DEPARTMENT OF MICROBIOLOGY AND IMMUNOLOGY

UNIVERSITY OF ROCHESTER MEDICAL CENTER

Ph.D. GRADUATE STUDENT HANDBOOK

2023-2024

This handbook was prepared to supplement but **not** replace the Official Bulletin of Graduate Studies, which should be reviewed by all students.

Table of Contents

This handbook is intended to summarize the major features and policies of the program leading to the Ph.D. in Microbiology and Immunology. Students and advisors are advised to consult both this Handbook and the "Regulations and University Policies Concerning Graduate Studies" (http://www.rochester.edu/GradBulletin/PDFbulletin/Regulations10-12.pdf)

CORE COURSE CURRICULUM FOR PH.D. STUDENTS

The Core Curriculum is designed to: (1) accelerate time-to-degree for doctoral students, (2) ensure that trainees can fully immerse themselves in independent research by the start of the second year, (3) accelerate the transition from a didactic undergraduate learning style to a self-directed, autonomous, adult learning style, and (4) to create the curricular "space" to allow trainees to explore a diversity of research career options. The required core curriculum for the program, all of which is completed in the first year of graduate training, is:

Core Requirements Common To All Three Tracks

IND 501	**Ethics in Research**
IND 431	**Foundations in Modern Biology I**
IND 432	**Foundations in Modern Biology II**
MBI 501	**Microbiology & Immunology Student Seminar**
MBI 507	**Laboratory Rotations**
MBI 519	**Experimental Design and Analysis**

YEAR 1

Fall Semester

Required:

IND 431	**Foundations in Modern Biology I**	**5 credits**
IND 501	**Ethics in Research**	**1 credit**
MBI 501	**Student Seminar**	**1 credit**
MBI 519	**Experimental Design and Analysis**	**1 credit**
MBI 506	**Scientific Writing in Research**	**1 credit**
MBI 507	**Laboratory Rotations**	**add # of credits needed to total 16 including one option below.**

*In addition, students must choose **one** of the following course options, based on their Track (Immunology, Microbiology or Virology)*

- ***Immunology Track option (MIM):***

MBI 473	Immunology	3 credits ***and***
MBI 573	Immunology Seminar	1 credit

- ***Microbiology Track option (MBM):***

MBI 414	Microbial Pathogenesis	3 credits ***and***
MBI 514	Pathogenesis Seminar	1 credits

- ***Virology Track option (MBV):***
  - MBI 473 Immunology — 3 credits ***and***
  - MBI 573 Immunology Seminar — 1 credit

  Or,
  - MBI 414 Microbial Pathogenesis — 3 credits ***and***
  - MBI 514 Pathogenesis Seminar — 1 credits

Total **16 credits**

Spring Semester Year 1

Required:

IND 432	**Foundations in Modern Biology II**	**5 credits**
MBI 501	**Student Seminar**	**1 credit**
MBI 507	**Laboratory Rotations**	**1 credit**
MBI 506	**Scientific Writing in Research**	**1 credit**

*In addition, students must choose **one** of the following course options, based on their Track (Immunology, Microbiology or Virology)*

- ***Immunology Track option (MIM):***

MBI 515	Advanced Immunology	4 credits

- ***Microbiology Track option (MBM):***

MBI 421	Microbial Genetics and Physiology	3 credits ***and***
MBI 521	Microbial Gen/Phys Seminar	1 credits

- ***Virology Track option (MBV):***

MBI 456	Virology	4 credits

Total	**16 credits**

YEARS 2-4

After the first year of didactic course work, students immerse themselves in their research, seminar-based classes and electives chosen in consultation with their advisor and thesis committee.

Immunology Track (MIM):

MBI 540	Advanced Topics in Immunology (one semester)
MBI 580	Immunology Research-in-Progress Seminar (at least six semesters)

Microbiology Track (MBM):

MBI 570	Advanced Topics in Molecular Microbiology (at least six semesters)

Virology Track (MBV):

MBI 588	Virology Research Seminar Series (at least three semesters)
MBI 589	Advanced Topics in Virology (at least three semesters)

Bioinformatics and Cancer Biology concentrations

Students interested in these concentrations should consult first with the IMV program director. For the bioinformatics concentration, students are also strongly encouraged to first discuss with Dr. Juilee Thakar. For the Cancer Biology concentration, they should discuss with Dr. Brian Altman.

Bioinformatics concentration

Students interested in pursuing the bioinformatics concentration (MIN) should take the following courses year 2 onwards:

Choose one of the following:

BCH 521	Bioinformatics for Life Scientists (Fall, 4 credits)

IND 419 Introduction to quantitative biology (Spring, 3 credits)
BIO 457 Applied genomics (4 credits)
IND 484 Current topics in Bioinformatics Research (Fall and Spring, 2 semesters, 1 credit per semester)

Choose one of the following:

DSC 462 Computational Introduction to Statistics (4 credits)
BST 467 Applied Statistics in the Biomedical Sciences (3 credits)
BST 434 Genomic Data Analyses (4 credits)

Cancer Biology concentration

Year 2: students interested in pursuing the Cancer Biology concentration should take the following courses on or beyond year 2:

PTH 507 Molecular and Cellular Biology of Cancer (3 credits)
IND 517 Clinical and Translational Oncology (2 credits, offered in Spring on even-numbered years)
IND 507 Cancer Biology Seminar (4 credits, 1 per semester)

THE FIRST YEAR

Laboratory Rotations - The first rotation is during the fall semester, while the second and third rotations are during the spring semester. In some cases, a student may wish to do a rotation in the summer preceding the fall semester (July 1-August 31). Planning such a summer rotation should be coordinated with the IMV Program Director. A student also may do a fourth rotation during the summer following the spring semester of the first year. The IMV Program Director may waive one rotation for students with substantive prior research experience.

The rotation schedule is as follows:

Summer Rotation:	July 1- August 31
Fall Rotation:	October 1 – December 15
Winter Rotation:	January 1 – March 15
Spring Rotation:	March 16 – May 31

The schedule of work involved during the individual rotations must be flexible to accommodate the very different kinds of research procedures that may be involved. These projects are nominally of eight to ten weeks duration. However, flexibility can be arranged for a variety of purposes, including holidays, conflicting obligations, and variations in experimental schedules. With this amount of flexibility built in, it should be possible to complete each project entirely within the allotted period, so that the student can move on to the next rotation, and give it the attention it deserves. No faculty member should expect a student to continue the project beyond the allotted time, and each student should expect to devote the appropriate amount of time and effort to each of his or her rotations during the block of time scheduled for it. Written evaluations of the rotation from both the student and the faculty mentor must be completed at the end of each rotation and given to the Graduate Student Coordinator. The forms can be found at the following website:
http://www.urmc.rochester.edu/education/graduate/home/forms.cfm

Nothing said here precludes a student from participating in additional experiments in any laboratory, on an informal, entirely voluntary basis, but a scheduled rotation is a formal part of each student's graduate training, and the student is responsible to the faculty member and to the Department for each assigned project.

MBI 506 Scientific Writing in Research - At the conclusion of each rotation, all students must complete a formal report on each of their lab rotation of ~10 pages in length (including figures and references) following the format of a scientific paper. The report is evaluated, with constructive criticism and written feedback provided by the faculty rotation mentor, and also by at least one additional faculty member (not directly involved with the project). The report must be submitted **no later than 10 days after the last day of the rotation period**. Thus, it is advised that the student begin preparing the report prior to finishing the rotation. **The reports cannot be submitted late without prior permission from the IMV Director**. The following are guidelines for preparation and formatting of the report.

1. The report will be organized similarly to a scientific paper, including Title, Abstract (250 words maximum), Introduction, Materials and Methods, Results and Discussion.

2. The length of the report is to be approximately **4-5 pages** (one-sided) of text, single spaced, Arial font, 11 point, one-inch margins on all four sides of the page. Figures, Tables and References are NOT included in this page limit. Pages must be numbered.

3. Complete references are to be provided after the Discussion section. There is no limit to the number of references; however, the student is expected to have read all the references cited.

4. Additional pages can be used, as needed for Figures, brief Figure Legends and Tables for data obtained during the rotation.

5. The rotation mentor will evaluate the document, and provide feedback to the student. **The document must be approved by the mentor,** and turned in to the Director of Graduate Studies before the student can proceed to the next rotation. It will be up to the student and the mentor to work together to assemble the report as the rotation period draws to a close, to assure the document is completed on time.

To indicate mutual approval of the final draft of the rotation report, a sign-off form will be provided for signatures by both the student and mentor, and submitted along with the report. The signed form will be included in the student's file along with the rotation evaluations requested by the Office of Graduate Education.

First Year Student Evaluation - Since the Department accepts students, provides student financial aid and recommends the granting of the graduate degree, it is the department's responsibility to keep track of its students and to determine that they are making progress in their graduate training. This review is done as follows:

A committee of faculty that includes the IMV Cluster Director will review first year student progress at the end of the second semester. The committee will use several criteria to determine if the student may continue in the program. These include; (1) first and second semester grades, (2) laboratory rotation evaluations and (3) laboratory rotation reports.

At the end of the first year, each student chooses a thesis committee and this committee must meet at least annually to review the student's progress. Therefore, at the end of a student's second, third, etc., years, the review is the meeting form report from the student's thesis committee (signed by all members) stating that it met, reviewed the student's progress, and agreed that the progress was acceptable. Any reservations regarding student progress should also be included in this note.

Choice of Research Advisor - During the first year each student chooses a faculty research advisor. A faculty member may decide not to accept a student on grounds that are not a reflection on the student. Examples are: limitation of laboratory space or facilities, limitation of funds to support research, pressing time commitments which preclude the faculty member devoting sufficient time to the student's training and education, plans for a

sabbatical leave, etc.

Each student, before making a choice, should have a chance to become acquainted with a range of individuals and research activities in the Department. To this end, the faculty has adopted the date of March 1 as the earliest date on which any faculty member is free to give any student assurance (overt or implied) that the student will be accepted into the faculty member's laboratory. It is recognized that some exceptions may be necessary (for example, a student comes to the University of Rochester specifically to work with a given faculty member). Any student desiring such an exception should discuss the case with the IMV Program Director.

Each student is encouraged to explore the research interests of several faculty members, not limited to those faculty members with whom the student has had laboratory rotations, and to do this over a period of several weeks before seeking acceptance into any laboratory. The purpose of setting a specific date before which no commitments can be made is to ensure that each student has ample time for this kind of exploration without "losing out" to a student who might be more prompt or forceful in seeking an early assurance of acceptance.

Students may subsequently change advisors without prejudice after consulting with the Chairman of the Graduate Committee. **YOU MUST INFORM THE DEPARTMENT OFFICE AS SOON AS YOU HAVE CHOSEN AN ADVISOR.**

Thesis Advisory Committee - As soon as is practical, **but no later than August of the second year**, after choice of a thesis advisor, the student and advisor should agree on the composition of an Advisory Committee. The student should contact all members to obtain their agreement to serve. It is the advisory committee that sets the program of courses for each student.

Before the end of the fall semester of the second year the student MUST hold a Thesis Advisory Committee meeting to determine the proposed Program of Study and discuss the student's Research Plan. The completed program of study form must be returned to the Departmental Office. Program of Study forms can be found at: http://www.urmc.rochester.edu/education/graduate/home/forms.cfm

The committee consists of the student's faculty advisor, at least two primary tenure track members affiliated to the PhD program and at least one tenure track member of not affiliated with the Microbiology and Immunology PhD program. Students must obtain permission from the Program Director if they wish to add a member whose academic appointment is not at the University of Rochester.

The thesis committee must meet at least once a year to review the progress of the student. After each meeting, the student and the advisor must complete the Annual PhD Student Evaluation/Progress Report, and submit it electronically to the IMV Graduate Coordinator and the IMV Director. The form can be found at the following website: http://www.urmc.rochester.edu/education/graduate/home/forms.cfm.
Note that a student's Qualifying Exam does not count as a Thesis Advisory Committee Meeting.

Seminars - There is an extensive program of seminars at the University to supplement classroom and laboratory teaching. The Microbiology/Immunology seminar program is most pertinent, and it is expected that all students will attend all general departmental seminars unless there is a conflict with formal classes. In addition, very useful information can be gained from seminars held in other departments.

Academic Honesty Policy - The University of Rochester considers academic honesty to be a central responsibility of all students. Suspected infractions of University policies will be treated with the utmost seriousness. Suspected graduate academic misconduct will be reported to the department chair and associate dean for graduate studies. This section is adapted from the University of Rochester graduate studies Bulletin 2010-2012 (http://www.rochester.edu/GradBulletin/PDFbulletin/Regulations10-12.pdf).

A common form of academic dishonesty is plagiarism. This is the use, whether deliberate or unintentional, of an idea or phrase from another source without proper acknowledgment of that source. The risk of plagiarism can be avoided in written work by clearly indicating, either in footnotes or in the paper itself, the source of any other major or unique idea that you could not or did not arrive at on your own. Sources must be given regardless of whether the material is quoted directly or paraphrased. Another form of plagiarism is the copying or obtaining information from another student. Submission of written work, such as laboratory reports, computer programs, or papers, which has been copied from the work of other students, with or without their knowledge and consent, is also plagiarism. In brief, any act that represents someone else's work as one's own is an academically dishonest act.

A second example of academic dishonesty relates to misuse of library materials. Any act that maliciously hinders the use of or access to library materials is academically dishonest and falls under the terms of this policy. The removal of pages from books or journals disadvantages others in the academic community. Similarly, the removal of books from the libraries without formally checking out the items, the intentional hiding of materials, or the refusal to return reserve readings to the library is dishonest and harmful to the community.

There are several other forms of academic dishonesty including, for example, obtaining an examination prior to its administration or using unauthorized aids during an examination. It is also academically dishonest to knowingly falsify data or data analysis results or assist someone else in an act of academic dishonesty.

A student remains responsible for the academic honesty of work submitted to the University as part of the requirements for the completion of a degree (or any other coursework taken at the University) even after the work is accepted or the degree is granted. This rule applies to students who are no longer matriculated at the University of Rochester, including those who have graduated.

Ignorance of these standards is not considered a valid excuse or defense.

Judicial Process for Academic Misconduct - Charges of academic misconduct are referred to the student's department by the associate dean. In a school or college without departments, the school or college will handle these matters. Each department, interdisciplinary program, or college will have a written policy on file with the associate dean to deal with these matters and a designated group called the Department Hearing Panel to hear the charge. The department may utilize one of several mechanisms for hearing charges of academic misconduct. These may include a panel that consists of (1) the usual faculty group that deals with graduate student business, (2) the entire faculty of the department, or (3) a committee appointed by the department chair specifically for the purpose of hearing the academic misconduct charge. A department's written policy may also call for graduate student representation on the panel.

The Department Hearing Panel, in consultation with the associate dean and in accordance with the standards set forth in the section Fundamental Fairness above (to the extent appropriate to the circumstances—with the associate dean functioning as the "judicial officer" and the Department Hearing Panel as the "hearing team") conducts a hearing, makes findings, and presents a recommendation to the appropriate dean or director. The dean or director then reviews the findings and recommendation, and submits them along with his or her recommendation to the University dean of graduate studies, which issues the final decision and sanction. An appeal may be made to the provost within seven days of the decision and will follow, to the extent feasible, the procedures set forth in the section Appeals above.

If either the department chair or the associate dean believes that the alleged misconduct in any way involves sponsored research (including federal training grants), threatens the integrity of the scientific method, or compromises the creation of new knowledge (including original art, scholarship, and research), the matter will be referred to and will follow the procedures outlined in the Policy on Misconduct in Scholarship and

Research in the Faculty Handbook.

THE SECOND YEAR

Teaching Requirement - As part of their graduate training, all Ph.D. and M.D./Ph.D. students are expected to have some teaching experience. This usually does not start until the second year, except for advanced students or students with previous teaching experience. In general, students are involved in the teaching of Microbiology 221 or assisting in one of the departmental courses and/or seminars. A second teaching assignment may be required.

Thesis Advisory Committee Meetings - In order to be in good standing for any academic year (starting in September), a student's progress must have been reviewed for the preceding year. **Note that a student's Qualifying Exam does not count as a Thesis Advisory Committee Meeting.** It is the responsibility of the advisor and the student to make sure that the committee meets and the Annual PhD Student Evaluation/Progress Report is submitted to the IMV Graduate Coordinator and IMV Director within two weeks of the meeting. The form is found here: http://www.urmc.rochester.edu/education/graduate/home/forms.cfm.
Students and faculty should note that fall registration **will not** be processed by the Department unless the preceding year's review has been done.

Qualifying Examination - The Department of Microbiology and Immunology requires that the Qualifying Exam be completed by October 1 of the student's third year (i.e. the fifth semester). The purpose of the Qualifying Examination is to evaluate whether a student is qualified and competent to continue studies toward a Ph.D. in Microbiology and Immunology. This determination involves evaluation of the potential of a student for independent thought, his or her approach to investigating a significant scientific problem in a sound manner, and his or her general knowledge of microbiology and immunology. The examination is not intended to be a specific evaluation of the proposed research problem or of the supporting experimental data.

For MD/PhD students, the deadline will be October 1 of the first semester of the second year of full-time Ph.D. studies. The Graduate Committee must approve any variance from this schedule in advance.

The qualifying examination cannot be taken until the student has completed 30 credit hours of courses/seminars/research, which normally occurs after the second semester of full-time graduate studies.

Qualifying Examination proposal: The examining procedure involves the preparation of a proposal based on the student's expected Ph.D. thesis problem, and an oral examination based on this proposal by an Examining Committee.

The document must be written in the format of an NIH F31 Proposal (*Arial font; no smaller than 11 point; 0.5 inch margins*):

Project Summary/Abstract (*Limited to 30 lines of text*)
Summarize the proposed activity succinctly, in a manner that is comprehensible to the scientifically literate general public. The summary/abstract should describe the health relevance, scientific premise and long term objectives of the proposed studies. Include a concise description of the specific aims and research training goals, as well as methods to be used to achieve them.

Project Narrative (*Limited to three sentences*)
Summarize the health relevance of the project in a manner understandable to non-scientifically/non-technically literate general public.

Specific Aims (*Limited to one page-single space*)

Succinctly state the scientific premise and goals of the proposal. Describe the expected outcomes and how the findings will contribute to filling a critical knowledge gap and/or challenge an existing paradigm in the field of study.

Research Strategy (*Limited to six pages-single space*)

Required sections:

Significance

Briefly, sketch the background for the proposed research and critically evaluate the literature in the area. Explain the scientific problem, or critical gap in the field of knowledge that will be addressed by the proposed research.

Preliminary Studies

Briefly, describe any preliminary results obtained by the student, or others, that support the scientific premise and/or address the feasibility of the proposed studies. Clearly indicate whether the data was generated by the student or by others in the lab. All figures and legends must fit within the 6 page limit, so chose the data to show wisely.

Approach *(should account for about 4 pages of the research strategy)*

Describe the rationale, and methods to be used to achieve the goals of each specific aim of the project. Include a description of how data will be collected and analyzed. The emphasis should be on the design of the experiments, including necessary controls, rather than the experimental details. For example, do not include reagent concentrations and volumes unless this information is critical to the experimental design and interpretation. Discuss possible results and consider results that do and do not support your hypothesis. Explain how the findings will be interpreted in light of the overall goals of the research. Describe any potential problems, and propose alternative approaches to circumvent them.

References (*no page limit*)

The student may consult with others (for example, his or her advisor, other faculty members, postdoctoral fellows, other students, and investigators outside the University) in preparing the written proposal. It is recognized that there will be some (even substantial) input by the student's advisor, since the thesis generally reflects research activities in the advisor's laboratory. **However, the actual written proposal is to be the intellectual output of the student, and plagiarism from publications or grant applications written by the advisor or others is not allowed.** When the student has completed the written proposal, the advisor must review it before the oral examination is scheduled. While the advisor may suggest modifications in the written proposal, all revisions are to be done by the student.

Qualifying Examination Timeline

20 full working days prior to exam	Abstract and Title Page needs to be submitted to your Graduate Coordinator
15 full working days prior to exam	All paperwork has to be submitted to the Graduate Education Office by your Graduate Coordinator
2 weeks prior (student)	Advisor Approval form needs to be signed by your Advisor.

	Once form is signed, the document can be distributed to the Committee and Chair. Signed form must be turned in to your Graduate Coordinator
1 week prior	The Chair of the Qualifying Exam will poll the members of the Committee to determine if the quality of the written proposal is sufficient to proceed with the exam. (See: Role of Examination Committee Chairs, Part 1, below)

Department Qualifying Chairs:

	Primary	Alternate
Bacteriology	Martin Pavelka	Paul Dunman
Virology	Toru Takimoto	Brian Ward
Immunology	Scott Gerber	Kristin Scheible

*In the event both the primary and alternate committee members of the student's thesis committee are on this Qualifying Examination Committee, the chair of the Graduate Committee will designate a faculty member in the Department to serve as an *ad hoc* member of the standing committee for the Qualifying Exam.

Examining Committee: The Examining Committee will consist of five members: the four members of the student's Thesis Committee (the advisor, two other members of the Department of Microbiology and Immunology, and one member of another department) and one member from the Department Qualifying Examination Committee. The member of the Qualifying Examination Committee (described below) will be chosen from the program track in which the student is pursuing his or her degree, and this member will chair the Qualifying Examination.

The Standing Committee will be appointed for each academic year by the Department Chair, and will consist of one faculty member (and an alternate) from each of the Department's three major program tracks: Immunology, Virology/Cell Biology, and Bacteriology/Molecular Biology. In the event both the Standing Committee member and alternate are members of the student's Thesis Committee, the Chair of the Graduate Committee will designate a faculty member in the Department to serve as an *ad hoc* member of the Standing Committee for the Qualifying Examination.

Role of Examination Committee Chairs

Before the exam
Committee chairs are expected to:

1. **Chairs are expected to obtain written feedback from all committee members (including herself or himself) on the acceptability of the written qualifying examination document (proposal) at least 7 calendar days in advance of the closed exam**. To do this, the chair should determine whether each member of the committee (including himself or herself) believes that the proposal, as it has been presented is of such quality that, if the candidate successfully passes the oral examination, the member would be willing to vote to recommend that the candidate has passed the examination. The chair should

explain that an affirmative answer means only that the member finds that the proposal is acceptable on the whole and does not commit the member to agreement with every sentence or paragraph. Moreover, an affirmative answer that the document is of sufficient quality to defend does not preclude changes after the exam. Finally, the chair should clarify that poor grammar or spelling will not, alone, constitute a sufficient basis to warrant a decision of unacceptable. <u>All committee members are expected not only to respond to the specific question of acceptability of the document, but also to provide at least 2-3 sentences of written commentary on the quality of the proposal</u>**.** *If one or more members of the committee respond that the dissertation is not acceptable, the members should meet briefly to discuss the objections. If the objections stand, then the closed examination cannot proceed. To ensure that students are not adversely affected by faculty tardiness, any committee members who fail to provide feedback within 7 days of the examination will be presumed to have found the document acceptable.*

2. **Remind all committee members that they are expected to come to the closed examination prepared to ask both project- related <u>and</u> general questions of the student.** Committee members should be asked to prepare several knowledge questions in advance.
3. **Remind all students of the expected format of the examination (below)** and that a 15-minute oral presentation is expected (typically, this will take the form of a Powerpoint presentation, with a maximum of 20 total slides and NO data slides). *Preliminary data should be provided ONLY in the text of the proposal and not in the oral presentation.*
4. **Remind all students that they should NOT provide food or beverages for the examining committee.** If the examination is scheduled over lunch (noon-2pm), the Chair should contact Brenda Knorr in the Department office, who will ensure that lunch is provided by the Department for all committee members and the student.

Course of action if the written proposal is judged unacceptable.

The Committee Chair is expected to:

1. Notify the student and advisor immediately (at least 7 days before the scheduled examination), and also notify the graduate studies office and the departmental office.
2. Solicit a more detailed one-page summary of the major concerns and deficiencies identified in the proposal, from each committee member.
3. Forward these critiques to the student and advisor. If there is a serious discrepancy in the critiques, the Committee Chair may choose to convene the committee in the absence of the student to discuss the concerns and to clarify what will be communicated to the student.
4. Supervise the proposal revision process outlined below.

Proposal revisions - The student will have an opportunity to prepare a revised proposal. It is recommended that the student speak individually to each of the committee members regarding their comments BEFORE revising the proposal. The revised proposal must be prepared with specific changes indicated in the text. The revised proposal will be due 4 weeks after the initial critiques are returned to the student.

The committee will evaluate a revised proposal as either acceptable or unacceptable. It is the Chair's responsibility to manage this process. If all committee members and the Chair agree that the proposal is acceptable, then the student can proceed and schedule an oral exam.

If one or more members of the committee or the Chair of the Examining Committee feels that the revised proposal is unacceptable, the committee will meet including the student's advisor in the absence of the student to discuss the situation. If upon discussion, a majority of the committee agrees to accept the proposal, the remaining concerns regarding the proposal should be summarized and provided to the student in writing. The student can proceed and schedule an oral exam, however, they should be prepared to discuss these concerns

during the oral exam.

If the Committee feels that the revised proposal remains unacceptable, the Committee, Chair of the Examining Committee, Director of the Departmental Graduate Program, and the Departmental Chair will meet to discuss the situation and whether the student can proceed in the program. A complete review of the student's file, including application materials, rotation reviews, transcripts, and critiques of the proposal should be included. Possible outcomes may include:

- A third revision of the existing proposal will be permitted.
- The student will be allowed to submit a new proposal, which should be significantly different from the previous version. This new proposal must be submitted no sooner than 2 months and no longer than 6 months after the first proposal.
- *Other possible outcomes can be considered only <u>after</u> a formal oral examination*

Conduct of the examination - The purpose of the Qualifying Exam is to evaluate whether a student is qualified and competent to continue studies toward a Ph.D. in Microbiology and Immunology. This determination involves evaluation of the potential of a student for independent thought, her or his approach to investigating a significant scientific problem in a sound manner and his or her general knowledge in microbiology and immunology. **The Department of Microbiology and Immunology requires that the procedures for the Qualifying Examination be started before the Fall semester and be completed before the end of the fall semester.**

There are two major goals of the Qualifying Examination. First, the preparation stage of the examination encourages the student to research and organize the background knowledge that serves as the basis for the research proposal and to devise a series of experiments that will investigate a significant and novel problem in the student's field of interest. The preparation stage culminates in a written Thesis Proposal presented to Thesis Committee. The format and requirements for the Thesis Proposal, as well as the criteria for its acceptance or refusal by the Thesis Committee, are described in the Graduate Student Handbook.

The second goal of the qualifying exam is an assessment of the student's basic knowledge in the chosen field of study. This assessment occurs during a closed meeting with the Qualifying Examination Committee. **The focus of the examination is not the Thesis Proposal or the supporting data.** Instead, the exam will evaluate the whether the student's basic theoretical and practical knowledge is sufficient for the student to pursue a significant thesis. In this respect, the Thesis Proposal serves as a touchstone that will guide the committee's questions. The goal of these questions is to determine whether the student's coursework and preparation for the examination provide a sufficient foundation to qualify the student for the investigation of a significant scientific problem. Accordingly, the questions will test the student's knowledge of (i) the general theories and paradigms in the chosen field of study, (ii) the classical and current literature related to the student's chosen field of study and (iii) the experimental techniques commonly used in the chosen field of study, as well as alternative approaches and their strengths and weaknesses.

The Chair is expected to ensure that the oral exam is conducted as follows

1. **Before the meeting:** the student should be asked to leave the room. There should be a brief discussion regarding the student's progress in the program (review of course/grades) and in the lab. The advisor should comment on the relative input of the student into the formulation of the project.

2. **Student Presentation:** 15-minute student presentation of the project **with no preliminary data** and no interruptions. *(It is expected that preliminary data will be included in the written document, and may be the subject of questions in the last phase of the examination).*

3. **General Knowledge Assessment:** 60-minute question period on general knowledge.

4. **Project-Related Assessment:** 60-minute question period on knowledge of the project-related literature, the theoretical underpinnings of the project, the proposed scientific methodology, expected results and potential alternatives should proposed approaches prove unsuccessful. This assessment should also encompass data interpretation and analysis, but is not an evaluation of the merits of the proposed research.

5. **After the meeting:** The student should be asked to leave the room again after the meeting. The committee should then discuss the student's performance on the examination.

Comment on steps 3 and 4: After the student presentation (Step 2), it is expected that some time for questioning will be allotted to each member of the committee. Since it is important for the committee to feel that they had an opportunity to evaluate the student, the usual order of questioning would involve the advisor going last, preceded immediately by the chair. However, this is flexible; you and the committee should determine what is most suitable.

Comment on Step 5: In many cases, a short break half-way through the examination (i.e., after the General Knowledge Assessment) may be helpful – it lets the student catch their breath, and the committee readjust its line of questioning, procedures, etc. When the time of termination agreed upon by the committee has been reached or when all the members of the committee have asked all the questions they wish to ask, the chair should ask the candidate to withdraw from the room. The chair should then poll the members of the committee on whether or not the candidate has passed. If it is not immediately obvious that the candidate passes by acclamation, the chair should individually poll the members of the committee. For the candidate to pass, 3/4 of the committee must agree; negative opinions should be noted on the signature sheet. *Note that the current (12/09) version of the Department Ph.D. Student Handbook indicates that "the advisor is to leave the final closed session before a vote is taken and does not have a vote". This does not accurately reflect current practice within the Department, which permits the advisor to participate in the closed-door discussion and vote. The Department Ph.D. Student Handbook will therefore be modified in the future.*

Feedback and evaluation of the qualifying exam - After the examination is over, the chair should discuss the exam briefly with the candidate and inform the candidate of the outcome. Please be certain that all committee members sign the form attesting the candidate has passed, conditionally passed or failed, and that in considering the exam performance and with all the candidate's previous work, should or should not be recommended for the Master's degree. A copy of this form should also be provided to the Graduate Coordinator.
In addition to determining whether the student has successfully passed the examination; the committee is expected to provide specific feedback on each of the areas for evaluation that are listed on the following page. The Chair is expected to complete this form on behalf of the committee. If the committee has specific recommendations for further student training in one or more of these areas, these should be identified. If so, the committee can enforce the recommendations at subsequent committee meetings.

Possible outcomes of the exam: Following the oral qualifying examination, the Examination Committee will meet in closed session to evaluate the student's overall performance (including the oral examination, academic record, and laboratory performance). The committee will then vote on the following options: (1) the student may pass; (2) the student may fail; or (3) the student may pass, but revisions to some portions of the proposal are required.

Summary of exam outcomes:

Pass. If the Examination Committee determines that the student has passed the exam, then the Committee will recommend one of two options. These are: (A) that the student be admitted formally into Candidacy for the Ph.D. degree or (B) that the student not be permitted to proceed to Candidacy for the Ph.D. degree (resulting in award of a terminal Master's degree). The recommendation to advance a student into Candidacy for the Ph.D. degree may in some cases be accompanied by a requirement that the student take a specific additional course (or courses)

as part of the Candidate's approved program of study. The recommendation that a student not be permitted to proceed to Candidacy for the Ph.D. degree, if made, may be based on concerns about scientific knowledge and/or advanced skills deemed essential to success in the Ph.D. program and would automatically be accompanied by award of a terminal Master's degree. Documentation supporting this assessment must be provided to the student and to the Senior Associate Dean for Graduate Education. *Please note this latter option is not described in the Department Ph.D. Student Handbook. However, it represents accepted current practise in the Department. The Handbook will therefore be modified to reflect this in the near future.*

Conditional pass: If the Examination Committee determines that the student has passed the exam, contingent on meeting some further requirement, then the Chair of the Examination Committee will inform the student of this in writing. In this outcome, the student should submit a revised proposal to the Chair of the examination committee no later than 6 weeks after the date of the qualifying exam. If revisions are complete and the thesis proposal deemed satisfactory, the Chair of the Examining Committee will inform the Senior Associate Dean for Graduate Studies (SADGE), and on the recommendation of the SADGE, the student will be advanced by the University Dean of Graduate Studies to the status of Candidate for the Degree, Doctor of Philosophy.

Failure: If the student failed the qualifying exam the enclosed forms should be signed stating that the student did not pass the examination. In case of failure, the following options are available to the Committee:

(1) A second oral examination may be permitted, at the discretion of the Examining Committee. This decision is not automatic, and will be made at the discretion of the committee. The committee will decide on a date for a second examination, which should occur no sooner than 5 months and no later than 1 year after the first examination. If the Examining Committee recommends a second oral examination, the student will be expected to schedule a new qualifying exam within the timeframe that the committee has established. According to the U of R Regulations and University Policies Concerning Graduate Studies, "*A second qualifying examination after failure, if permitted, may be taken after a period of five calendar months*." Thus, if the committee wishes to permit a student to retake the examination sooner than 5 calendar months, the committee should put a request to this effect in writing to the Senior Associate Dean for Graduate Education, with a very brief explanation of why retaking the examination in < 5 months is recommended.

(2) If the Examination Committee determines that the student has failed the exam, and does not recommend a second examination, then the student is terminated from the program. If terminated without a master's degree, the student may apply to transfer to the terminal Plan A or Plan B master's program. If approved, this transfer would involve a separate written and oral examination.

(3) The student may be dismissed from the program.

The M.S. "on the way" to the Ph.D. - Many students will qualify for the M.S. degree under Plan B on the way to earning the Ph.D. In this case, passing the Ph.D. qualifying Examination will substitute for the Master's Essay. At the time of the Qualifying Examination, the student will prepare a Master's Program, listing 24 hours of course credit and 6 credits of Ph.D. Research. As a general rule, no Research credit should be included. The student will also prepare a Ph.D. program, which will list at the top "Credit for M.S. degree ..... 30 hours" in the appropriate spaces. Additional courses and Ph.D. Research (**MBI 595**) will then be listed, up to a total of 96 hours. **No courses or any other credit that is a part of the Master's Program should be listed again here.**

Programs of Study - Usually, upon passing the qualifying examination, the student is recommended for the M.S. degree. Therefore, at the time of the examination, a filled-in M.S. program plan, which includes 30 hours of graduate credit, should be submitted. Shortly afterwards, a completed Ph.D. program, approved by the student's advisor and initialed by the members of the advisory committee, should be filed. This will list the 30 hours credit for the M.S. degree, plus additional credit, for a total of 96 hours, including Ph.D. research credit. Should the entire program be successfully completed, including a successfully defended Ph.D. thesis, with fewer than 96 hours, a program form with the research credit actually completed can be substituted.

FINAL YEAR

Bi-annual committee meetings. Students on their fifth year and onwards are required to hold meetings with their advisory committees every 6 months to assess progress towards their defense.

Seminar - During the final year of study, each Ph.D. candidate MUST present the results of his/her research conducted for the thesis at a departmental seminar. This seminar will immediately precede the final examination but may be part of the regular departmental seminar series. In the latter case, the Chairman of the seminar committee should be consulted well ahead of time because there are generally scheduling problems in the spring semester.

Preparation for writing the thesis - When the student and mentor decide that the thesis work is nearing completion it is recommended that the student schedule a Thesis Advisory Committee meeting to obtain permission to write the thesis. At this meeting the student should summarize the work to date and present an outline of the Thesis itself. Agreement from the Thesis Advisory Committee at this stage avoids disagreement about the student's readiness at the time of the thesis defense.

Ph.D. Defense

Nomination and Appointment of the Chair for Defense

A Chair is appointed for each PhD oral defense exam to monitor and promote fairness and rigor in the conduct of the defense. The Chair's status as a nonmember of the advisor's and student's working group, program, or department enables distance from previously established judgments on the candidate's work.

The program director (with input from the student and advisor) identifies **three individuals** to serve as Chair. These individuals must be current full-time faculty members with a PhD or MD-PhD degree, at assistant professor rank or higher from outside the department offering the degree program, or not a core member of the interdisciplinary degree program faculty.

Nominations are submitted to the Senior Associate Dean via a **Nomination Form for PhD Defense Chairperson** along with a thesis title page and abstract. The Senior Associate Dean for Graduate Education reviews the nominations. One faculty member is approved as Chair; notice of the selection is provided to the Chair, the student, the advisor, the program director and the graduate coordinator. The student will include in the Chair in planning for specific dates for the defense.

Defense Timeline and Paperwork

2 months prior	Poll your Committee and your Defense Chair to determine their preference for thesis format (PDF or hard copy)
25 FULL working days prior to defense	Provide your Committee AND Defense Chair a copy of your thesis. This will be your final copy that

	cannot change until after your defense.
15 FULL working days prior to defense ** Note – we will have worked on your defense record prior to this date – this is just when it gets approved	Your Graduate Coordinator will submit defense record through online system and approve. This will generate emails to your Committee and the MBI Program Director with link for their approval.
10 FULL working days prior to defense	Approvals from your Committee *(NOTE: Defense Chair approval NOT needed)* and Program Director due – AT THE LATEST. You should start contacting them the week before to encourage them to log on and approve before this date.

The items below are needed for the online defense paperwork:

- ✓ Thesis (**pdf**)
- ✓ Program of Study (This is completed when you submit your Chair Request)
- ✓ Program Statement on Completion (Graduate Coordinator will do)
- ✓ CV or Resume
- ✓ Student Update form to be completed at: https://www.urmc.rochester.edu/smd/graduate-student-update.aspx
- ✓ Advising Record (Registrar will send)

The following information is needed to create your online defense record:

1. Name as you would like it on your Diploma:

2. Personal Email address (non UR):

3. Address for Commencement and Diploma mailings:

Thesis Format

When the student's thesis committee and advisor have approved the completion of the thesis research the appropriate form should be signed and delivered to the Departmental office.

Guidelines for the Content of a Basic Science PhD Thesis

(Prepared for the Office for Graduate Education and Postdoctoral Affairs by Dirk Bohmann and Eric Phizicky, May 4, 2012)

1. Purpose of this document:

This document provides a summary of the expectations for the written content of a thesis; that is, it provides a guide for how a thesis should be structured for writing, and for the content that comprises a well-written thesis.

This document is meant to be a supplement to the general guidelines of the University of Rochester for preparation of a thesis (THE PREPARATION OF DOCTORAL THESES: A MANUAL FOR GRADUATE

STUDENTS), which can be found at the website: http://www.rochester.edu/Theses/ThesesManual.pdf, and which governs all theses at this university. Rather, the guidelines described here are meant to be a guide for the written content of the thesis.

2. Overview of thesis contents

A thesis is a description and interpretation of the research conducted by the candidate that qualifies him/her for the degree of PhD.

It is written for non-specialized scientists (not for the mentor!). Specifically, every member of the thesis examination committee, including faculty from other science departments, have to be able to read and understand everything that is included in the text without consulting secondary sources. Specialist terms need to be explained or avoided. Non-standard techniques have to be explained.

It is written in English with correct spelling and grammar. It is not the job of the committee to proof-read the text. Having the text of the thesis corrected and edited for clarity by a second person (mentor or otherwise) is acceptable and highly recommended. A committee member can refuse to accept a thesis with excessive grammatical or graphical errors.

There is no formal minimum or maximum length. The thesis has to give an in depth account of the background and scientific question addressed, as well as a detailed description of the conducted experiments, that is typically more specific than the published literature on the same work. Independent and original thought is welcome. An alliteration of published fact(oid)s with tangential relevance to the research topic (just to fill up pages) should be avoided.

3. Sections of the thesis

Title page Office for Graduate Education and Postdoctoral Affairs Page 2 of 4 Guidelines for the Content of a Basic Science PhD Thesis May 4, 2012 **Abstract**
-- Must be a maximum of 350 words.
-- Should contain no references, and no undefined non-standard abbreviations.

Acknowledgements
My boss rocks... but I am glad to be out of here... and I love my mother.

Foreword
Although the thesis document can contain experimental data not generated by the candidate (for example those supplied by a collaborator or technician, if they are critical for the scientific argument), all such contributions must be specified in the foreword.

Glossary
A table explaining non-standard abbreviations and terms. For generally accepted abbreviations see the website at the Journal of Biological Chemistry (http://www.jbc.org/site/misc/abbrev.xhtml)
curriculum vitae
Short academic history and list of papers published by the candidate. Date of birth and dates of earlier degrees are no longer included.

4. Organization of the Thesis

Introductory chapter

The introduction outlines the background of the field, and should set the stage for formulating the scientific question/problem addressed in the experimental part of the thesis. The introduction should tell a story with the candidate's own thoughts, to frame the question to be addressed in the thesis, and should not summarize all the papers that the candidate has read.
The last paragraphs of the introduction should explicitly state the questions to be addressed in the thesis, or the set of experimental aims, and the organization of the thesis.

Results chapters

Results chapters are most conveniently organized as papers or manuscripts, complete with abstract (250 word limit), introduction, materials and methods, results, figures and tables, discussion, and references. If there are several chapters with similar materials and methods the candidate is encouraged to organize all of the materials and methods into a single chapter. This eliminates unnecessary redundancy. Office for Graduate Education and Postdoctoral Affairs Page 3 of 4 Guidelines for the Content of a Basic Science PhD Thesis May 4, 2012

It is not necessary to include all of a published paper in a chapter, if for instance the candidate's contribution was a limited part. Additional data not included in the paper can also be added to a chapter.

One or more final chapters may include a collection of experiments that are not yet organized as manuscripts. These chapters should also have a title, an abstract, and a discussion that contains more in-depth interpretations and/or a general perspective on the overall set of results.
The paper format is encouraged as it is expected that every candidate will have one or more first author papers by the time of the thesis defense. However, the alternate format of having the thesis organized as separate chapters containing the Materials and Methods, Results, and Discussion is also acceptable.

Perspectives chapter

Each thesis should also include a final chapter (which could be entitled "Final Perspectives", "Perspectives", "Overall Conclusions", or some similar title) in which the candidate tries to tie up his thesis and add any overall perspectives. For example, the candidate might recapitulate the state of the field at the outset of the thesis, summarize the major results of the thesis, explain the status of the field as a result of the thesis work, explain current gaps in our knowledge of the field, raise questions that arise as a result of the thesis, or speculate on likely future directions of the field.

5. Description of the specific contents of each section of a chapter:

Title and Abstract: Each chapter should have its own title page, and an abstract page (abstract limited to 250 words)

Introduction: The introduction of each results chapter (manuscript, paper or results chapter) should outline the relevant background of the field without getting too expansive or detailed, and should frame the question(s) being addressed in the chapter in the context of the background. Often the last part of the introduction includes a very brief statement of the results and their significance.

Results sections:
Each experiment/group of experiments in the result section should include:
a statement of the purpose of the experiment
a description of the experiments and the results, with figures, tables, etc
a brief explanation or interpretation of the results.

Discussion sections: Office for Graduate Education and Postdoctoral Affairs Page 4 of 4 Guidelines for the

The discussion section of results chapters should include a BRIEF summary of the major findings and discoveries, without regurgitation of the results section. This section of the chapter might also address questions such as: What does it mean? Why is it relevant? How does it add to/extend existing knowledge? What general conclusions and principles (beyond the immediate field of study) may arise from this research? What were the experimental problems, ambiguities, and alternative explanations? What next?

Materials and Methods

This is the most important, and most read part of the thesis for your colleagues and lab mates (and your future self). Use the opportunity to carefully document techniques that you have worked out during your PhD research in a way that others can use it as a protocol book. If the results chapters come from published papers, the materials and methods may be removed from those chapters and grouped into a single chapter. This is generally recommended as it makes the thesis easier to read and a better source for techniques.

Figures and Legends

Each figure should be clear and self-explanatory. It should be possible to gain at least a superficial understanding of the displayed experiments without reading the text or figure legends.
Each legend should have a title that conveys the conclusion of the presented experiments or data. If there are multiple panels (A, B, etc), each of these should also have a title. The body of each legend should explain all items included in the figure.
Figures can be placed on separate pages, or can be embedded in the text as text boxes.

References

All references in the thesis should be modeled on a journal (such as Cell) and should include a full set of authors (for ten or less authors), the complete title of the work, and the volume, and page numbers (and editor and publishers as necessary). If using reference management software, the references should be checked manually for completeness and accuracy.

Supplements, appendices

This part of the thesis is not a requirement, but can be highly useful for including data that does not easily fit within the main part of the thesis. Examples include movies, genomic data sets, PCR primer sets, and crystallographic coordinates or even supporting preliminary data.

Other relevant comments - Although there is no formal requirement, students are urged to prepare a preliminary copy of the thesis for evaluation by the advisory committee. This procedure can save on extensive revisions of the final typed copy. Also, it is good to know before the final examination that the committee finds the thesis generally acceptable. It is possible to obtain partial support for preparation of thesis from research grants, especially if figures and tables from the thesis are used for the preparation of scientific journal articles.

MISCELLANEOUS

A. Melville A. Hare Awards for Excellence in Teaching and Research - The Department makes annual awards to students to recognize superior performance in teaching or research, with one to two awards given in each category. The awards will consist of a certificate and a monetary award, funded by contributions from the family of Dr. Melville A. Hare.

For the teaching award, the course director will nominate a graduate student for the award, providing a

letter of recommendation and soliciting supporting letters from students taking the course. This nominating material will be sent to the Chairman of the Hare Award Committee to choose the awardee from among those nominated. There may be one, two, or no awards given in a particular year. The committee will meet before the end of the spring semester, and awards will be presented at the fall Medical School Convocation.

For the research award, the student will be nominated by his/her advisor, with letters of recommendation also solicited from members of the student's Thesis Committee, and other faculty members, as appropriate. Supporting material should be included with the nomination, e.g., a published paper, a manuscript submitted for publication, or a copy of a poster presented at a professional meeting. The student's performance in **MBI 501** may be included. If a student has collaborated with others in his/her research, the contribution of the student to the research project must be clearly defined. The nominations will be submitted to the Chairman of the Hare Award Committee, and the awardee(s) will be determined either by the committee. The award(s) will be presented at the fall Medical School Convocation.

B. Housing - It is the responsibility of each student to secure a place to live in Rochester. The University offers a limited number of housing facilities within walking distance of the Medical Center for both single and married students. Information about these facilities as well as an abbreviated list of apartments and houses in the immediate area can be found at http://www.rochester.edu/reslife/graduate/.

C. Graduate Student Society (GSS) - The GSS includes all full-time graduate students in the Medical Center. Each year the GSS selects a Board of Officers responsible for planning the year's activities as well as serving as a liaison between the students and the Administration. The GSS Board keeps the students informed on all policy matters in the Medical Center and periodically plans social functions giving graduate students the opportunity to meet students from other departments in a relaxed atmosphere. Information about the GSS is found at: http://www.urmc.rochester.edu/education/graduate/current-students/graduate-student-society/

D. Student-PI interactions – In addition to their annual committee meeting, students are expected to have regularly scheduled (e.g., at least monthly) meetings with their PIs to assess progress in their research studies. Students are encouraged to take the lead on setting these meetings up and come to the meetings prepared with topics (including, but not limited to, experimental plans and data) that they wish to discuss.

E. Attendance to specialized professional and scientific meetings - Students and advisors are encouraged to seek opportunities to attend institutional, local, regional, and/or national conference meetings. Examples of professional societies offering travel awards are:

The American Association of Immunologists: https://www.aai.org
The American Society for Microbiology: https://asm.org
The American Society for Virology: https://asv.org

M.D./Ph.D. Combined Degree Program

Departmental requirements for the M.D./Ph.D. degrees reflect the fact that most students enter the Ph.D. program after completion of two years of the Medical School Curriculum.

- Typical MD/PhD students enter the PhD portion of their combined degree program after the basic science years of the MD curriculum. During their first and/or second year of the MD program, they should discuss the PhD program in Microbiology and Immunology with the departmental faculty including the director of graduate studies in this department. During this period, they should also be considering possible dissertation research mentors. Research rotations in two (or more) of the prospective labs are conducted, typically in the summers before their entry into the Ph.D. program. This results in a waiver for MBI 507 (Laboratory Rotations) and MBI 506 (Scientific Writing in Research).

- Depending on their research focus, MD/PhD candidates, like all doctoral candidates in the Department of Microbiology & Immunology, enter either the Immunology Track, the Microbiology Track, or the Virology Track; required and elective course offerings in each track are described below. In addition, each student is required to take the Microbiology & Immunology Student Research Seminar (MBI 501) given every semester, and Biomedical Ethics (IND 501).

- PhD research training focuses on the following major topics of cluster faculty members' interest such as: microbial pathogenesis; molecular genetics; microbial physiology; oral microbiology; molecular virology; neurovirology; viral immunology; vaccine biology; autoimmunity, tumor immunology; lymphocyte biology; developmental immunology; cytokines and immune regulation; psychoneuroimmunology; immunogenetics; and phylogeny of immunity. MD/PhD students typically begin their dissertation research upon entry into the PhD program. Their research focus intensifies in subsequent years during which time there is also an emphasis on presentation of research results locally, at national and international scientific meetings, and in journal articles. Didactic course work is usually completed before the end of the second year. Additional required courses are typically small group seminars and journal clubs (1-2 credits) where students learn how to critically evaluate and orally present recent literature in their chosen field of study.
- Based on their basic science courses in the Medical School Curriculum, MD/PhD students are granted 30 credits toward the 96-credit requirement for the PhD. This results in a waiver for IND 431 and IND 432 (Foundations of Modern Biology I&II). Of course, any portions of these courses may be audited as needed.

- **MD/PhD students must take an oral qualifying examination on their proposed thesis research by the October 1 of their second year in the PhD Program**. The qualifying exam tests both the baseline level of knowledge of the field of study and well as a working knowledge of areas such as genetics, cell biology and biochemistry. Additionally, and critically, the qualifying exam tests the student's ability to integrate this knowledge in the design and interpretation of experiments. **See page 10 for instructions on the PhD oral qualifying exam.**

- The doctoral program typically takes four years for combined degree students to complete. **M.D./Ph.D. students will not be allowed to enter the clinical years until their thesis has been submitted to ProQuest and approved.**

Track specific requirements:

Immunology Track

Track Requirements

MBI 515	**Advanced Immunology**	**4.0 credits**
MBI 580	**Immunology Research in Progress (RIPS) + Journal Club-Each semester for at least six semesters**	**1.0 credits**
MBI 540	**Advanced Topics in Immunology- One semester**	**1.0 credits**

Electives:
Chosen after consultation with the research advisor and PhD committee, to best serve the needs of the student's program, background, and interests. Electives taken by students have included:

MBI 456	**General Virology**	**4.0 credits**
MBI 414/514	**Mechanisms of Microbial Pathogenesis + Co –Seminar**	**5.0 credits**
MBI 421/521	**Microbial Genetics and Physiology + Co-Seminar**	**5.0 credits**
PTH 507	**Cancer Biology**	**3.0**
MBI 403	**Drug Discovery**	**2.0**

Virology Track

Track Requirements

MBI 456	**General Virology**	**4.0 credits**
MBI 588	**Virology Research Seminar Series – At least three semesters**	**1.0 credits**
MBI 589	**Advanced Topics in Virology –– At least three semesters**	**1.0 credits**

Electives:
Chosen after consultation with the research advisor and PhD committee, to best serve the needs of the student's program, background, and interests. Electives taken by students have included:

MBI 473/573	**Immunology + Co-Seminar**	**5.0**
MBI 414/514	**Mechanisms of Microbial Pathogenesis + Co –Seminar**	**5.0 credits**
MBI 421/521	**Microbial Genetics and Physiology + Co-Seminar**	**5.0 credits**
PTH 507	**Cancer Biology**	**3.0**
MBI 403	**Drug Discovery**	**2.0**

Microbiology Track

Track Requirements

MBI 414/514	**Mechanisms of Microbial Pathogenesis + Co –Seminar**	**5.0 credits**
MBI 421/521	**Microbial Genetics and Physiology + Co-Seminar**	**5.0 credits**
MBI 570	**Advanced Topics in Molecular Microbiology – At least six semesters**	**1.0 credit**

Electives:
Chosen after consultation with the research advisor and PhD committee, to best serve the needs of the student's program, background, and interests. Electives taken by students have included:

MBI 403	**Drug Discovery**	**2.0**

The following courses are **waived** for MD/PhD students:

IND 431 Foundations I
IND 432 Foundations II
MBI 507 Lab Rotations
MBI 519 Experimental Design and Analysis
MBI 506 Scientific Writing in Research

Immunology:
MBI 473 Immunology
MBI 573 Immunology Seminar