MICROBIOLOGY, B.S. (L&S)

Admissions to the Microbiology [B.A. or B.S. (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

Admissions to the Microbiology [B.A. or B.S. (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 (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 (B.S.)

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

<table>
<thead>
<tr>
<th>Category</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mathematics</strong></td>
<td>Complete two courses of 3+ credits at the Intermediate or Advanced level in</td>
</tr>
<tr>
<td></td>
<td>MATH, COMP SCI, or STAT subjects. A maximum of one course in each of COMP</td>
</tr>
<tr>
<td></td>
<td>SCI and STAT subjects counts toward this requirement.</td>
</tr>
<tr>
<td><strong>Foreign Language</strong></td>
<td>Complete the third unit of a foreign language.</td>
</tr>
<tr>
<td><strong>L&amp;S Breadth</strong></td>
<td>Complete:</td>
</tr>
<tr>
<td></td>
<td>• 12 credits of Humanities, which must include at least 6 credits of</td>
</tr>
<tr>
<td></td>
<td>Literature; and</td>
</tr>
<tr>
<td></td>
<td>• 12 credits of Social Science; and</td>
</tr>
<tr>
<td></td>
<td>• 12 credits of Natural Science, which must include 6 credits of</td>
</tr>
<tr>
<td></td>
<td>Biological Science and 6 credits of Physical Science.</td>
</tr>
<tr>
<td><strong>Liberal Arts and Science</strong></td>
<td>Complete at least 108 credits.</td>
</tr>
<tr>
<td><strong>Coursework</strong></td>
<td>Complete at least 60 credits at the Intermediate or Advanced level.</td>
</tr>
<tr>
<td><strong>Major</strong></td>
<td>Declare and complete at least one major.</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td>Complete at least 120 credits.</td>
</tr>
<tr>
<td><strong>UW-Madison Experience</strong></td>
<td>Complete both:</td>
</tr>
<tr>
<td></td>
<td>• 30 credits in residence, overall, and</td>
</tr>
<tr>
<td></td>
<td>• 30 credits in residence after the 86th credit.</td>
</tr>
<tr>
<td><strong>Quality of Work</strong></td>
<td>• 2.000 in all coursework at UW–Madison</td>
</tr>
<tr>
<td></td>
<td>• 2.000 in Intermediate/Advanced level coursework at UW–Madison</td>
</tr>
</tbody>
</table>

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/#requirementsforundergraduatesudytext) 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

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mathematics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete one of the following:</td>
<td>Calculus with Algebra and Trigonometry I and Calculus with Algebra and Trigonometry II</td>
<td>5-10</td>
</tr>
<tr>
<td>MATH 171 &amp; MATH 217</td>
<td>Calculus with Algebra and Trigonometry I</td>
<td></td>
</tr>
<tr>
<td>MATH 221</td>
<td>Calculus and Analytic Geometry I</td>
<td></td>
</tr>
<tr>
<td><strong>Statistics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete one of the following:</td>
<td>Introduction to Statistical Methods</td>
<td>3</td>
</tr>
<tr>
<td>STAT 301</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAT 371</td>
<td>Introductory Applied Statistics for the Life Sciences</td>
<td></td>
</tr>
<tr>
<td><strong>General Chemistry</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete one of the following:</td>
<td>General Chemistry I and General Chemistry II</td>
<td>5-10</td>
</tr>
<tr>
<td>CHEM 103 &amp; CHEM 104</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 109</td>
<td>Advanced General Chemistry</td>
<td></td>
</tr>
<tr>
<td>CHEM 115 &amp; CHEM 116</td>
<td>Chemical Principles I and Chemical Principles II</td>
<td></td>
</tr>
<tr>
<td><strong>Organic Chemistry</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete ALL of the following:</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>CHEM 343</td>
<td>Organic Chemistry I</td>
<td></td>
</tr>
<tr>
<td>CHEM 344</td>
<td>Introductory Organic Chemistry Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>CHEM 345</td>
<td>Organic Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td><strong>Biology Foundation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete one of the following:</td>
<td></td>
<td>10-13</td>
</tr>
<tr>
<td>BIOLOGY/BOTANY/ZOOLOGY 151 &amp; BIOLOGY/ BOTANY/ZOOLOGY 152</td>
<td>Introductory Biology and Introductory Biology</td>
<td></td>
</tr>
</tbody>
</table>

### Mathematics

- Complete one of the following:
  - 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:
  - STAT 301: Introduction to Statistical Methods
  - STAT 371: Introductory Applied Statistics for the Life Sciences

### General Chemistry

- Complete one of the following:
  - 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
  - CHEM 344: Introductory Organic Chemistry Laboratory
  - CHEM 345: Organic Chemistry II

### Biology Foundation

- Complete one of the following:
  - BIOLOGY/BOTANY/ZOOLOGY 151 & BIOLOGY/ BOTANY/ZOOLOGY 152: Introductory Biology and Introductory Biology

### Microbiology Courses

- **Microbiology Core (all required):**
  - Except where noted, all Microbiology Core courses are offered every fall and spring semester.
  - MICR03 BIOLOGY of Microorganisms
  - MICR04 BIOLOGY of Microorganisms
  - MICR05 Critical Analyses in Microbiology
  - MICR05 Diversity, Ecology and Evolution of Microorganisms
  - MICR07 Microbial Genetics & Molecular Machines
  - MICR07 Physiology of Microorganisms
  - MICR08 Advanced Laboratory Techniques in Microbiology (FALL ONLY)

- **Microbiology Capstone (required):**
  - MICR051 Capstone Research Project in Microbiology (SPRING ONLY)

### 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

- MICR052 Food Microbiology Laboratory
- MICR053 Food Microbiology
- MICR054 Host-Parasite Interactions
- MICR055 The Microbiome of Plants, Animals, and Humans
### Microbiology, B.S. (L&S)

#### Set A:
- MICROBIO 345 Introduction to Disease Biology
- MICROBIO/SOIL SCI 425 Environmental Microbiology
- 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 565 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
- M M & I/POP HLTH 603 Clinical and Public Health Microbiology
- ONCOLOGY/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

#### 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 residence
- 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:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MICROBIO 303</td>
<td>Biology of Microorganisms</td>
<td>3</td>
</tr>
<tr>
<td>MICROBIO 304</td>
<td>Biology of Microorganisms Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>MICROBIO 330</td>
<td>Host-Parasite Interactions</td>
<td>3</td>
</tr>
<tr>
<td>MICROBIO/SOIL SCI 425</td>
<td>Environmental Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>MICROBIO 450</td>
<td>Diversity, Ecology and Evolution of Microorganisms</td>
<td>3</td>
</tr>
<tr>
<td>MICROBIO 470</td>
<td>Microbial Genetics &amp; Molecular Machines</td>
<td>3</td>
</tr>
<tr>
<td>MICROBIO 526</td>
<td>Physiology of Microorganisms</td>
<td>3</td>
</tr>
<tr>
<td>PATH-BIO/M M &amp; I 528</td>
<td>Immunology</td>
<td>3</td>
</tr>
<tr>
<td>MICROBIO 607</td>
<td>Advanced Microbial Genetics</td>
<td>3</td>
</tr>
<tr>
<td>MICROBIO/BIOCHEM/GENETICS 612</td>
<td>Prokaryotic Molecular Biology</td>
<td>3</td>
</tr>
<tr>
<td>PL PATH 622</td>
<td>Plant-Bacterial Interactions</td>
<td>2-3</td>
</tr>
<tr>
<td>MICROBIO 632</td>
<td>Industrial Microbiology/ Biotechnology</td>
<td>2</td>
</tr>
<tr>
<td>ONCOLOGY/PL PATH 640</td>
<td>General Virology-Multiplication of Viruses</td>
<td>3</td>
</tr>
<tr>
<td>MICROBIO/BMOLCHEM 668</td>
<td>Microbiology at Atomic Resolution</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Total Credits

64-88
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. 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

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 MICROBIOLOGY FOUR-YEAR PLAN

<table>
<thead>
<tr>
<th>Semester</th>
<th>Credits</th>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshman</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Chemistry</td>
<td>4-5 General Chem or Electives</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Math</td>
<td>3 Math</td>
<td>3-5</td>
<td></td>
</tr>
<tr>
<td>Spring</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Senior</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MICROBIO 526</td>
<td>3 MICROBIO 450</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MICROBIO 527</td>
<td>2 MICROBIO 551</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Microbiology Elective-Set A</td>
<td>3 Microbiology Elective-Set B</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Research</td>
<td>1-4 Research</td>
<td>1-4</td>
<td></td>
</tr>
<tr>
<td>Social Science Breadth</td>
<td>3 Humanities Breadth</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>14</td>
<td>15</td>
</tr>
</tbody>
</table>

Communication A | 3 Foreign Language (if needed) | 4 |

Foreign Language (if needed) | 4 Literature Breadth | 3 |

Total Credits 120

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 (https://www.asm.org/Careers/Career-Planning/) 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/)

**PEOPLE**

**Research Faculty**

- Daniel Amador-Noguez
- Karthik Anantharaman
- Jean-Michel Ané
- Briana Burton
- Kerri Coon
- Cameron R. Currie
- 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
- Jade Wang
- Karen M. Wassarman
- Jae-Hyuk Yu

**Teaching Faculty**

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

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**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).