

HUMAN GENETICS DEPARTMENT GUIDELINES FOR PRELIMINARY EXAMINATION FOR THE Ph.D. DEGREE

Students should read these guidelines carefully and take particular note of the exam timeline and deadlines.

Overview

The preliminary examination comprises (1) a written component consisting of a **Project Proposal** that includes a Specific Aims page, Introduction and Review of the field, and Proposed Thesis Research; and (2) an oral component consisting of a **Defense** of the Project Proposal in the context of the field.

Deadlines

The preliminary examination must occur during the fall semester of the second year of graduate study. Upon joining a thesis lab, the student should recruit his/her Prelim Committee and schedule dates for both the Abstract and Exam meetings, which should be no more than 7 weeks apart. To ensure completion of the exam during the fall semester, the Abstract Meeting should occur no later than **October 19**, and the Prelim Exam must occur no later than **December 7**. Students who do not initiate their preliminary exam during this time frame will **automatically fail**. The student must inform the Graduate Secretary (Human Genetics Dept Office) of his/her intent to take the exam by filling out the necessary paperwork no later than **July 15**. If the student receives a Conditional Pass for the exam then any remedial work and final Committee decision must be completed within 4 weeks of the oral Defense date, and a final evaluative summary must be provided by the Prelim committee's chair within 2 additional weeks and no later than the end of January. Students who join the Department later than June of their first year of graduate study should consult with the graduate director about an appropriate timeline for completing the exam.

Goals of the prelim process

- To achieve a thorough understanding of the key experiments, methodologies, or algorithms in the field of choice. What is known already? What does the scientific literature suggest we need to know to further our understanding of this area? What are the gaps and inconsistencies in the published data?
- To compose a scholarly review of a research field, synthesizing key concepts, data, analytical strategies, and models that are currently prevalent in the field and identifying key questions that need to be addressed, either experimentally or by development of new methods of data collection or analysis. Ideally, the review should go beyond a simple description of the published literature to a critical analysis of inconsistencies in the field and/or to formulation of new or alternative models and techniques.
- To develop a line of experimentation related to one's field of research. This includes, but may not be limited to:

- Formulation of relevant, testable models or hypotheses based on existing data
- Design of experiments that specifically and directly test these models or hypotheses
- Creation of new statistical or computational techniques that address an existing gap in the field and/or permit new areas of investigation
- Critical evaluation of the interpretations as well as the limitations of specific experimental directions

- To effectively present and defend one's ideas orally before an examining committee.

The expectation of the committee is that the student will demonstrate mastery of the basic principles and methods of modern biological science, as taught in the first year graduate classes, journal clubs, and laboratory experiences. This demonstration of mastery will be conveyed during both the written and oral parts of the examination. The student should expect to be asked about fundamental aspects of modern biology, including, but not limited to, an understanding of the basic principles of genetics. The candidate must be knowledgeable in all aspects of the first year course material as a prerequisite for satisfactory performance on the preliminary examination.

ADMINISTRATION

The preliminary examination will be administered by the "Prelim" Committee, which normally consists of the student's Supervisory Committee minus their Research Advisor (i.e., four faculty). See the Student Guidelines for a description of the Supervisory Committee. The Advisor will not be present during the Abstract or Exam meetings. During the Abstract meeting, the Prelim Committee must designate a chairperson. The chair has the following responsibilities: he/she will oversee the exam; write an Evaluation of the student's overall performance; and, if necessary, coordinate communication between the committee and student. The Evaluation will be sent to the student and all members of the Supervisory Committee to help guide the student's future instruction.

Special circumstances: Students should avoid including collaborating faculty members on their Prelim Committee. Although collaborators may be ideal for the Supervisory Committee, they are often too closely involved with the student's research to provide an unbiased perspective during the preliminary exam. The Prelim Committee has the option to invite an "ad hoc" member to join in order to provide additional expertise.

The following forms need to be completed and submitted to the graduate office during the exam process. These can be obtained from the Graduate Advisor in the Department Office:

Prelim Organization: due July 15

Abstract Meeting: due immediately after the Abstract Meeting

Preliminary Exam: due immediately after the Oral Exam Meeting.

Conditional Pass: if necessary, due upon final completion of the Exam.

ROLES OF THE RESEARCH ADVISOR, PRELIM COMMITTEE, AND OTHER COLLEAGUES

During the summer prior to the Prelim exam, it is expected that the student will be actively engaged in initiating a research project. This generally occurs as a collaboration with the Advisor. In addition, the Advisor will likely engage in a variety of other mentoring activities. For example, they may guide the student to become familiar with important areas of relevant literature and/or discuss specific papers; they may share funding applications or other materials describing experimental directions planned for the lab; they may discuss general principles of experimental design, grantsmanship, or oral presentation. However, the Advisor **should not provide specific instruction concerning the content** of the student's written or oral exams. The Advisor **should not be directly involved in designing, writing, or editing the student's Abstract, written exam or oral presentation**. All writing must be **in the student's own words**.

The Prelim committee may, at their discretion, suggest modifying the focus or scope of the student's Introduction or Proposal. After the Abstract meeting, the student is encouraged to seek additional input from the Prelim Committee, but not to discuss specific details that could impact the final exam.

During the preparation of the written and oral examination, the student is encouraged to contact other scientists to discuss the model to be tested, experimental ideas, technical questions, and/or questions on grant writing. This can include student or postdoc colleagues, faculty (not on the Prelim Committee and not your advisor), or scientists off campus.* Obtaining input from experienced scientists on the written exam and oral presentation is critical for success – and this is how real science is done. However, all input from faculty should be limited to discussion of the science for the proposal – and NOT involve critical reading of the proposal or participation in a practice exam.

*It is noted that the student should obtain guidance from his/her advisor on the lab's policy regarding sharing of information.

Regardless of where ideas may originate, the student is responsible for choosing the final content of his/her Proposal and writing the exam in his/her own words, as well as appropriately citing reference sources. It is expected that the student will be able to defend the content of the proposal in the oral exam.

The University's definitions and rules, including consequences, for academic misconduct apply to all students in the Department of Human Genetics. For guidance see the [University Regulations](#) and [Biosciences Academic Standards](#) websites.

TIME LINE

Students should review this time line carefully to ensure that they initiate and complete their exams within the required time frame.

The process begins during the summer of the student's first year. Upon joining a thesis lab, the student should immediately recruit his/her Prelim Committee and schedule dates for both the

Abstract and Exam meetings, which should be no more than 7 weeks apart. To ensure completion of the exam during the fall semester, the Abstract Meeting should occur no later than October 19, and the Prelim Exam must occur no later than December 7. Both dates should be set at the same time to ensure that all committee members will be available for both meetings. One handy way to schedule these dates is using a web-based scheduler, such as Doodle (www.doodle.com). If some committee members are not available for one date, the student must select alternates. This will ensure that the exam will be completed on time. Under no circumstance should the interval between the Abstract and Exam meetings extend beyond a 7 week period. Students may choose to spend less than 7 weeks if desired. The student must inform the Graduate Secretary (Human Genetics Dept Office) of his/her intent to take the exam by submitting the necessary paperwork no later than July 15.

2. Prelim Abstract Meeting: The purpose of this meeting is to provide feedback to the student as he/she initiates the writing phase of the exam. The student should write a brief description of the overall project and list the specific aims (1-2 pages total) and send this Abstract to the Prelim Committee one week prior to the Abstract meeting.

3. During the next 6 weeks, the student will expand the outline into a written review of the field and refine the project goals into a coherent set of Specific Aims and experiments suitable for a thesis project, as described in detail below. It is expected that students will continue to attend Human Genetics Department Journal Club and RIP meetings during this period. Other commitments (research, TA-ships, courses) should be minimized.

4. Oral Defense: The oral defense meeting must be held **no more than 7 weeks after** the Abstract meeting. The written portion of the exam should be distributed to the Prelim Committee and Advisor **one week before** the oral examination date (no later than the first week of December). If any remedial work is required by the committee, this must be completed within 4 weeks. After a final outcome (pass or fail), an evaluative Summary should be communicated to the student, committee, advisor, and graduate office within 2 weeks. All students should receive a final evaluation no later than the end of January.

5. Thesis Committee Meeting: Students who pass their preliminary exam should meet with their Ph.D. Thesis Supervisory Committee **within 12 months of completion of the prelim exam, and at least yearly thereafter**. Based on the student's progress and performance on the Prelim Exam, the Committee may suggest a shorter time frame for scheduling this meeting. One week before the first thesis meeting, the student will present his/her committee with a 1-2 page outline of his/her updated thesis research project.

FORMAT – WRITTEN EXAM

Overview: The format of the written examination consists of three parts: a Specific Aims page, an Introduction, and a Project Proposal, all related to the student's planned thesis research. The Introduction should be crafted like a review to provide background information, significance, and context for the proposal. This written document will provide the basis for an oral exam, during which the student's knowledge of the subject area, general biological concepts, and ability to design and interpret experiments will be explored.

It is likely that most students will stick close to the (actual) plans for their thesis research when deciding on the focus and scope of the written exam. However, independence and creativity are encouraged. A line of research can follow many different paths. The student is not limited to Aims that he/she has previously discussed with the Advisor, but may propose alternative approaches or even come up with his/her own experimental directions.

1. **Specific Aims** (1-2 pages)

The Specific Aims page should follow standard format for an NIH grant. This should include: an introduction to the topic, a description of the major opening in the field that will be addressed by the proposal; an overall hypothesis that will be tested; 2-3 specific aims that will address the hypothesis; and a wrap-up paragraph that puts the proposed research in the context of the overall field.

2. **Introduction** (10-12 pages)

The student will compose a scholarly review of his/her research field, synthesizing key concepts, data, analytical strategies, and models that are currently prevalent in the field and identifying key questions that need to be addressed. Ideally, the Introduction should go beyond a simple description of the published literature to a critical analysis of inconsistencies in the field and/or to formulation of new or alternative models and techniques. The student should identify the opening in the field that they will address in their proposal, state the hypothesis that will be tested, and specify how their proposed research will advance the field in new and important directions.

Formatting:

- The Research Proposal should have an informative title that conveys its topic and scope.
- Text should be double-spaced; Arial or Times; 11 or 12 point; at least 1 inch margins on all sides. Figures can be embedded within the text (preferable) or combined into their own section after the main body of the text. Figures should be numbered and associated with a legend; minimum font size for figures is 6 point.
- There is no limit on the number of references, which are not included in the page limit. The reference list can be single-spaced. In-text citations can be either sequentially numbered or in an Author-Date format. Include all Authors, unless there are more than 10 authors (in which case list only the first 4); the full Title of the article, chapter, etc.; Journal name; Issue; inclusive Page numbers; and Year. A reference formatting program **should be used** to simplify reference management and avoid errors; examples are Endnote, Papers and Bookends.

Guidance on figures:

Figures are an essential component of a proposal. Some examples of figures that are particularly useful for an Introduction include a schematic of tissue/organ structure, showing relevant cell types; a diagram of a genetic, biochemical, or signaling pathway; models clarifying alternative models or hypotheses; or a diagram showing the workflow for collecting or analyzing data.

Often, a figure illustrating a particular point may already exist in the literature or be in general use within the thesis lab. If a figure is not ideal, it is better to create a new version. If no significant alterations are needed, figures can be reproduced verbatim, but must be clearly labeled as such, as well as associated with the appropriate citation. Alternatively, figures can be

modeled closely after a published version but should be labeled as "adapted from" the appropriate citation. Finally, "in-house" figures from the lab can be used but should be attributed to the source.

3. Project Proposal (6-8 pages)

The student will develop a line of experimentation related to his/her field of research. This includes, but may not be limited to:

- Design of experiments that specifically and directly test their models and hypotheses
- Creation of new statistical or computational techniques that address an existing gap in the field and/or permit new areas of investigation
- Critical evaluation of the expected results as well as the limitations of specific experimental directions and alternative approaches.

The proposal should tackle an important question in the field as outlined at the end of the Introduction. The scope of the project should be that of a graduate thesis project, i.e., achievable by a single individual with some technical support over a 4-5 year period. The student is expected to understand all aspects of the experimental procedures that are proposed, and questions addressing the logic, methods, and feasibility of specific experiments are likely to be raised during the oral exam.

Project proposal formatting:

The research proposal should include the experimental aims and a statement of how completion of the project will impact the field.

- Formatting, e.g. font size, margins, etc., should follow the same guidelines as for the Introduction.
- Experimental approaches should be described to convey how the aims will be addressed. No details should be provided, but all proposed experiments should be included to show the flow of experimental approaches that will be used. The student should be prepared to go into details in the oral part of the exam.
- Potential outcomes of the experiments should be briefly described and alternative methods can be included.
- The proposal should conclude with a paragraph that describes how the proposed research has addressed a major topic in the field.

FORMAT - ABSTRACT MEETING

The preliminary examination process begins with a meeting with the Prelim Committee to discuss the student's specific aims for the written exam. The student should write an approximately two page description of the proposal and distribute this "Abstract" to their Prelim Committee members and Advisor one week before the meeting. The Abstract should convey the expected scope of the planned proposal in the context of the field, stating the scientific problem being addressed, present a central hypothesis, and two to three specific aims, including a general experimental strategy that will test the hypothesis. This document need not be a polished treatment of the subject, but should provide adequate information to promote discussion and aid the committee in providing specific guidance for the final written exam. A figure(s) can be included if useful.

The student will briefly present his/her plan for the written exam to the Prelim Committee. This should consist of a 10-15 minute verbal presentation using either slides or a chalk talk format. The Committee will discuss the Exam topic and preliminary Proposal goals with the student, including the extent to which these overlap with the direct focus of the lab and the student's thesis research. The student should remember that this is not the exam, and that the Committee is there to help the student refine his/her topic and proposal into a form that can be developed for the final written exam.

It is possible that the Prelim Committee will decide that the proposal or specific aims need to be described in more detail or otherwise modified before the student is ready to begin writing his/her final document. Under these circumstances, the committee is encouraged to arrange for email contact to approve a modified version of the proposal or, if necessary, schedule another meeting within one week after the initial meeting to approve the modified proposal. Not all committee members need to be present at a follow-up meeting. The student is encouraged to actively communicate with his/her committee during this one week period. Approval of a majority of the committee is required before the student can move on to preparing their detailed written proposal. Note that the final prelim exam must occur 5 weeks after this second meeting in order to stay within the 7 week exam time limit.

FORMAT – ORAL EXAM

During the oral examination, the student will demonstrate an understanding of the key experiments, methodologies, and/or algorithms in his/her field of research. The student will briefly summarize the pertinent background of the research proposal, their central hypothesis, the significance of their contribution to the field, and outline their research plans - this should take no more than 30 minutes. The Prelim Committee will ask questions designed to discover whether the student: a) understands the significance of the Project Proposal with respect to the current state of knowledge in the field; b) understands the theoretical and practical aspects of the methods and procedures contained in or relevant to the proposal; c) can defend the rationale of the experimental design of the proposal. Note that questions may not be limited to the written proposal, and can cover any aspect of modern biology at a level appropriate to a second year graduate education. The oral exam will typically last 1.5-2 hours.

EVALUATION

There are three possible outcomes for the exam. Any of these decisions requires the approval of a majority of the Committee (i.e., three out of the four members).

(1) **pass**, with permission to start thesis research. Students who receive a pass should meet again with their Committee within one year after passing their exam to discuss their Ph.D. thesis research, and at least yearly thereafter.

(2) **incomplete**, in which a restricted deficiency is uncovered, correction of which will, considering the exam overall, provide a valuable learning experience for the student. Students who receive a conditional pass meet with their committee immediately after the oral exam to

discuss the strengths and weaknesses of their presentations. It is critical that the student understands what he/she did that was good, and what deficiencies need to be addressed before he/she can be given a passing grade. The most appropriate time frame for completing additional work can be decided by the committee in consultation with the student, but is not to exceed 4 weeks, and a specific deadline must be provided. The committee will then vote for either a pass or a fail. A conditional pass cannot be offered. The student may not appeal a failing grade and may either leave the graduate program or obtain a Master's degree, if qualified.

(3) **fail.** Students not performing to the satisfaction of the Prelim Committee will fail the exam. Under these circumstances, with the consent of the student's advisor, the student who fails at the first attempt may have the option to retake the exam, meeting again with his/her committee 1-4 months after the initial oral exam. However, the University of Utah Graduate School rules state: "An examination or parts of an examination may be repeated only once and only at the discretion of the student's supervisory committee". Thus, in cases of extreme deficiencies, the option of retaking the exam will not be offered. Once the student has attempted to overcome their deficiencies, the Committee will meet again and vote to decide whether the student passes or fails the preliminary examination. If a student fails the second attempt at the preliminary exam they can either leave the graduate program or obtain a Master's degree, if qualified.

FEEDBACK

The chair of the Prelim Exam Committee should write a short summary of the student's performance during the exam that reflects the consensus of the committee. This summary should be sent to the other committee members, the student, the Research Advisor, and the Department Graduate Advisor. Copies of the written exam should also be filed with the Department office.

PREPARING FOR THE EXAM

Find colleagues to help you think through your ideas, edit your writing, and practice your presentation skills! DO NOT prepare your exam without input from experienced scientists who are willing to be critical. Beware of "friends" who have only good things to say. What you seek is constructive criticism, and the ability to provide constructive criticism is an acquired skill that only comes with experience.

- Discuss the science over and over again; pick at the flaws in published work, your hypotheses, and your experiments, and correct them through successive iterations of presentation and critique.

- Get feedback (from anyone except faculty) to edit and re-edit your written exam to make your project proposal logical and clear.

- **Present a practice oral exam in front of trained and critical colleagues** (anyone except faculty). Practice not only your presentation, but also answering questions and defending your ideas. This will give you an opportunity to get experience thinking on your feet, and could uncover critical flaws in your thinking or presentation.

Review what you learned in the first year of graduate school. Many students forget principles and facts they have not used, so review the basics of molecular biology and the theory underlying how experiments are done. You will likely be asked basic questions about principles

and methods – be prepared!

A spell checker is an essential tool that you should employ for final editing of your document. A style/grammar checker may also be helpful. Typographical and grammatical errors suggest sloppy thinking.

A reference manager such as Endnote is also an essential tool. Typing citations yourself will waste an enormous amount of time and inevitably introduces errors. Also, adding references takes more time than you think. It is best to build your reference library and insert citations from the beginning of the writing process.

Please consult writing and style guides regarding difficulties with word usage, grammar or punctuation. (recommended: Strunk and White, *Elements of Style*, 3rd Edition, MacMillan, NY, 1979). Avoid lab jargon and shorthand. Also avoid excessive use of uncommon abbreviations. If abbreviations must be used, they should be defined at the beginning of the main text.