Microbiology, Ph.D.

Graduate study in microbiology is designed to help students become highly qualified in microbiology research and teaching. Ph.D. students develop expertise in research in a specific area of microbiology and/or immunology. Faculty members have strengths in bacterial genetics and physiology, animal virology, pathogenic bacteriology and virology, and immunology. Areas of research include bioinformatics, cellular microbiology, molecular virology and immunology, bacterial biochemistry and physiology, bioremediation, bacterial and viral pathogenesis, and molecular parasitology. Working in the laboratory of their Ph.D. advisor, students learn to define and experimentally investigate scientific questions and to conduct original research in preparation for positions in academia, government, and industry.

Requirements

The Doctor of Philosophy in microbiology requires a minimum of 72 s.h. of graduate credit, including at least 12 s.h. of graded coursework. Students must maintain a cumulative g.p.a. of at least 3.00 to earn the degree. Qualified students interested in earning the Doctor of Medicine along with the Ph.D. may apply to the Medical Scientist Training Program, which offers a combined M.D./Ph.D. program.

Students have the opportunity to tailor their curriculum with courses that enhance their educational goals. They take a combination of graduate-level courses that include seminar courses.

The Ph.D. with a major in microbiology requires the following coursework.

Core Curriculum

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MICR:7263</td>
<td>Graduate Student Research Seminar</td>
<td>1</td>
</tr>
<tr>
<td>BMED:7270</td>
<td>Scholarly Integrity/ Responsible Conduct of Research I</td>
<td>0</td>
</tr>
<tr>
<td>BMED:7271</td>
<td>Scholarly Integrity/ Responsible Conduct of Research II</td>
<td>0</td>
</tr>
</tbody>
</table>

Additional courses offered by the Department of Microbiology and Immunology and other departments, as appropriate for each student.

Examples of Elective Coursework

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL:4213/GENE:4213/IGPI:4213</td>
<td>Bioinformatics</td>
<td>2, 4</td>
</tr>
<tr>
<td>BMED:5207</td>
<td>Principles of Molecular and Cellular Biology</td>
<td>3</td>
</tr>
<tr>
<td>MMED:6220/ACB:6220/MPB:6220</td>
<td>Mechanisms of Cellular Organization</td>
<td>3</td>
</tr>
</tbody>
</table>

Additional Requirements

Laboratory Rotations

Graduate students rotate through two to three different laboratories during their first academic year. The laboratory rotations are approximately ten weeks each. At the conclusion of each rotation, a student meets with the rotation mentor for an exit interview and an evaluation of the student's performance. This evaluation becomes part of the student's departmental record. The student also is required to present the research completed during the rotation in the graduate seminar course.

Teaching

Graduate students participate in the formal teaching activities of the department for at least two semesters. First-year students as well as students who are within a year of receiving the Ph.D. degree typically are not asked to teach. Teaching may take a variety of forms, including tutoring, leading discussions and laboratory groups, correcting examinations, preparing teaching materials, and lecturing.

Comprehensive Examination

The comprehensive examination is designed to measure a student's ability to write and defend a research proposal. The format of this proposal follows guidelines for research proposals outlined by major external funding agencies (i.e., National Institutes of Health (NIH), National Science
Foundation (NSF), and U.S. Department of Agriculture (USDA). Guidance, in the design of these proposals, is provided by the director of graduate studies and the student’s comprehensive examination committee.

**Written Examination**
During the spring semester of the second year, a student prepares a detailed research proposal. The topic of the research proposal is determined in collaboration with the comprehensive examination committee. A detailed guide can be found in the Graduate Program in Microbiology Graduate Student Handbook on the Department of Microbiology and Immunology website.

**Oral Examination**
Questions during the oral examination may come from the examination proposal, coursework, or other general areas of microbiology. In order to pass the comprehensive examination, a student must satisfactorily defend the written research proposal and answer questions of general microbiology that are germane to the proposal or that are important for a full understanding of the proposed experiments and their interpretation.

**Final Examination**
The five-member Ph.D. thesis committee serves as an advisory body for preparation of the thesis. This committee meets with the student to review the material that is expected to be incorporated in the thesis. Although meetings of the candidate with the committee should be yearly, the candidate, thesis advisor, or the committee can request a meeting at any time. A final draft of the thesis must be given to all members of the committee two weeks before the final examination. The final examination takes the form of a seminar presented to the department. This presentation is announced according to the Graduate College policy. Questions, comments, and discussion will follow. After the seminar, the candidate meets with the committee for the final thesis defense. The Ph.D. degree is not awarded until the thesis is signed. In some cases, revisions maybe required.

**Combined Programs**

**Ph.D./M.D.**
Students may work toward the Doctor of Medicine degree and a Ph.D. in microbiology in a combined degree program offered by the Department of Microbiology and Immunology and the Carver College of Medicine. Applicants must be admitted to both programs before they may be admitted to the combined degree program. See the Medical Scientist Training Program (Carver College of Medicine) in the Catalog.

**Admission**
Applicants must meet the admission requirements of the Graduate College; see the Manual of Rules and Regulations of the Graduate College on the Graduate College website. They should have a cumulative g.p.a. of at least 3.00 and must have completed courses in biology, chemistry (inorganic and organic), mathematics including calculus, and physics. Those admitted with deficiencies must complete the relevant course work during their first year of graduate study. Admission is determined through a review and formal vote by the faculty.

Financial Support
Graduate student tuition, benefits, and a stipend are fully supported during Ph.D. training, which typically spans five years.

Career Advancement
Graduates typically pursue research or teaching positions.