Molecular Microbiology and Microbial Pathogenesis Program

Qualifying Exam Guidelines

1. Purpose of the Qualifying Exam

The Qualifying Exam is the final academic checkpoint of the Program in Molecular Microbiology and Microbial Pathogenesis. Examining Committees are charged with evaluating whether graduate students are prepared and qualified to carry out their doctoral thesis work, as well as whether they have sufficient depth and breadth of knowledge relevant to their future as scientists. A student who has successfully completed the Qualifying Exam is formally considered a doctoral candidate, and primary training responsibility shifts from the Program to the student's thesis advisor and thesis committee.

2. Format and Timetable

Students are eligible to take the Qualifying Exam once they have completed the core course requirements and one advanced elective course. The exams are all scheduled during the second and third weeks of January each year.

The exam is 2 hours long and is administered by an Examining Committee consisting of four Program faculty members. It is an oral exam, with questions and discussion based on a pre-defined set of primary research articles. These papers are all featured in the "Research Highlights" section of *Nature Reviews Microbiology*. The reading list for each year's exam is derived from the first 75 papers highlighted in the calendar year preceding the exam date. Each eligible paper in *Nature Reviews Microbiology* is accompanied by a short article that introduces the topic and explains why the paper was highlighted. Papers that are only briefly summarized (from the "In Brief" sections) are not eligible for discussion. A faculty committee (selected by and from the Program Steering Committee) will review these 75 papers and choose 20 of them to exclude from this list. After these 20 have been excluded, the students will collectively select 5 additional articles to exclude from the remaining 55 papers. The exam will be based on the 50 remaining papers.

3. Committee Selection

The Program Director will construct Examining Committees for each student, based on faculty availability and a balance of interest areas. Each Examining Committee will represent 3-4 areas of microbiology research interest (virology, bacteriology, eukaryotic microbes, and host defense). At least one Steering Committee member will be assigned to each Examining Committee, helping to insure consistency between exams. The student's thesis advisor will not be appointed to that student's Examining Committee. Students will not know the Examining Committee composition in advance, and the Examining Committee will not know the student's identity in advance.

The Steering Committee member on each Examining Committee will serve as chair. (If two or more Steering Committee members are on an Examining Committee the Program Director will select one of them to serve as Examining Committee Chair.) Immediately before the exam, the

Program Coordinator will provide the Chair with relevant background information on the student's academic history in graduate school. The Chair will also be given a USB flash drive containing a complete set of PDF files corresponding to each eligible article on the reading list, as well as written copies of these Guidelines.

4. Examination Procedure

Before the student enters the examination room, the Examining Committee Chair will briefly prepare the committee in two ways. First, the Chair will orally summarize the student's background (e.g., coursework and grades, rotations, thesis lab), using information provided by the Program Coordinator. Second, the Chair will distribute copies of these guidelines and review conduct of the exam, with specific review of section 5 ("Evaluation").

Once the student is called into the room, the Committee Chair will introduce the committee and invite them to ask questions. When a paper is open for discussion, the Committee Chair should locate the PDF file of this paper (sorted alphabetically according to the last name of the first author) and project the title page. If a discussion point revolves around a particular figure of key interest, a committee member can request that the figure be displayed on screen.

Each faculty member should be allowed at least 30 minutes for discussion during this exam. This total time period is a rough guideline and can be extended if the committee feels that is necessary for a fair examination.

The Chair will conclude the exam, and after the student leaves the room, the Committee will discuss the performance of the student. The Chair will make brief written notes that summarize the consensus of this discussion. Each Committee member will privately grade the student (see section 6) and turn in both a written score and written comments to the Chair.

5. Evaluation

Evaluation will be based on the student's
(i) understanding of the concepts and technology in the 50 papers and relevant information from related articles and coursework;
(ii) ability to critically evaluate the experiments and offer alternative approaches;
(iii) ability to relate the authors' results and conclusions to previous/competing work; and
(iv) ability to propose future experiments that challenge or extend the authors' conclusions.

6. Grading

Each committee member will assign a grade of 1 to 10 points (10 = best), evaluating the student's performance on the entire exam. The Committee Chair will confidentially communicate these individual scores and written comments to the Program Coordinator.

As soon as possible after the season's exams have been completed, the Steering Committee will meet to review all the exam results, as compiled by the Program Coordinator. The general guideline is that the student must cumulatively score ≥ 30 points to pass. However, the Steering Committee will review the scoring of all exams before deciding on the absolute threshold for a

passing grade. The Steering Committee will also consider the written comments from the Examining Committee as they deliberate any decision to fail a student. In addition, the Steering Committee may choose to recognize particularly outstanding student performances and record these as "Passed with Distinction."

Decisions will be e-mailed directly to all students who have taken the Qualifying Exam immediately after the Steering Committee meeting. Students will later be sent (by campus mail) a copy of the handwritten comments from the Examining Committee Chair, and students should contact the Chair or other Examining Committee members if they have any questions.

7. Consequences of Failing

If the scores assigned by the Examining Committee are judged to be a failing grade by the Steering Committee, the student will be given a second opportunity to take the exam. This will be scheduled for between four and six weeks after the exam results are released, and the Examining Committee will consist of two previous members supplemented by two new members. The Program Director will consult with the Examining Committee Chair regarding the replacement of any committee members.

The re-examination will be conducted exactly the same way as the original exam, with all 50 papers still open for discussion.

When the Steering Committee reviews the scores and comments of this re-examination, they will recommend either that the student be passed or that the student be dismissed from graduate school. If the student feels that the action of the Steering Committee has been incorrect due to a procedural flaw in the examination process, the student may submit a written petition to the Chair of the Programs and Student Affairs Committee.

8. Advice to Students

a. Microbiology is a very diverse field, and part of the purpose of this exercise is to broaden your microbiology background and bring you up-to-date on a wide range of topics. Many of these areas will be new to you, and therefore you must also allow yourself time to do appropriate background reading. You are encouraged to start your preparation early, and to make good use of the class-free summer months.

b. Other important aspects of this exercise are to learn how to read the primary literature with efficiency and to determine what information must be critically evaluated and retained. Remember that the faculty have a limited time to examine you, and it is likely that no single paper will be discussed for more than about 15 minutes. Given that time frame, the Committee is not interested in seeing if you have memorized details; they are trying to assess whether you can carry on a meaningful conversation about the science and its impact on the field. Learn to pick out the important aspects of a paper (the points that make it interesting to discuss), and focus on understanding them in depth.

c. Form study groups of diverse composition and expertise. It may be helpful to assign "experts" (people most familiar with that research area) to lead the discussion of each paper and to identify

the best background material for the rest of the group. In the course of your discussion, remember to consider why each study was performed, how it was performed, whether it convincingly achieves its goals, why it is (or is not) important, relevant coursework, and future directions for research.

d. Many of you have not previously taken oral exams. You are encouraged to practice with your peers to become familiar with the format and thinking 'on your feet'. As you practice, consider how best to succinctly express your thoughts about the papers.

e. The Examining Committee will almost certainly ask you questions that you cannot answer. This is a lot of what differentiates oral exams from written ones, as it allows the questioner to probe your knowledge with no specific endpoint. Take the time you need to understand and consider every question and do your best to answer -- but be straightforward if you cannot. The examiners are expecting this to happen and so should you. They will move on to new topics, and your thoughts must move with them. Be confident that this is a normal part of oral examinations.

9. Advice to Faculty

a. Be prepared to ask questions on at least two of the papers on the reading list. Given the limited time for the exam, no single paper should occupy more than about 15 minutes of discussion. When you have selected the papers of interest to you, please contact the Committee Chair to be sure that these papers have not already been selected by other Committee members.

b. Remember that the students are responsible for 50 papers covering a broad variety of topics, while you have selected only a few (and probably in areas familiar to you). They will be nervous and may have trouble remembering isolated points from papers they read in depth months earlier. As you evaluate their performance, do not confuse occasional memory lapses with comprehension, analysis, and synthesis. Please review the Advice to Students above.

c. Most (but not all) students will have taken the advanced elective course "Molecular Microbiology and Pathogenesis," a microbiology journal club, and a Special Topics course in microbial pathogenesis. However, courses can change considerably from year-to-year, and unless you have personal knowledge of what a given student "should know" from coursework, you should be careful not to make too many assumptions about their background. Instead, your expectations for adequate responses should be based primarily on the reading list, as well as the relevant background information needed to understand those papers.

d. Grade the student on the entire exam performance, not just the answers to your questions. If you think the student's overall performance meets your expectations, the score should be in the 7.5-10 range. Of course, lower individual scores may still result in a passing grade when all the scores are totaled. Remember that it is the Steering Committee's job to look at the scores and comments for all of the students, and this committee will ultimately determine which students pass.

e. Keep your scores and any other comments about the exam completely confidential.