL PATH 300	Introduction to Plant Pathology	4
M M & I 341	Immunology	3	PL PATH/ SOIL SCI 323	Soil Biology	3
M M & I/ENTOM/ PATH-BIO/ ZOOLOGY 350	Parasitology	3	PL PATH 517	Plant Disease Resistance	2-3
M M & I/PATH- BIO 528	Immunology	3	PL PATH 558	Biology of Plant Pathogens	3
M M & I 554	Emerging Infectious Diseases and Bioterrorism	2	PL PATH 559	Diseases of Economic Plants	3
M M & I/ POP HLTH 603	Clinical and Public Health Microbiology	5	PL PATH 602	Ecology, Epidemiology and Control of Plant Diseases	3
MED PHYS/ H ONCOL 410	Radiobiology	2-3	PL PATH 622	Plant-Bacterial Interactions	2-3
MED PHYS/ B M E/H ONCOL/ PHYSICS 501	Radiation Physics and Dosimetry	3	PL PATH/ ONCOLOGY 640	General Virology-Multiplication of Viruses	3
MICROBIO 303	Biology of Microorganisms	3	PSYCH 454	Behavioral Neuroscience	3
MICROBIO 304	Biology of Microorganisms Laboratory	2	SOIL SCI/ F&W ECOL 451	Environmental Biogeochemistry	3
MICROBIO 330	Host-Parasite Interactions	3	SOIL SCI/ CIV ENGR 623	Microbiology of Waterborne Pathogens and Indicator Organisms	3
MICROBIO/AN SCI/ BOTANY 335	The Microbiome of Plants, Animals, and Humans	3	SOIL SCI/ CIV ENGR/ M&ENVTOX 631	Toxicants in the Environment: Sources, Distribution, Fate, & Effects	3
MICROBIO 345	Introduction to Disease Biology	3	ZOOLOGY 300	Invertebrate Biology and Evolution	3
MICROBIO/ SOIL SCI 425	Environmental Microbiology	3	ZOOLOGY 301	Invertebrate Biology and Evolution Lab	2
MICROBIO 450	Diversity, Ecology and Evolution of Microorganisms	3	ZOOLOGY 304	Marine Biology	2
MICROBIO 470	Microbial Genetics & Molecular Machines	3	ZOOLOGY/ ENVIR ST 315	Limnology-Conservation of Aquatic Resources	2
MICROBIO 520	Planetary Microbiology: What Life Here Tells Us About Life Out There	3	ZOOLOGY 316	Laboratory for Limnology- Conservation of Aquatic Resources	2-3
MICROBIO/ SOIL SCI 523	Soil Microbiology and Biochemistry	3	ZOOLOGY 425	Behavioral Ecology	3
MICROBIO 525	Field Studies of Planetary Microbiology and Life in the Universe	3	ZOOLOGY 430	Comparative Anatomy of Vertebrates	5
MICROBIO 526	Physiology of Microorganisms	3	ZOOLOGY 470	Introduction to Animal Development	3
MICROBIO 527	Advanced Laboratory Techniques in Microbiology	2	ZOOLOGY 504	Modeling Animal Landscapes	3-5
MICROBIO 551	Capstone Research Project in Microbiology	2	ZOOLOGY/ ENVIR ST 510	Ecology of Fishes	3
MICROBIO 607	Advanced Microbial Genetics	3			

ZOOLOGY/ ENVIR ST 511	Ecology of Fishes Lab	2
ZOOLOGY/ PSYCH 523	Neurobiology	3
ZOOLOGY/ GEOSCI 541	Paleobiology	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/NTP/ PSYCH 619	Biology of Mind	3
ZOOLOGY 625	Development of the Nervous System	2

### Option B (Biocore)

### 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:		
BIOCORE 382	Evolution, Ecology, and Genetics Laboratory	4
BIOCORE 384	Cellular Biology Laboratory	
BIOCORE 486	Principles of Physiology Laboratory	
<b>Total Credits</b>		<b>16</b>

## PHYSICS (CALCULUS-BASED)

### Physics Requirements

Code	Title	Credits
Complete one of the following options: <sup>1</sup>		
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
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### Select one of the following options:

BIOCHEM 507 & BIOCHEM 508	General Biochemistry I and General Biochemistry II (recommended)	6-7
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### OR

BIOCHEM 501	Introduction to Biochemistry	3
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And one of the following advanced biochemistry electives:

BIOCHEM/ NUTR SCI 510	Nutritional Biochemistry and Metabolism	
BIOCHEM 550	Principles of Human Disease and Biotechnology	
BIOCHEM 570	Computational Modeling of Biological Systems	
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/ PHMCOL-M/ ZOOLOGY 630	Cellular Signal Transduction Mechanisms	
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.<sup>2</sup>
- 15 credits in BIOCHEM, taken on campus

<sup>1</sup>

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 550, BIOCHEM 570 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/ PHM COL-M/ ZOOLOGY 630, BIOCHEM/ NUTR SCI 645
  - Honors coursework in MATH, CHEM, or PHYSICS, from the list below:

### Math

Code	Title	Credits
MATH 275	Topics in Calculus I	5
MATH 276	Topics in Calculus II	5
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	3
CHEM 565	Biophysical Chemistry	4
CHEM 563	Physical Chemistry Laboratory I	1
CHEM 562	Physical Chemistry	3
CHEM 564	Physical Chemistry Laboratory II	1

### 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

**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

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

### SAMPLE FOUR-YEAR PLAN

This Sample Four-Year Plan is a tool to assist students and their advisor(s). Students should use it—along with their DARS report, the Degree Planner, and Course Search & Enroll tools—to make their own four-year plan based on their placement scores, credit for transferred courses and approved examinations, and individual interests. As students become involved in athletics, honors, research, student organizations, study abroad, volunteer experiences, and/or work, they might adjust the order of their courses to accommodate these experiences. Students will likely revise their own four-year plan several times during college.

### 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	Literature Breadth	3
BIOCHEM 100 <sup>1</sup>	1	Social Science Breadth	3
	<b>13</b>		<b>15</b>

#### Sophomore

Fall	Credits	Spring	Credits
ZOOLOGY/BIOLOGY/ BOTANY 151 <sup>2</sup>	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
	<b>15</b>		<b>16</b>

#### 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	Electives	4
	<b>15</b>		<b>16</b>

#### Senior

Fall	Credits	Spring	Credits
CHEM 565	4	BIOCHEM 551	4
Upper-Level Biology for major	3	Upper-Level Biology for major	3
Social Science Breadth	3	Humanities Breadth	3
Electives	2	Electives	2
BIOCHEM 691 or 681 (if needed) <sup>3</sup>	3	BIOCHEM 692 or 682 (if needed)	3
	<b>15</b>		<b>15</b>

**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

### 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](mailto: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.

## L&S CAREER RESOURCES

Every L&S major opens a world of possibilities. SuccessWorks (<https://successworks.wisc.edu/>) at the College of Letters & Science helps students turn the academic skills learned in their major, certificates, and other coursework into fulfilling lives after graduation, whether that means jobs, public service, graduate school or other career pursuits.

In addition to providing basic support like resume reviews and interview practice, SuccessWorks offers ways to explore interests and build career skills from their very first semester/term at UW all the way through graduation and beyond.



Students can explore careers in one-on-one advising, try out different career paths, complete internships, prepare for the job search and/or graduate school applications, and connect with supportive alumni and even employers in the fields that inspire them.

- SuccessWorks (<https://careers.ls.wisc.edu/>)
- Set up a career advising appointment (<https://successworks.wisc.edu/make-an-appointment/>)
- Enroll in a Career Course (<https://successworks.wisc.edu/career-courses/>) - a great idea for first- and second-year students:
  - INTER-LS 210 L&S Career Development: Taking Initiative (1 credit)
  - INTER-LS 215 Communicating About Careers (3 credits, fulfills Comm B General Education Requirement)
- Learn about internships and internship funding (<https://successworks.wisc.edu/finding-a-job-or-internship/>)
  - INTER-LS 260 Internship in the Liberal Arts and Sciences
- Activate your Handshake account (<https://successworks.wisc.edu/handshake/>) to apply for jobs and internships from 200,000+ employers recruiting UW-Madison students
- Learn about the impact SuccessWorks has on students' lives (<https://successworks.wisc.edu/about/mission/>)

## PEOPLE

### PROFESSORS

Amasino, Rick  
 Attie, Alan  
 Bednarek, Sebastian  
 Butcher, Sam  
 Cox, Mike  
 Craig, Elizabeth  
 Fox, Brian (Chair)  
 Friesen, Paul  
 Henzler-Wildman, Katie  
 Holden, Hazel  
 Kimble, Judith  
 Landick, Bob  
 Ntambi, James  
 Palmenberg, Ann  
 Ralph, John  
 Rayment, Ivan  
 Record, Tom  
 Rienstra, Chad  
 Senes, Alessandro  
 Sussman, Mike  
 Wright, Elizabeth

### ASSOCIATE PROFESSORS

Hoskins, Aaron  
 Raman, Vatsan

### ASSISTANT PROFESSORS

Cantor, Jason  
 Coyle, Scott  
 Grant, Tim  
 Kirchdoerfer, Robert  
 Lim, Ci Ji  
 Romero, Phil  
 Simcox, Judith  
 Venturelli, Ophelia

Weeks, Amy

### ASSOCIATE FACULTY

Pennella, Mario  
 Shu, Erica

### ACADEMIC ADVISORS

Biochemistry & Microbiology Undergraduate Advising Hub (<https://biochemmicrobio.wisc.edu/advising/>)

For more information, see the Department of Bacteriology directory (<https://bact.wisc.edu/people.php>).

## 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/undergraduate\\_program/research-opportunities-undergraduate-program/](https://biochem.wisc.edu/undergraduate_program/research-opportunities-undergraduate-program/)) and the advisors can provide more information on finding research opportunities. Summer funding awards for research are available through the department.