

# MICROBIOLOGY, PH.D.

The Department of Bacteriology in the College of Agricultural and Life Sciences and the Department of Medical Microbiology and Immunology in the School of Medicine and Public Health (see separate course listings) administer the interdepartmental microbiology doctoral training program (MDTP). Incoming students have the opportunity to do laboratory rotations with any of the primary faculty, affiliate faculty, and trainers from multiple departments. This group includes more than 90 faculty members in numerous departments and programs involved in microbiology research and graduate training. In addition to this breadth of opportunities in microbiology research training, the program also encompasses graduate courses offered by both departments. Please refer to the separate Microbiology listing in this catalog for more detailed information, or visit the program website.

The Ph.D. program prepares graduates for research and teaching positions in universities and colleges, for industry or government, and for clinical microbiology. Research emphasis includes, but is not limited to, prokaryotic (bacteria and archaea), viral and lower eukaryotic systems (fungi, oomycetes, and parasites); antibiotics and antibiotic resistance, biofilm formation; bioinformatics and computational biology; biotechnology and industrial microbiology, including biofuels; cell–cell signaling; cell motility and chemotaxis; DNA, including nucleic acid synthesis, DNA replication and recombination; food microbiology; fungal development, pathogenesis, and metabolism; gene expression and its regulation; immunology; microbial physiology and metabolism; macrophage activation and other cell immune systems; mechanisms of microbial persistence; mechanisms of pathogenesis; microbial cell division; microbial ecology; microbial microbiota and metagenomics; nitrogen fixation; quorum sensing; RNA, including molecular structure–function relationships of transfer RNA, small RNAs, RNA polymerase, and other components of transcription and translation; secondary metabolism; structural microbiology; symbioses, including host–microbe symbioses, plant–microbial interactions, animal–microbial interactions, microbe–microbe interactions; and virology, including host–virus interactions. Dissertation research emphasizes creative and innovative problem–solving using basic knowledge acquired through scientific interactions and collaborations in addition to a thorough understanding of the scientific literature.

In order to better train MDTP students for microbiology-related professions, students need a chance to gain knowledge and experience not just in academic research, but also in other fields where their microbiology education may be put to good use.

The professional development options encompass many professional development opportunities for MDTP students beyond academic research and teaching. Opportunities for professional development can consist of course work, an internship, a summer workshop, outreach experiences, or a second teaching–practicum experience.

## DOUBLE DEGREE

Students may complete a double Ph.D. degree in MDTP and another program on campus under the following conditions. The student must apply for admission to MDTP by the program's yearly deadline and be admitted using the same criteria applied to other applicants. The student must complete all requirements of the MDTP in addition to the requirements for the other program sponsoring the double degree. The student must pass a different preliminary examination in each program. The student's dissertation committee and preliminary examination must

adhere to MDTP guidelines. The Ph.D. advisor must be a trainer in the MDTP. A significant portion of the student's dissertation research must be completed in the laboratory of the Ph.D. advisor. The student's program, including any deviations, must be approved by the steering committee.

## ADMISSIONS

Please consult the table below for key information about this degree program's admissions requirements. The program may have more detailed admissions requirements, which can be found below the table or on the program's website.

Graduate admissions is a two-step process between academic programs and the Graduate School. **Applicants must meet** the minimum requirements (<https://grad.wisc.edu/apply/requirements/>) **of the Graduate School as well as the program(s)**. Once you have researched the graduate program(s) you are interested in, apply online (<https://grad.wisc.edu/apply/>).

Requirements	Detail
Fall Deadline	December 1
Spring Deadline	The program does not admit in the spring.
Summer Deadline	The program does not admit in the summer.
GRE (Graduate Record Examinations)	Not required.
English Proficiency Test	Every applicant whose native language is not English or whose undergraduate instruction was not in English must provide an English proficiency test score and meet the Graduate School minimum requirements ( <a href="https://grad.wisc.edu/apply/requirements/#english-proficiency">https://grad.wisc.edu/apply/requirements/#english-proficiency</a> ).
Other Test(s) (e.g., GMAT, MCAT)	n/a
Letters of Recommendation Required	3

## PROGRAM APPLICATION MATERIALS

Note that all application materials are submitted through the UW Graduate School Admissions Office. (<https://grad.wisc.edu/apply/>) See the Microbiology program website (<https://microbiology.wisc.edu/how-to-apply/>) for more information and guidance for the application components.

- Personal statement, also known as "Statement of Purpose".
- A statement of applicant's experiences and ambitions that will contribute to the program's commitment to diversity and inclusion.
- An official or unofficial copy of transcripts from each college or university attended.
- Three or more letters of reference from individuals (faculty, staff, supervisor, mentor) who can comment on the applicant's qualifications. This should include scholarly and academic qualifications, and can also include experiences in teaching, outreach, and community service. Directions for submission will be provided once you have initiated your application.
- A brief resume/CV listing academic awards, scholarships, location and length of research experiences, co-authorship on any publications or presentations at scientific conferences.

- Any student whose undergraduate instruction was not in English should also submit results of the TOEFL examination. The code for the University of Wisconsin-Madison is 1846.

This program is a research-intensive program. Therefore, strong letters of recommendation, a well-crafted personal statement, and extensive research experience often aid students with below-average grades.

## COURSE PREREQUISITES

We have recommended courses based on material that previous students have found valuable for success in the program, both in the lab and in required graduate level coursework. However, we recognize that the backgrounds of many students – and future student career goals – are varied and diverse, and that this diversity is a strength of our program. In the online application process, you will be asked if you have completed the following prerequisites:

- **Biology:** Two semesters. Such as the following UW-Madison course equivalents: (BIOLOGY/BOTANY/ZOOLOGY 151 and BIOLOGY/BOTANY/ZOOLOGY 152) or (BIOLOGY/ZOOLOGY 101, BIOLOGY/ZOOLOGY 102, and BIOLOGY/BOTANY 130)
- **Genetics:** One semester. Such as: MICROBIO 470, GENETICS 466, or (GENETICS 467 and GENETICS 468)
- **Chemistry:** Four semesters, including two semesters organic chemistry with one semester organic chemistry lab component. Such as: (CHEM 103 and CHEM 104), CHEM 109, or (CHEM 115 and CHEM 116), and (CHEM 343, CHEM 344, and CHEM 345)
- **Biochemistry:** One semester. Such as: BIOCHEM 501, (BIOCHEM 507 and BIOCHEM 508)
- **Physics:** One semester. Such as: (PHYSICS 104, PHYSICS 202, or PHYSICS 208)
- **Mathematics:** Two semesters of calculus or one semester each of calculus and statistics. Such as: MATH 171, MATH 217, MATH 221, STAT 301, or STAT 371
- **Second semester of physics OR other quantitative reasoning course** such as physical chemistry, differential equations, or upper-level course in computer programming, bioinformatics or statistics. Such as: PHYSICS 104, PHYSICS 202, PHYSICS 208, CHEM 561, (CHEM 563 and CHEM 565), MICROBIO 657, COMP SCI 319, COMP SCI/ B M I 576, STAT 303, MATH 319, or MATH 320

For each prerequisite, please be prepared to enter the course name and number. If you do not have all the recommended coursework, please use the text box in the application system to explain any deficiencies. We ask that you fill in the course list as appropriate, but more broadly that you include a dedicated section within your personal statement to note how your academic preparation has prepared you for Ph.D. training in microbiology.

## FUNDING

## GRADUATE SCHOOL RESOURCES

Resources to help you afford graduate study might include assistantships, fellowships, traineeships, and financial aid. Further funding information (<https://grad.wisc.edu/funding/>) is available from the Graduate School. Be sure to check with your program for individual policies and restrictions related to funding.

## PROGRAM RESOURCES

Research assistantships are available for most students from department and college-level funding sources or from competitive fellowship and traineeship awards, with continued support contingent upon adequate progress in classes and research. Applicants with outstanding records will be nominated for special fellowships or for traineeships on one of several NIH training grants awarded to UW-Madison.

## REQUIREMENTS

## MINIMUM GRADUATE SCHOOL REQUIREMENTS

Review the Graduate School minimum academic progress and degree requirements (<http://guide.wisc.edu/graduate/#policiesandrequirements>), in addition to the program requirements listed below.

## MAJOR REQUIREMENTS MODE OF INSTRUCTION

Face to Face	Evening/ Weekend	Online	Hybrid	Accelerated
Yes	No	No	No	No

### Mode of Instruction Definitions

**Accelerated:** Accelerated programs are offered at a fast pace that condenses the time to completion. Students typically take enough credits aimed at completing the program in a year or two.

**Evening/Weekend:** Courses meet on the UW-Madison campus only in evenings and/or on weekends to accommodate typical business schedules. Students have the advantages of face-to-face courses with the flexibility to keep work and other life commitments.

**Face-to-Face:** Courses typically meet during weekdays on the UW-Madison Campus.

**Hybrid:** These programs combine face-to-face and online learning formats. Contact the program for more specific information.

**Online:** These programs are offered 100% online. Some programs may require an on-campus orientation or residency experience, but the courses will be facilitated in an online format.

## CURRICULAR REQUIREMENTS

### Requirement Detail

Minimum 51 credits  
Credit Requirement

Minimum 32 credits  
Residence Credit Requirement

Minimum 26 credits must be graduate-level coursework. Details can be found in the Graduate School's Minimum Graduate Coursework (50%) policy (<https://policy.wisc.edu/library/UW-1244>) (<https://policy.wisc.edu/library/UW-1244/>).

Overall	3.00 GPA required.
Graduate GPA Requirement	This program follows the Graduate School's GPA Requirement policy ( <a href="https://policy.wisc.edu/library/UW-1203">https://policy.wisc.edu/library/UW-1203</a> ( <a href="https://policy.wisc.edu/library/UW-1203/">https://policy.wisc.edu/library/UW-1203/</a> )).
Other Grade Requirements	n/a
Assessments and Examinations	Doctoral students are required to take a comprehensive preliminary/oral examination after they have cleared their record of all Incomplete and Progress grades (other than research and thesis). Deposit of the doctoral dissertation in the Graduate School is required.
Language Requirements	None.
Graduate School Breadth Requirement	All doctoral students are required to complete a doctoral minor or graduate/professional certificate.  Students in the program may fulfill the minor requirement under either Option A: a full minor in a single department outside the major (e.g., Biochemistry, Genetics, Population Health) with at least 10 credits, or Option B: a distributed minor between two or more departments with a total of 10 credits. M M & I and MICROBIO courses can be used for minor credit rather than major credit in the Option B minor. Coursework to fulfill major and minor requirements must be reviewed and approved by student's thesis committee.

## REQUIRED COURSES

Code	Title	Credits
<b>Required Courses</b>		<b>10</b>
MICROBIO 810	Current Issues in Microbiology	
MICROBIO 811	Advanced Problems in Microbiology	
At least three courses must come from the following list:		
GENETICS 885	Advanced Genomic and Proteomic Analysis	
MICROBIO 526	Physiology of Microorganisms	
MICROBIO 607	Advanced Microbial Genetics	
MICROBIO/ BIOCHEM/ GENETICS 612	Prokaryotic Molecular Biology	
MICROBIO 657	Bioinformatics for Microbiologists	
MICROBIO 710	Microbial Symbiosis	
MICROBIO/ BMOLCHEM 668	Microbiology at Atomic Resolution	
MICROBIO 875	Special Topics	
M M & I/PATH- BIO 528	Immunology	
M M & I 740	Mechanisms of Microbial Pathogenesis	
ONCOLOGY/ PL PATH 640	General Virology-Multiplication of Viruses	
PL PATH/ BOTANY/ GENETICS/ M M & I 655	Biology and Genetics of Fungi	
<b>Seminar Requirement</b> <sup>1</sup>		<b>6</b>
MICROBIO 731	Seminar	

or M M & I 901 Seminar	
<b>Breadth</b>	<b>10</b>
The remaining credits may be other MICROBIO or M M & I courses approved by the Advising Committee or your thesis committee, excluding research, directed study, seminar or journal club course except as approved by the Steering Committee.	
<b>Research Credits</b>	
Students complete enough credits of 990 to meet the total minimum credit requirement. Credits of 990 in subjects outside of MICROBIO and M M & I are acceptable with advisor approval.	
M M & I 990	Research and Thesis
or MICROBIO 990	Research
<b>Total Credits</b>	<b>51</b>

1

Students must enroll for the program's seminar (MICROBIO 731 or M M & I 901) during their first three years. Students are expected to present during their third year when enrolled in the seminar as well as in their fourth year of the program, although they may not be enrolled.

### Rotation Requirement

Incoming students are required to rotate in a minimum of three research labs. Students who are directly admitted into a lab are exempt from this rotation requirement.

### Professional Development Requirement

Professional Development is a required part of the program's curriculum. Students are required to perform a second semester of teaching practicum, carry out an internship for as long as one semester, take at least 2 credits of coursework from the list of approved classes or through the Delta Program, or perform other professional development activities equivalent to 2 semester hours of coursework as judged by the thesis committee. The thesis committee must give approval for the student to participate in the chosen professional development activity. Thesis committees will also determine if each student has met the requirement. Students should complete the professional development requirement by the end of the fourth year.

### Options for completing Professional Development requirement:

**Courses.** The Graduate School has agreed to allow dissertator students to enroll in courses from a limited list of classes appropriate for professional development of the program's students. Students would take one or two courses in an area of interest after they become dissertators. Additional courses may be added to this list if they are appropriate for the program's students and are approved for this purpose by the Graduate School.

**Teaching practicum.** A second semester of teaching practicum may be the most appropriate training for students that seek a career in academic research and teaching. If students do not arrange for other professional development activities, the default professional development training would be a second semester of teaching in a teaching practicum.

**The Delta Program.** Students interested in teaching as a career can participate in the Delta Program, allowing students to take classes and gain experience in teaching. Successful students are granted a certificate from the Delta Program, and this achievement and experience likely make the students more attractive for teaching positions.

Summer courses or workshops. For students most interested in continuing in academic research, one or more summer courses or workshops may be the most appropriate training. Examples of such courses are those that cover research areas or methods or scientific writing or grant preparation.

Internship. As an alternative to class work or a second semester of teaching practicum, students could participate in an internship with a business or other organization. Students doing internships would have to arrange to be paid through the organization, and they would not be paid by their advisors while away from their research.

### Teaching Practicum Requirement

All students in the program are required to complete a Teaching Practicum. This Teaching Practicum is usually completed during the second year. Students choose from a list of courses and work with faculty delivering instruction in a lecture or lab setting.

## POLICIES

### GRADUATE SCHOOL POLICIES

The Graduate School's Academic Policies and Procedures (<https://grad.wisc.edu/acadpolicy/>) provide essential information regarding general university policies. Program authority to set degree policies beyond the minimum required by the Graduate School lies with the degree program faculty. Policies set by the academic degree program can be found below.

### MAJOR-SPECIFIC POLICIES

#### PRIOR COURSEWORK

##### Graduate Work from Other Institutions

With program approval, up to 9 credits of coursework may be accepted from other graduate institutions. Coursework earned ten or more years prior to admission to a doctoral degree is not allowed to satisfy requirements.

##### UW–Madison Undergraduate

For well-prepared advanced students, the program may decide to accept up to 6 credits numbered 300 or above completed at UW–Madison toward fulfillment of minimum degree and minor credit requirements. This work would not be allowed to count toward the 50% graduate coursework minimum unless taken at the 700 level or above. Coursework earned ten or more years prior to admission to a doctoral degree is not allowed to satisfy requirements.

##### UW–Madison University Special

The program may decide to accept up to 9 University Special student credits as fulfillment of the minimum graduate residence, graduate degree, or minor credit requirements on occasion as an exception (on a case-by-case basis). UW–Madison coursework taken as a University Special student would not be allowed to count toward the 50% graduate coursework minimum unless taken at the 700 level or above. Coursework earned ten or more years prior to admission to a doctoral degree is not allowed to satisfy requirements.

### PROBATION

This program follows the Graduate School's Probation policy. (<https://policy.wisc.edu/library/UW-1217/>)

### ADVISOR / COMMITTEE

This program follows the Graduate School's Advisor policy (<https://policy.wisc.edu/library/UW-1232/>) and the Graduate School's Committees policy (<https://policy.wisc.edu/library/UW-1201/>), except that:

To ensure that students are making satisfactory progress toward a degree, students are required to meet with their advisor annually.

The committee is required to have five faculty members, two of which must hold appointments in either Bacteriology or Medical Microbiology and Immunology.

### CREDITS PER TERM ALLOWED

15 credits

### TIME LIMITS

This program follows the Graduate School's Time Limits policy. (<https://policy.wisc.edu/library/UW-1221/>)

### GRIEVANCES AND APPEALS

These resources may be helpful in addressing your concerns:

- Bias or Hate Reporting (<https://doso.students.wisc.edu/bias-or-hate-reporting/>)
- Graduate Assistantship Policies and Procedures (<https://hr.wisc.edu/policies/gapp/#grievance-procedure>)
- Hostile and Intimidating Behavior Policies and Procedures (<https://hr.wisc.edu/hib/>)
  - Office of the Provost for Faculty and Staff Affairs (<https://facstaff.provost.wisc.edu/>)
- Dean of Students Office (<https://doso.students.wisc.edu/>) (for all students to seek grievance assistance and support)
- Employee Assistance (<http://www.eao.wisc.edu/>) (for personal counseling and workplace consultation around communication and conflict involving graduate assistants and other employees, post-doctoral students, faculty and staff)
- Employee Disability Resource Office (<https://employee disabilities.wisc.edu/>) (for qualified employees or applicants with disabilities to have equal employment opportunities)
- Graduate School (<https://grad.wisc.edu/>) (for informal advice at any level of review and for official appeals of program/departmental or school/college grievance decisions)
- Office of Compliance (<https://compliance.wisc.edu/>) (for class harassment and discrimination, including sexual harassment and sexual violence)
- Office of Student Conduct and Community Standards (<https://conduct.students.wisc.edu/>) (for conflicts involving students)
- Ombuds Office for Faculty and Staff (<http://www.ombuds.wisc.edu/>) (for employed graduate students and post-docs, as well as faculty and staff)
- Title IX (<https://compliance.wisc.edu/titleix/>) (for concerns about discrimination)

The program will follow the College of Agricultural and Life Sciences Grievance Policy. For clarity, the program director, vice-director and/or the program coordinator shall serve as grievance advisors. The grievance advisor will refer complaints to the program's Steering Committee.

## College of Agricultural and Life Sciences: Grievance Policy

In the College of Agricultural and Life Sciences (CALs), any student who feels unfairly treated by a member of the CALs faculty or staff has the right to complain about the treatment and to receive a prompt hearing. Some complaints may arise from misunderstandings or communication breakdowns and be easily resolved; others may require formal action. Complaints may concern any matter of perceived unfairness.

To ensure a prompt and fair hearing of any complaint, and to protect the rights of both the person complaining and the person at whom the complaint is directed, the following procedures are used in the College of Agricultural and Life Sciences. Any student, undergraduate or graduate, may use these procedures, except employees whose complaints are covered under other campus policies.

1. The student should first talk with the person at whom the complaint is directed. Most issues can be settled at this level. Others may be resolved by established departmental procedures.
2. If the student is unsatisfied, and the complaint involves any unit outside CALs, the student should seek the advice of the dean or director of that unit to determine how to proceed.
  - a. If the complaint involves an academic department in CALs the student should proceed in accordance with item 3 below.
  - b. If the grievance involves a unit in CALs that is not an academic department, the student should proceed in accordance with item 4 below.
3. The student should contact the department's grievance advisor within 120 calendar days of the alleged unfair treatment. The departmental administrator can provide this person's name. The grievance advisor will attempt to resolve the problem informally within 10 working days of receiving the complaint, in discussions with the student and the person at whom the complaint is directed.
  - a. If informal mediation fails, the student can submit the grievance in writing to the grievance advisor within 10 working days of the date the student is informed of the failure of the mediation attempt by the grievance advisor. The grievance advisor will provide a copy to the person at whom the grievance is directed.
  - b. The grievance advisor will refer the complaint to a department committee that will obtain a written response from the person at whom the complaint is directed, providing a copy to the student. Either party may request a hearing before the committee. The grievance advisor will provide both parties a written decision within 20 working days from the date of receipt of the written complaint.
  - c. If the grievance involves the department chairperson, the grievance advisor or a member of the grievance committee, these persons may not participate in the review.
  - d. If not satisfied with departmental action, either party has 10 working days from the date of notification of the departmental committee action to file a written appeal to the CALs Equity and Diversity Committee. A subcommittee of this committee will make a preliminary judgement as to whether the case merits further investigation and review. If the subcommittee unanimously determines that the case does not merit further investigation and review, its decision is final. If one or more members of the subcommittee determine that the case does merit further investigation and review, the subcommittee will investigate and seek to resolve the dispute through mediation. If this mediation attempt fails, the subcommittee will bring the case to the full committee. The committee may seek additional information

from the parties or hold a hearing. The committee will present a written recommendation to the dean who will provide a final decision within 20 working days of receipt of the committee recommendation.

4. If the alleged unfair treatment occurs in a CALs unit that is not an academic department, the student should, within 120 calendar days of the alleged incident, take his/her grievance directly to the Associate Dean of Academic Affairs. The dean will attempt to resolve the problem informally within 10 working days of receiving the complaint. If this mediation attempt does not succeed the student may file a written complaint with the dean who will refer it to the CALs Equity and Diversity Committee. The committee will seek a written response from the person at whom the complaint is directed, subsequently following other steps delineated in item 3d above.

## OTHER

We offer funding to all students in the program through fellowships, trainees and research assistantships.

## PROFESSIONAL DEVELOPMENT

### GRADUATE SCHOOL RESOURCES

Take advantage of the Graduate School's professional development resources (<https://grad.wisc.edu/pd/>) to build skills, thrive academically, and launch your career.

### PROGRAM RESOURCES

In order to better train MDTP students for microbiology-related professions, students need a chance to gain knowledge and experience not just in academic research, but also in other fields where their microbiology education may be put to good use. Opportunities for professional development can consist of coursework, an internship, a summer workshop, outreach experiences, or a second teaching practicum experience. Professional Development plans must be approved by a student's thesis committee. Please see requirements (p. ) for more information.

## LEARNING OUTCOMES

1. Gain a broad understanding of the microbiology principles that underlie all biological processes.
2. Articulate, discuss and define limits to the theory and knowledge in microbiology.
3. Think critically to address research challenges using a broad range of the theories, research methods, and approaches to scientific inquiry.
4. Communicates complex ideas in a clear and understandable matter.
5. Collaborate with investigators within the program, university, and beyond to advance the science of microbiology.
6. Foster professional and ethical conduct in the sciences.
7. Ethical design of experimental protocols.
8. Reproducibility of experimental results.
9. Professional behavior in industrial, government and academic settings.
10. Develop communication skills that enable the articulation of research to fellow scientists and non-scientists.
11. Develop teaching and mentoring skills in both lecture and laboratory settings.

12. Explore career development opportunities in industry, government, academia and private industry to realize professional goals.

## PEOPLE

**Faculty:** Professors JD Sauer (program director, Medical Microbiology and Immunology), and Trina McMahon (vice-director, Bacteriology) lead the current MDTP Steering Committee. For a list of more than 90 participating faculty, see the program website (<http://www.microbiology.wisc.edu/>) or contact the program office.