

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

HOW TO GET IN

Admissions to the Microbiology [BA or BS (L&S)] have 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 (biochemmicrobio-advisor@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).

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.

L&S Breadth Complete:

- 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:

- 30 credits in residence, overall, and
- 30 credits in residence after the 86th credit.

Quality of Work

- 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 | <ul style="list-style-type: none"> • 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

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

ZOOLOGY/
BIOLOGY 101
& ZOOLOGY/
BIOLOGY 102
& BOTANY/
BIOLOGY 130

Animal Biology
and Animal Biology Laboratory
and General Botany

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

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

| | |
|--|---|
| MICROBIO/ FOOD SCI 325 | Food Microbiology |
| MICROBIO 330 | |
| 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 | |
| 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 | |
| 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 |
|---|-------------------------------|

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 | | 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 | | 3 |
| MICROBIO/ BIOCHEM/ GENETICS 612 | Prokaryotic Molecular Biology | 3 |
| PL PATH 622 | Plant-Bacterial Interactions | 2-3 |
| MICROBIO 632 | | 2 |
| ONCOLOGY/ M M & I/ PL PATH 640 | General Virology-Multiplication of Viruses | 3 |

MICROBIO/ Microbiology at Atomic Resolution 3
 BMOLCHEM 668

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

LEARNING OUTCOMES

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

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 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

ADVISING AND CAREERS

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