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.

The Department of Bacteriology and the Department of Medical Microbiology and Immunology offer Ph.D. degrees through the microbiology doctoral training program. 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 serve as lead departments for the joint cross-campus microbiology doctoral training program.

Incoming students have the opportunity to do laboratory rotations with any of the primary faculty, affiliate faculty, or 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 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 program 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

Admission to MDTP is highly competitive. To qualify for admission to the microbiology program, an applicant should have a bachelor’s degree from an accredited institution with a GPA of at least 3.0 (on a 4.0 scale) that includes two semesters of biology (can include microbiology); one semester of genetics; four semesters of chemistry, including two semesters of organic chemistry with lab component; one semester of biochemistry; two semesters of physics; and two semesters of calculus or one semester of calculus and one semester of statistics. Deficiencies in excess of 6 semester credits should be removed before enrollment. An online application must be accompanied by a thoughtful essay, strong letters of recommendation from three persons who are familiar with the applicant’s academic ability and who can assess the applicant’s potential for a research career, transcripts from all undergraduate and graduate institutions attended, and an academic resume or CV. Previous research experience is strongly recommended. All applicants must provide scores from the general Graduate Record Exam (GRE), the subject test in a related discipline is not required; students whose undergraduate degree was obtained in an institution in which English was not the primary language of instruction must provide evidence of English proficiency by taking the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System (IELTS) exam.

GRADUATE SCHOOL ADMISSIONS

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

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 processes 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#text), in addition to the program requirements listed below.

MAJOR REQUIREMENTS

MODE OF INSTRUCTION

<table>
<thead>
<tr>
<th>Face to Face</th>
<th>Evening/Weekend</th>
<th>Online</th>
<th>Hybrid</th>
<th>Accelerated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Mode of Instruction Definitions

- **Evening/Weekend:** These programs are offered in an evening and/or weekend format to accommodate working schedules. Enjoy the advantages of on-campus courses and personal connections, while keeping your day job. For more information about the meeting schedule of a specific program, contact the program.
- **Online:** These programs are offered primarily online. Many available online programs can be completed almost entirely online with all online programs offering at least 50 percent or more of the program work online. Some online programs have an on-campus component that is often designed to accommodate working schedules. Take advantage of the convenience of online learning while participating in a rich, interactive learning environment. For more information about the online nature of a specific program, contact the program.
- **Hybrid:** These programs have innovative curricula that combine on-campus and online formats. Most hybrid programs are completed on-campus with a partial or completely online semester. For more information about the hybrid schedule of a specific program, contact the program.
- **Accelerated:** These on-campus programs are offered in an accelerated format that allows you to complete your program in a condensed time-frame. Enjoy the advantages of on-campus courses with minimal disruption to your career. For more information about the accelerated nature of a specific program, contact the program.

CURRICULAR REQUIREMENTS

<table>
<thead>
<tr>
<th>Minimum Credit Requirement</th>
<th>51 credits</th>
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<tbody>
<tr>
<td>Minimum Residence Credit Requirement</td>
<td>32 credits</td>
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</tbody>
</table>

Minimum Graduate Coursework Requirement

Half of degree coursework (26 credits out of 51 total credits) must be completed graduate-level coursework; courses with the Graduate Level Coursework attribute are identified and searchable in the university’s Course Guide (http://my.wisc.edu/CourseGuideRedirect/BrowseByTitle).

Overall Graduate GPA Requirement

3.00 GPA required.

Other Grade Requirements

The Graduate School requires an average grade of B or better in all coursework (300 or above, not including research credits) taken as a graduate student unless conditions for probationary status require higher grades. Grades of Incomplete are considered to be unsatisfactory if they are not removed during the next enrolled semester.

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

- **Doctoral Minor/Breadth Requirements**
  - All doctoral students are required to complete a minor.

REQUIRED COURSES

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MICROBIO 731</td>
<td>Seminar</td>
<td>1</td>
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<tr>
<td>MICROBIO 810</td>
<td>Current Issues in Microbiology</td>
<td>1</td>
</tr>
<tr>
<td>MICROBIO 811</td>
<td>Advanced Problems in Microbiology</td>
<td>1</td>
</tr>
<tr>
<td>MICROBIO 901</td>
<td>Advanced Seminar</td>
<td>1</td>
</tr>
<tr>
<td>MICROBIO 526</td>
<td>Physiology of Microorganisms</td>
<td>3</td>
</tr>
<tr>
<td>MICROBIO/GENETICS 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>MICROBIO/ONCOLOGY/PL PATH 640</td>
<td>General Virology-Multiplication of Viruses</td>
<td>3</td>
</tr>
<tr>
<td>MICROBIO/BOTANY/GENETICS/M M &amp; I/PL PATH 655</td>
<td>Biology and Genetics of Fungi</td>
<td>3</td>
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<tr>
<td>MICROBIO/BMOLCHEM 668</td>
<td>Microbiology at Atomic Resolution</td>
<td>3</td>
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<tr>
<td>MICROBIO/M M &amp; I 740</td>
<td>Mechanisms of Microbial Pathogenesis</td>
<td>3</td>
</tr>
<tr>
<td>MICROBIO/M M &amp; I/PATH-BIO 790</td>
<td>Immunology of Infectious Disease</td>
<td>3</td>
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<td>MICROBIO 875</td>
<td>Special Topics</td>
<td>1-4</td>
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<tr>
<td>M M &amp; I 990</td>
<td>Research and Thesis</td>
<td>1-12</td>
</tr>
</tbody>
</table>
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

GRADUATE PROGRAM HANDBOOK

The Graduate Program Handbook (https://microbiology.wisc.edu/students_current.php) is the repository for all of the program’s policies and requirements.

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

The Graduate School regularly reviews the record of any student who earned grades of BC, C, D, F, or Incomplete in a graduate course (300 or above), or grade of U in research credits. This review could result in academic probation with a hold on future enrollment or in being suspended from the Graduate School.

ADVISOR / COMMITTEE

Every graduate student is required to have an advisor. An advisor is a faculty member, or sometimes a committee, from the major department responsible for providing advice regarding graduate studies. An advisor generally serves as the thesis advisor. In many cases, an advisor is assigned to incoming students. Students can be suspended from the Graduate School if they do not have an advisor.

To ensure that students are making satisfactory progress toward a degree, the Graduate School expects them to meet with their advisor on a regular basis. A committee often accomplishes advising for the students in the early stages of their studies.

CREDITS PER TERM ALLOWED

15 credits

TIME CONSTRAINTS

Doctoral degree students who have been absent for ten or more consecutive years lose all credits that they have earned before their absence. Individual programs may count the coursework students completed prior to their absence for meeting program requirements; that coursework may not count toward Graduate School credit requirements.

A candidate for a doctoral degree who fails to take the final oral examination and deposit the dissertation within five years after passing the preliminary examination may be required to take another preliminary examination and to be admitted to candidacy a second time.

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

Purpose: To prepare MDTP students for microbiology-related careers.

Background. In order to better train MDTP students for microbiology-related professions, the 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 Delta Program in teaching has been a great asset to MDTP students interested in teaching as a career, 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.

Professional Development Options. With this plan we are expanding professional development opportunities for MDTP students beyond academic research and teaching. Opportunities for professional development can consist of coursework, an internship, a summer workshop, outreach experiences, or a second teaching practicum experience.

Courses. The Graduate School has agreed to allow MDTP dissertator students to enroll in courses from a limited list of classes appropriate for professional development of MDTP 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 MDTp 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.

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, MDTp 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.

Requirement. In order to ensure that MDTp students are allowed to participate in the Professional Development opportunities, their participation will be required. Students will be 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. This requirement will go into effect with the MDTp class entering in fall 2011.

**Refer to the Professional Development Opportunities document. (http://www.microbiology.wisc.edu/docs/downloads/Professional_Development_Opportunities.pdf)

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 Garret Suen (program director, Bacteriology), and JD Sauer (vice-director, Medical Microbiology and Immunology) 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.