

MICROBIOLOGY, BS (L&S)

Admissions to the Microbiology [BA or BS (L&S)] has been suspended as of fall 2023, and the program will be discontinued as of fall 2027. Students interested in Microbiology can contact the Microbiology major advisors (academicaffairs@cals.wisc.edu) to discuss the College of Agricultural and Life Sciences Microbiology major. For other questions, please contact CALS Academic Affairs (academicaffairs@cals.wisc.edu).

Microbiology, the study of microorganisms, helps us understand our world and solve major problems. Microorganisms, or microbes, were the first life forms on Earth and influence our lives and our planet in innumerable ways. The field of microbiology is constantly expanding as we learn more about the role of microbes in infectious disease, environmental remediation, bioenergy, food safety, antibiotic resistance, biotechnology, and much more. Communities of microbes (or "microbiomes") are critically important in human health, global warming, agricultural yield, criminal justice, economic development, and other issues of national concern.

The **microbiology major**, offered by the Department of Bacteriology, is a rigorous path of study, providing a curriculum packed with deep knowledge on broad aspects of microbiology and emphasizing modern laboratory skills. The core courses focus on the diversity, genetics, biochemistry, and physiology of microorganisms. A variety of elective courses provide the opportunity to study environmental microbiology, food microbiology, microbial pathogenesis, immunology, virology, microbiomes, and microbial biotechnology, as well as advanced topics in microbial genetics and physiology. In the instructional laboratory courses, students learn beginning through advanced laboratory techniques – gaining the type of hands-on experiences with modern equipment that employers and graduate schools seek. Additionally, students can conduct mentored and independent research projects in faculty laboratories.

The bachelor's degree provides a strong background in the biological sciences for students planning to enter medical, dental, veterinary, or other professional schools, as well as those planning graduate studies in any branch of microbiology or other biological sciences such as biochemistry, pathology, and molecular or cell biology.

Students who end their training with a bachelor's degree are well-prepared for a variety of career opportunities, including laboratory positions in pharmaceutical firms, biotechnology firms, university laboratories, and government laboratories. They also work as specialists in industrial quality testing and control and as regulatory workers in government agencies and public health laboratories. Exposure to the scientific process as well as training in microbiology allows microbiology graduates to enter fields as diverse as business, technical service, sales, and technical writing.

HOW TO GET IN

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Agricultural and Life Sciences Microbiology major. For other questions, please contact CALS Academic Affairs (academicaffairs@cals.wisc.edu).

REQUIREMENTS

COLLEGE OF LETTERS & SCIENCE DEGREE REQUIREMENTS: BACHELOR OF SCIENCE (BS)

Students pursuing a Bachelor of Science 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 the Bachelor of Arts or the Bachelor of Science degree requirements.

BACHELOR OF SCIENCE DEGREE REQUIREMENTS

Mathematics	Complete two courses of 3+ credits at the Intermediate or Advanced level in MATH, COMP SCI, or STAT subjects. A maximum of one course in each of COMP SCI and STAT subjects counts toward this requirement.
Language	Complete the third unit of a language other than English.
LS Breadth	Complete: <ul style="list-style-type: none"> • 12 credits of Humanities, which must include at least 6 credits of Literature; and • 12 credits of Social Science; and • 12 credits of Natural Science, which must include 6 credits of Biological Science and 6 credits of Physical Science.
Liberal Arts and Science Coursework	Complete at least 108 credits.
Depth of Intermediate/Advanced Coursework	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	Complete both: <ul style="list-style-type: none"> • 30 credits in residence, overall, and • 30 credits in residence after the 86th credit.
Quality of Work	<ul style="list-style-type: none"> • 2.000 in all coursework at UW-Madison • 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.

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/#requirementsforundergraduatetext>) section of the *Guide*.

General Education	• Breadth—Humanities/Literature/Arts: 6 credits
	• 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
	• Breadth—Social Studies: 3 credits
	• Communication Part A Part B *
	• Ethnic Studies *
	• 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.

REQUIREMENTS FOR THE MAJOR

Code	Title	Credits
Mathematics		
Complete one of the following:		5-10
MATH 171 & MATH 217	Calculus with Algebra and Trigonometry I and Calculus with Algebra and Trigonometry II	
MATH 221	Calculus and Analytic Geometry I	
Statistics		
Complete one of the following:		3
STAT 301	Introduction to Statistical Methods	
STAT 371	Introductory Applied Statistics for the Life Sciences	
General Chemistry		
Complete one of the following:		5-10
CHEM 103 & CHEM 104	General Chemistry I and General Chemistry II	
CHEM 109	Advanced General Chemistry	
CHEM 115 & CHEM 116	Chemical Principles I and Chemical Principles II	
Organic Chemistry		
Complete ALL of the following:		
CHEM 343	Organic Chemistry I	3
CHEM 344	Introductory Organic Chemistry Laboratory	2
CHEM 345	Organic Chemistry II	3
Biology Foundation		
Complete one of the following:		10-13

BIOLOGY/ BOTANY/ ZOOLOGY 151 & BIOLOGY/ BOTANY/ ZOOLOGY 152	Introductory Biology and Introductory Biology
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BIOCORE 381 & BIOCORE 382 & BIOCORE 383 & BIOCORE 384 & BIOCORE 485	Evolution, Ecology, and Genetics and Evolution, Ecology, and Genetics Laboratory and Cellular Biology and Cellular Biology Laboratory and Principles of Physiology
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ZOOLOGY/ BIOLOGY 101 & ZOOLOGY/ BIOLOGY 102 & BOTANY/ BIOLOGY 130	Animal Biology and Animal Biology Laboratory and General Botany
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Physics

Complete one of the following: 8-10

PHYSICS 103 & PHYSICS 104	General Physics and General Physics
PHYSICS 207 & PHYSICS 208	General Physics and General Physics
PHYSICS 201 & PHYSICS 202	General Physics and General Physics

Biochemistry

Complete one of the following: 3-6

BIOCHEM 501	Introduction to Biochemistry
BIOCHEM 507 & BIOCHEM 508	General Biochemistry I and General Biochemistry II

Microbiology Courses

Microbiology Core (all required):

Except where noted, all Microbiology Core courses are offered every fall and spring semester.

MICROBIO 303	Biology of Microorganisms	3
MICROBIO 304	Biology of Microorganisms Laboratory	2
MICROBIO 305	Critical Analyses in Microbiology	1
MICROBIO 450	Diversity, Ecology and Evolution of Microorganisms (SPRING ONLY)	3
MICROBIO 470	Microbial Genetics & Molecular Machines	3
MICROBIO 526	Physiology of Microorganisms	3
MICROBIO 527	Advanced Laboratory Techniques in Microbiology (FALL ONLY)	2

Microbiology Capstone (required):

MICROBIO 551	Capstone Research Project in Microbiology (SPRING ONLY)	2
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Microbiology Electives

Complete at least 6 credits; at least 3 credits must come from Set A. Not all elective courses are offered every semester.

Set A: 3-6

MICROBIO/ FOOD SCI 324	Food Microbiology Laboratory
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MICROBIO/ FOOD SCI 325	Food Microbiology
MICROBIO 330	Host-Parasite Interactions
MICROBIO/ AN SCI/ BOTANY 335	The Microbiome of Plants, Animals, and Humans
MICROBIO 345	Introduction to Disease Biology
MICROBIO 357	General Bioinformatics for Microbiologists
MICROBIO/ SOIL SCI 425	Environmental Microbiology
MICROBIO 520	Planetary Microbiology: What Life Here Tells Us About Life Out There
MICROBIO/ SOIL SCI 523	Soil Microbiology and Biochemistry
MICROBIO/ ONCOLOGY 545	Topics in Biotechnology (topics vary by semester)
MICROBIO 607	Advanced Microbial Genetics
MICROBIO/ BIOCHEM/ GENETICS 612	Prokaryotic Molecular Biology
MICROBIO 657	Bioinformatics for Microbiologists
MICROBIO/ BMOLCHEM 668	Microbiology at Atomic Resolution
Set B: 0-3	
BIOCHEM 570	Computational Modeling of Biological Systems
BIOCHEM/M M & I 575	Biology of Viruses
BIOCHEM 601	Protein and Enzyme Structure and Function
BOTANY 330	Algae
BOTANY/PL PATH 332	Fungi
BOTANY/ ENTOM/PL PATH 505	Plant-Microbe Interactions: Molecular and Ecological Aspects
CHEM 665	Biophysical Chemistry
COMP SCI/ B M I 576	Introduction to Bioinformatics
F&W ECOL/SURG SCI 548	Diseases of Wildlife
FOOD SCI 550	Fermented Foods and Beverages
M M & I 301	Pathogenic Bacteriology
M M & I 341	Immunology
M M & I/ENTOM/ PATH-BIO/ ZOOLOGY 350	Parasitology
M M & I 554	Emerging Infectious Diseases and Bioterrorism
ONCOLOGY/ M M & I/ PL PATH 640	General Virology-Multiplication of Viruses
PATH-BIO/ M M & I 528	Immunology
PL PATH 622	Plant-Bacterial Interactions

PL PATH/ BOTANY/ GENETICS/ M M & I 655	Biology and Genetics of Fungi
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Total Credits**64-88**

RESIDENCE AND QUALITY OF WORK

- 2.000 GPA in all MICROBIO courses and courses approved for the major
- 2.000 GPA on 15 upper-level major credits, in residence¹
- 15 credits of MICROBIO or courses counting toward the major, taken on campus

¹ MICROBIO 300 through 699 count as upper level in the major, excluding MICROBIO 303 and MICROBIO 304. Intermediate- and advanced-level courses outside of MICROBIO that count for the major are also considered upper level.

HONORS IN THE MAJOR

Students may declare Honors in the Microbiology Major in consultation with the Microbiology undergraduate advisor.

HONORS IN THE MAJOR REQUIREMENTS

To earn Honors in the Major in Microbiology, students must satisfy both the requirements for the major (above) and the following requirements:

- Earn a 3.300 University GPA
- Earn a 3.300 GPA for all courses accepted in the major
- MICROBIO 681 and MICROBIO 682 for a total of 6 credits
- 9 credits of Honors course work (with grade B or better) from:

Code	Title	Credits
MICROBIO 303	Biology of Microorganisms	3
MICROBIO 304	Biology of Microorganisms Laboratory	2
MICROBIO 330	Host-Parasite Interactions	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 526	Physiology of Microorganisms	3
PATH-BIO/ M M & I 528	Immunology	3
MICROBIO 607	Advanced Microbial Genetics	3
MICROBIO/ BIOCHEM/ GENETICS 612	Prokaryotic Molecular Biology	3
PL PATH 622	Plant-Bacterial Interactions	2-3
MICROBIO 632	Industrial Microbiology/ Biotechnology	2
ONCOLOGY/ M M & I/ PL PATH 640	General Virology-Multiplication of Viruses	3

MICROBIO/ BMOLCHEM 668	Microbiology at Atomic Resolution	3
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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

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1. Develop a fundamental understanding of the principles of microbiology and the necessary skills for a professional career in microbiology.
2. Apply the scientific method to questions. Formulate a hypothesis, gather data, and analyze that data to assess the degree to which their work supports the hypothesis.
3. Demonstrate proficiency in the techniques used in microbiology and an ability to critically analyze data and integrate ideas for problem solving.
4. Access the primary and secondary literature and, in combination with their own findings, effectively communicate their ideas both orally and in written form.
5. Learn about and demonstrate personal and professional ethics.

FOUR-YEAR PLAN

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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 MICROBIOLOGY FOUR-YEAR PLAN

Freshman

Fall	Credits Spring	Credits
General Chemistry	4-5 General Chem or Electives	5
Math	3 Math	3-5
Communication A	3 Foreign Language (if needed)	4
Foreign Language (if needed)	4 Literature Breadth	3
	15	15

Sophomore

Fall	Credits Spring	Credits
CHEM 343	3 CHEM 344	2
Math	3-5 CHEM 345	3
Intro Biology, Semester 1	5 Intro Biology, Semester 2	5
Ethnic Studies/Social Science Breadth	3 Social Science Breadth	3
	Literature Breadth	3
	16	16

Junior

Fall	Credits Spring	Credits
General Physics, Semester 1	4-5 General Physics, Semester 2	4-5
MICROBIO 303	3 MICROBIO 470	3
MICROBIO 304	2 BIOCHEM 501	3
MICROBIO 305	1 Research	1-3
Research	1-3 Social Science Breadth	3
Humanities Breadth	3	
	15	15

Senior

Fall	Credits Spring	Credits
MICROBIO 526	3 MICROBIO 450	3
MICROBIO 527	2 MICROBIO 551	2
Microbiology Elective-Set A	3 Microbiology Elective-Set B	3
Research	1-4 Research	1-4
Social Science Breadth	3 Humanities Breadth	3
	14	14

Total Credits 120

ADVISING AND CAREERS

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Current UW–Madison students should use Starfish to schedule an appointment with an advisor in the Biochemistry & Microbiology Undergraduate Advising Hub (<http://biochemmicrobio.wisc.edu/>).

Prospective/future UW–Madison students should send an email to the Biochemistry & Microbiology Undergraduate Advising Hub (biochemmicrobio-advisor@wisc.edu) to set up an appointment, which can be conducted in person or via phone call.

Read about and explore possible microbiology careers at the American Society for Microbiology website.

Learn more about health-related careers through the ExploreHealthCareers.org (<https://explorehealthcareers.org/>) website.

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/>)

Jade Wang
Jae-Hyuk Yu

TEACHING FACULTY

Melissa Christopherson
Timothy D. Paustian
Jon T. Roll
Michelle R. Rondon
Betty Slinger

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>).

PEOPLE

PEOPLE RESEARCH FACULTY

Daniel Amador-Noguez
Karthik Anantharaman
Jean-Michel Ané
Briana Burton
Kerri Coon
Timothy J. Donohue
Katrina T. Forest (Chair)
Richard L. Gourse (Emeritus)
David Hershey
Betül Kaçar
Charles W. Kaspar
Erica L-W Majumder
Katherine D. McMahon
Federico E. Rey
Garret Suen
Michael G. Thomas