

MCRO Educational Goals, Curriculum, and Assessment

Educational Goals

Our goal is to train our Ph.D. students to become first-rate scientists. The skills that we aim to impart include:

- Acquisition of broad background knowledge in modern microbiology and immunology.
- Demonstrate ability to critically evaluate the scientific literature.
- Demonstrate strong written and oral communication skills.
- Demonstrate facility in experimental design and execution, from concept through interpretation of results to publication.
- Foster collaboration and comfort with interdisciplinary science.
- Demonstrate teaching experience.
- Demonstrate appropriate professional conduct, including the responsible conduct of research.

Over the years, our department faculty has spent a lot of time thinking about and debating how to best educate graduate students. Each aspect of our curriculum is designed to foster one or more of the skills listed above. Our department has collectively developed and fine-tuned a coherent and comprehensive plan for graduate education. An obvious measure of our commitment to education is the willingness with which faculty devote an exceptional amount of time to implementing our plan.

Ph.D. Curriculum

To achieve our educational goals, we implement the following curriculum. Note that many elements of our curriculum are relevant to multiple educational goals:

- Professional development during the first year in BBSP.
- Six, semester-long, graduate level courses in biomedical sciences. Due to the diverse background and interests of our students, only the writing class (see below) is specifically required.
- Two of the six classes must be based on reading and discussion of the primary literature rather than lecture format.
- A required class on developing and writing research proposals, open only to students in our department, that includes 13 weekly writing assignments, each of which receives extensive written comments from two faculty members.
- Required attendance at two-thirds of weekly departmental and student seminars every semester.
- Students in their third year and above speak annually in the student seminar series.
- Individual mentoring in laboratory research by the research advisor and departmental colleagues.
- Written preliminary doctoral examination. The written exam is intended to be an educational as well as an evaluative experience. Students develop and write an

original (non-dissertation) research proposal, inspired by a foundation paper chosen from a list provided by faculty. Students are allowed and encouraged to talk to anyone other than department faculty about their ideas. Exclusion of department faculty allows proposals to be submitted anonymously for grading.

- Oral preliminary doctoral examination, which is held in conjunction with the dissertation topic approval meeting. The exam focuses on command of relevant background knowledge, concepts of experimental design, and logical thinking.
- Act as teaching assistant for two semesters, usually in an undergraduate microbiology laboratory course.
- Annual progress report and dissertation committee meetings.
- Refresher training in the Responsible Conduct of Research in the fifth year.
- An expectation of completing sufficient work for at least two first-author research papers. At a minimum, submission of a first author manuscript describing original research and authorship on published paper is required prior to the Ph.D. defense.
- Final dissertation defense and public seminar.

Assessment Strategy

Each aspect of our curriculum is designed to foster one or more of the educational goals listed above. Because scientific research requires integration of multiple skills and assessments are generally centered on elements of the curriculum, many assessments cover more than one educational goal.

One component of learning outcomes assessment is assessment of individual students. The educational progress of each student is individually assessed regularly and rigorously through the following mechanisms:

- Faculty feedback and grades on course assignments, tests, and overall course performance.
- Written preliminary doctoral examination. Students who are not adequately prepared postpone the exam for a year while they perform remediation work. This delay does not preclude parallel progress on dissertation research. Students who fail the exam also complete remediation prior to their next attempt. Each examination committee includes a "common reviewer" whose role is to ensure that common standards are applied across multiple students.
- Oral preliminary doctoral examination. Each examination committee includes a "common reviewer" whose role is to ensure that common standards are applied across multiple students. If the exam reveals deficiencies, then the committee can require remediation activities, even if the student passes the exam.
- Submission of annual progress reports in conjunction with dissertation committee meetings.
- Peer review of any manuscripts or fellowship applications submitted.
- Final dissertation defense.

A second component of learning outcomes assessment is a comprehensive program review conducted by the Graduate School every eight to ten years. The review includes a year-long self-study by the department (most recently in 2018-19), a site visit by a review team of outside experts (most recently in 2019), a formal departmental response to the review team's report (most recently in 2020), and a follow-up "mid-point check"

with the Graduate School three to four years later to assess progress. In addition, the department Chair is reviewed by the School of Medicine every five years. A new Chair arrived in 2019. Again, the Chair review involves a self-study, a site visit by a review team, etc. Although not the primary focus, the graduate program is a subset of the topics covered by the Chair review.

Responsibility for Assessment

Responsibility for assessment of Ph.D. students is distributed across multiple individuals:

- Individual Microbiology & Immunology faculty members assess the students with whom they personally interact in various capacities, including as research advisor, classroom instructor, member of written or oral preliminary doctoral examination committees, and/or member of dissertation committee.
- The Director of Microbiology Teaching Laboratories assesses the performance of graduate students as Teaching Assistants and also collects evaluations of TAs by undergraduate students.
- The Student Services Specialist monitors progress with regard to courses, dissertation committee meetings, and major degree milestones; maintains academic records for all students; organizes seminar presentations; communicates with the Director of Graduate Studies on an almost daily basis; and alerts the Director of Graduate Studies to potential problems.
- The Director of Graduate Studies meets individually with students as they join the department at the end of their first year to review progress with course work and discuss degree requirements; organizes preliminary examinations; develops remediation plans for students who fail preliminary examinations or have other difficulties; individually monitors the progress of all senior students (5th year and beyond); maintains and analyzes records of student performance such as publications and time to defense; and leads department preparations for comprehensive program reviews.
- The Education & Training Committee is comprised of ten faculty members (including the Director of Graduate Studies), three graduate student representatives, three postdoctoral scholar representatives, and the Student Services Specialist. The Education & Training Committee meets to evaluate our Ph.D. program (as well as postdoctoral and undergraduate training) and consider improvements as the need arises but at least three times per year.