GRADUATE PROGRAM

DEPARTMENT OF PATHOLOGY,
Division of Microbiology and Immunology

Requirements for the Ph.D. Degree

The requirements of the Department of Pathology, Division of Microbiology and Immunology for the granting of the Ph.D. degree are described in this document.

Most students will enter the Pathology Ph.D. program from either the interdepartmental program in Molecular Biology (MB) or Biological Chemistry (BC), after successfully completing the program Capstone Exam. Other students may enter the program as Direct Admissions students. These Direct Admissions students will be evaluated for admission by a faculty committee, which will also provide recommendations as to the specific Preliminary Exam requirements for each specific Direct Admissions student.

A. Requirements for the Ph.D. Degree

1. The required courses are the first year curriculum for either the MB or BC Program. See the the first year curriculum requirements listed on the MB/BC Program website (http://www.bioscience.utah.edu). If a grade of less than a B- is earned in a core course, the student is required to retake the course and receive a B- or better before the end of the 2nd year. MD/PhD students are required to successfully complete the courses for the first two years of Medical School, and to complete any graduate course required by the student’s Thesis Advisory Committee.

2. Laboratory rotations and 1st year Journal Clubs. See the MB/BC Program website for explanations and listings of these requirements (http://www.bioscience.utah.edu). These are to be completed in the 1st year.

3. At least one additional graduate-level didactic course (numbered 6000 or above) other than a special topics course. The specific course(s) must be approved by the student's Thesis Advisor and/or Thesis Advisory Committee. Students must receive a passing grade of B- or better. Courses numbered 5000-5999 may be taken for graduate credit with prior approval by the student's Thesis Advisor and/or Thesis Advisory Committee.

4. At least one additional graduate-level special topics course (numbered 6000 or above). The specific course(s) must be approved by the student’s Thesis Advisor and/or Thesis Advisory Committee. Students must receive a passing grade of B- or better. Courses numbered 5000-5999 may be taken for graduate credit with prior approval by the student's Thesis Advisor and/or Thesis Advisory Committee.

5. The following activities are an essential part of graduate training and are required of all students:

Pathology Department Journal Club
Pathology Department Research in Progress
Departmental Seminars and Thesis Defenses

(6) Accumulation of at least 20 credit hours of Pathology 7970 (Ph.D. Thesis Research).

(7) Teaching Assistant duty is required for one semester or two half-semester courses, regardless of the source of individual stipends, for all students who have entered the Pathology graduate program through either of the combined Molecular Biology or Biological Chemistry programs. TA assignments are made through the MB/BC Program Office (or their designee) for various courses offered by the departments who participate in the combined MB/BC programs.

(a) International students are required to successfully pass a SPEAK test and attend the International TA Program Workshop prior to fulfilling their TA responsibilities.

(8) Registration

(a) Prior to passing the preliminary/qualifying examination: Students should register for 9 credit hours each semester.

(b) After passing the preliminary/qualifying examination:

(i) Students whose tuition is paid by the Graduate School’s Tuition Benefit Program must be registered for 9 credit hours each semester.

- Students are required by the Graduate School’s Tuition Benefit Program to apply for residency in the State of Utah as soon as they have completed 45 credit hours of coursework.

(ii) Students whose tuition is paid by a training grant must register for 3 or 9 credit hours as instructed by that training grant’s administrator.

(iii) Students, whose tuition is paid by a grant obtained directly by the student, must register for 3 or 9 credit hours according to the instructions of the individual award.

(iv) Students whose tuition is paid by their Thesis Advisor (due to expiration of or disqualification from their other funding sources) should register for 3 credit hours of only Pathology 7970 (Thesis Research) each semester; this will maintain the student's full-time status.

(9) Preliminary Examination (see detailed guidelines below) - Students should have completed their Preliminary Examinations (written and oral) before the start of the third year of full-time graduate study.

(10) During their second year, students are required to prepare a fellowship application and submit it to either NIH or to NSF, or to both. Students should start with their Preliminary Examination Proposal (see Section C), and with the help of their
advisor, craft a fellowship application. Information on the NIH F31 Predoctoral Individual National Research Service Awards is available here: https://researchtraining.nih.gov/programs/fellowships/F31. (MD/PhD students should apply for an F30 fellowship.) The deadlines for the NIH F31 and F30 Predoctoral Individual National Research Service Awards are April 8, August 8, and December 8. Students are responsible for verifying the deadlines for their application, and responsible for working with the Departmental Grants Administrators in getting their application submitted in a timely fashion. Note that you may need to submit your application to the Grants Administrator more than a week before the NIH deadline. The student shall also supply a copy to the department’s Graduate Program Administrator, so that completion of this requirement can be recorded.

For students applying for the NSF Graduate Research Fellowship Program, information is available here: https://www.nsfgrfp.org. The deadline for the 2016 NSF GRFP application was October 24, 2016; upcoming deadlines have not yet been published.

Cases in which a student does not submit a predoctoral fellowship application should be presented in writing to the department’s Director of Graduate Studies by both the student and PI, and will be considered on a case-by-case basis to determine whether the student is permitted to continue in the program.

Foreign students are not eligible for NIH or NSF fellowship support, and they are exempted from this requirement.

(11) Compensation

(a) It is anticipated that each student making satisfactory progress will receive a stipend, plus full coverage of tuition expenses. Students also receive medical and dental insurance coverage.

(b) The student is expected to devote full effort toward graduate studies while enrolled in the program. It is not permissible for a student to work at another job, nor to be enrolled in another educational program. Student loans are available in cases of financial hardship.

B. Activities of the Second Year

During the second year of graduate training the student should complete as many of the course and teaching requirements as possible, develop his/her own research project, and prepare for and pass the preliminary examination. Students will also be required to give Journal Club and Research in Progress presentations beginning in the second year.

C. Guidelines for the Preliminary Examination

Goal: The goal of the preliminary exam is to determine whether the student is prepared for PhD-level work. The committee will evaluate the student’s general knowledge (including coursework up until the exam date), knowledge of his/her field, and critical thinking and writing skills.

Overview: The preliminary exam consists of two parts:
1. A written proposal based on the student’s thesis project. This proposal should consist of 2-3 specific aims. At least one of these aims must be independently conceived and developed by
the student and not based directly on any work proposed by or ongoing in the thesis lab. If the student chooses to not write directly on his/her thesis project, the proposal can focus on any project in the student’s field that is not currently under investigation in the thesis lab.

2. An oral exam that includes defense of the proposal and general knowledge. “General knowledge” includes the thesis field of research, all coursework up until the time of the exam, and general molecular biology, biochemistry, cell biology, and genetics.

Exam committee: The exam committee should be the same as the student’s thesis committee. The committee should consist of four members plus the thesis advisor. At least one member should be from outside the Pathology Department, and at least three members must be from the Pathology Department. The student should work with his/her advisor to choose committee members.

Timeline: The preliminary exam should be completed by the end of the fall semester of the student’s first year in the thesis lab (second year in graduate school for PhD students, third year for MD/PhD students). It is the student’s responsibility to perform the tasks associated with scheduling and preparing for the exam.

1. Select an exam committee and schedule a date and room. The committee must be formed and the prelim coordinator notified of committee membership by September 30th at the latest. The exam should be scheduled for no later than the final day of the semester.

2. Prepare the preliminary exam proposal. The preliminary exam period begins six weeks before the exam date. The student is expected to read and think deeply and broadly in his/her field and prepare his/her exam proposal. In addition to daily reading and writing, the student is expected to continue to complete lab and department responsibilities, including attending journal clubs, seminars, and lab meetings.

3. Send the Specific Aims page to the committee at least four weeks prior to the exam date. The student is expected to meet individually with each committee member to discuss the specific aims, particularly the student-derived aim(s) and revise the aim(s) based on committee feedback before preparing the final proposal.

4. Prepare for the oral exam and submit the final proposal. The proposal is due to the committee at least one week prior to the oral exam date. The student should prepare a presentation that would take 30 minutes to present without interruptions.

Written proposal:
The proposal guidelines follow those of the NIH F31 Predoctoral Fellowship application.

Applicants must describe a well-defined research project that is well-suited to his/her stage of career development and can be accomplished by the individual within the time-frame of the training period (3–5 years). The text of the written proposal must be the student’s original writing. Students may not use text from the thesis advisor’s previous grants or papers or any previous Prelim Exam by students in the laboratory. Plagiarism in a Prelim Exam is grounds for failure. The thesis advisor, mentors, and examiners may not comment on the written exam before the oral exam.

Content (excerpted from NIH NRSA F31 instructions):
Specific Aims (1 page)
Introduce the problem that will be addressed.
List succinctly the specific objectives of the research proposed, e.g., to test a stated hypothesis, create a novel design, solve a specific problem, challenge an existing paradigm or clinical practice, address a critical barrier to progress in the field, or develop new technology. Summarize the experimental approach in Specific Aims (including at least one novel student-developed aim), where each aim reflects a major research goal. While specific aims can be interrelated, it is critically important that one aim not be entirely dependent upon another. Summarize the expected outcome(s), including the impact that the results of the proposed research will exert on the research field(s) involved.

Research Strategy (6 pages)
Organize the Research Strategy in the specified order using the instructions provided below. Start each section with the appropriate section heading — Significance and Approach. We strongly suggest including figures as appropriate; to increase the incentive for the student to create figures, these will not count towards the page limit. Figures can (but are not required to) include the student’s own preliminary data as well as data from the laboratory. If the student includes data from a lab member/collaborator, these data must be appropriately attributed and the student should obtain permission from the person who generated the data (if unpublished). The student should also consider including figures that show predicted experimental outcomes as well as a graphical abstract or diagram that illustrates aspects of the models or hypotheses being tested to help orient the reviewers to the design of the study. If the student presents predicted experimental outcomes, these data should be in cartoon format and should NOT be made from photoshopped images of real gels, microscopy pictures, etc. This restriction applies to the oral presentation slides as well. These figures should be clearly labeled as predicted and not actual experimental outcomes.

Significance
- Introduce the problem or question that will be addressed in this study
- Provide a review of the field that explains the importance of the problem or critical barrier to progress in the field that the proposed project addresses.
- Explain how the proposed project will improve scientific knowledge, technical capability, and/or clinical practice in the relevant research fields.
- Describe how the concepts, methods, technologies, treatments, services, or preventative interventions that drive this field will be changed if the proposed aims are achieved.

Approach
- Describe the overall strategy, methodology, and analyses to be used to accomplish the specific aims of the project.
- Describe how the data will be collected, analyzed, and interpreted
- Discuss potential problems, alternative strategies, and benchmarks for success anticipated to achieve the aims
- If the project is in the early stages of development, describe any strategy to establish feasibility, and address the management of any high-risk aspects of the proposed work.

Bibliography and References Cited (no page limit):
Cite published experimental details in the Research Strategy section and provide a bibliography of any references cited. Each reference should be formatted according to NIH standard.
guidelines. This is a good time to learn to use available citation software such as Endnote. The bibliography should be formatted using the “NIH” output style and must list all authors and full titles of the articles. Students should be especially careful to follow scholarly practices in providing citations for source materials.

Page Formatting:
Font: Arial 11 point in the main text. Font in figures and figure legends should be Arial 9 pt font.
Spacing: Single Spaced
Margins: 0.5 inch page margins on all sides.
Language: Formal Scientific American English. Avoid jargon. If terms are not universally known, spell out the term the first time it is used and note the appropriate abbreviation in parentheses. The abbreviation may be used thereafter.

Oral Exam:
The goal of the oral examination is to determine whether the student has the fundamental knowledge and skills needed to succeed in their thesis research. By the start of the exam, the committee will appoint a chair (other than the advisor). The chair will provide the final feedback to the student and write a short summary of the exam for the chair, committee, and department graduate coordinator. The exam committee will evaluate the student’s knowledge of his/her field, critical thinking skills and ability to formulate hypotheses, originality and creativity, and presentation skills. The student should prepare a presentation that would take 30 minutes to present without interruption for the oral portion of the exam. This presentation should summarize and defend the proposal and the student should be prepared for numerous interruptions. The student is expected to have substantial depth of knowledge in the thesis area, broadly defined. The examiners are interested in a student’s understanding of the concepts, assumptions, and limitations of their proposal and ability to address any questions/concerns, including designing additional experiments or revising existing ones. A key element of the oral examination will be an explanation and defense of the importance of the questions to be addressed, placement of these questions in the broader context of the field, and a logical presentation of how the proposed experiments will answer the questions posed. The student is expected to be well-versed in the relevant literature and broader areas, including cell biology, genetics, molecular biology, and biochemistry. It is recommended that the student organize a mock oral exam involving other students and post-docs to practice in preparation for the questioning of the oral examination. The thesis advisor, mentors, and examiners may not participate in mock examinations.

Role of the Thesis Advisor:
The student is encouraged to consult with his/her thesis advisor during preparation for the exam about the concepts and principles of the study. The thesis advisor can have conversations with the student about specific aims and provide guidance and recommendations on the development of the experimental approach. However, the student is responsible for crafting of a document that speaks in his/her voice and the details of the proposal should be developed by the student. The thesis advisor should not read or edit the student's written proposal before the oral exam. The thesis advisor will be asked at the beginning of the oral exam to comment on how much of the proposal includes details and ideas synthesized by the student, rather than verbatim from the advisor and lab members. The thesis advisor is asked to confirm that the written document is the student’s own writing and does not include text from grants or papers. At least one of the
Specific Aims should be entirely conceived and developed by the student. The thesis advisor is not allowed to participate in mock examinations in preparation for the oral exam.

Exam day procedure: The student should schedule the exam for two hours. Once the committee has gathered, the student will be asked to leave the room. The committee will then:
1. Decide who will serve as the exam committee chair-person. The chair must be someone other than the thesis advisor.
2. The thesis advisor should report on the extent to which the proposal includes details and ideas synthesized by the student, rather than verbatim from the advisor and lab members.
3. The thesis advisor is asked to confirm that the written document is the student’s own writing and does not include text from grants or papers.
4. The thesis advisor is asked to confirm that one of the Specific Aims was entirely conceived and developed by the student.
5. Discuss the student's overall record, particularly any deficiencies that might need special attention in the oral questioning.
6. Discuss the written proposal and identify any weaknesses that should be pursued in oral questioning.

The chair will then invite the student to return to the room and ask the student to begin the prepared 30 minute presentation. The committee should interrupt the student during the presentation with questions about the proposal, general knowledge related to the topic proposal, or general knowledge in broader fields. At the conclusion of the presentation and questions the student will be asked to leave the room. The exam committee will discuss the student’s performance and decide on a recommendation (pass, conditional pass, or fail). The thesis advisor can stay in the room to help relay content and advice from the committee’s discussion to the student, but the thesis advisor should remain quiet unless asked for input by the committee. The student will be asked to return to the exam room, and will be told the results of the exam. The committee chair and committee members will give the student feedback on their performance, including suggestions for how to improve their knowledge base and skill sets.

Exam scoring: It is the responsibility of each specific Prelim Exam Committee to decide whether it is in the best interest of the student and the department for the student to advance to candidacy and continue with their thesis research. The successful completion of a PhD dissertation requires substantial commitment of time and resources on the part of the student as well as the thesis advisor, faculty and institution. The student will be evaluated based on several criteria outlined in detail on the Prelim Exam scoring sheet including, knowledge of their field, critical thinking and the ability to formulate hypotheses, originality and creativity, and writing and presentation skills.

Possible outcomes:
1. Pass: The student receives a full pass if the committee feels that they have performed well on all aspects of the exam and are qualified to work towards a doctorate.
2. Conditional pass: If a student performs well overall, but exhibits a significant deficiency in one area, the committee may require additional work in that particular area. This could include additional coursework, rewriting the proposal, or an additional oral presentation.
3. Fail: If a student fails the Prelim Exam, the committee feels that they were severely deficient in one or more aspects of the exam. The student has the right to retake the exam within a 4-6 week time frame. However, if the committee thinks that the deficiencies are such that the student is unlikely to pass the second time, they will say so. The student will
receive either a full pass or fail. If the student fails the second exam, the exam committee will pass that information onto the Graduate Committee and recommend termination. This recommendation must be approved by a vote of the entire Graduate Committee and all appeals must go through the Graduate Committee.

Implementation: The new preliminary examination guidelines will apply to the Fall 2016 entering class (current first years). Second year students who joined the Pathology Department in Fall 2015 will take the preliminary examination under the old format.

D. Completion of the Preliminary Exam

Successful completion of the Preliminary Exam qualifies the student to proceed with the Ph.D. degree and is regarded as:

1. Assurance to the faculty of the Division of Microbiology and Immunology that the student is ready, or at least sufficiently developing in the ability to:
   a. Envisage and formulate a specific scientific problem (hypothesis and experiments, not an approach nor a long-term research project)
   b. Express a research problem concisely in writing and
   c. Effectively present and defend these ideas orally before a selected examining group.

2. Assurance of sufficiency of basic background information. Demonstrated areas of deficiency in the background of the student may be filled in by any of several means (courses, examinations, tutorials, etc.).

3. After the Preliminary Examination, a five person Thesis Advisory Committee will be appointed to take over the student's full-time educational activities. The members of this committee will be chosen by the student with consent of his/her Thesis Advisor and must be approved by the Head of the Graduate Committee.
   a. Students are required to form a Thesis Advisory Committee within 3 months of passing their Preliminary Examination.
   b. Students are required to organize and convene their first Thesis Advisory Committee meeting within 6 months of passing their Preliminary Examination.
   c. The Thesis Advisory Committee is required to meet with the student at least every 12 months until graduation. In order to monitor a timely progression towards completion of the PhD degree, all fifth year students are required have two formal meetings per year and beyond the fifth year all students will have a minimum of three meetings. During each meeting the student is expected to articulate their past and ongoing thesis research progress, and outline plans for completing their thesis work that must be approved the committee.
   d. The Chair of the Thesis Advisory Committee will prepare a meeting summary, including progress to date and specific recommendations for future studies. This document will be circulated to all Thesis Advisory Committee members for comments and clarification, with the final version
given to the student and a copy placed in the student’s file. This document can be reviewed at the next committee meeting.

E. **Scientific Expectations**

Benchmarks for matriculation:

(1) Demonstration of independence and critical thinking skills  
(2) Creativity and competence in research  
(3) Understanding of the scientific literature

Evidence for attainment of these benchmarks includes at least one first author research paper accepted or published. Deviations require the consent of the full thesis committee.

F. **Thesis writing and defense**

(1) The student may begin writing his/her thesis upon approval by the student’s Thesis Advisory Committee. The thesis must conform to the guidelines of the University Thesis Editor.

(2) The thesis should be presented to each member of the Thesis Advisory Committee at least 1 week prior to the date of the thesis defense and final exam.

(3) After the thesis is written, the student will give a one-hour seminar on the thesis research, after which the Thesis Advisory Committee and student will meet for the Final Examination.

(4) The university requires that "the candidate must be regularly enrolled for three or more credit hours during the semester in which the final oral examination is taken."

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