

# DEPARTMENTAL GUIDELINES FOR HUMAN GENETICS PRELIMINARY EXAMINATION FOR THE Ph.D. DEGREE

Students should read these guidelines carefully and take particular note of the time constraints. In no cases will the total time required for the preliminary exam exceed 7 weeks. The preliminary examination must be initiated before the end of the second year of graduate study. Students who do not begin their preliminary exam by this time will automatically fail.

## ADMINISTRATION

The preliminary examination will be administered by the "Prelim" Committee, which 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 has the option of attending the Prelim exam meetings if they wish to observe their student's performance, but they cannot participate in any aspect of the examination. The Prelim Committee has the option to invite a fifth "ad hoc" member to join in order to provide expertise in a particular area that will be covered during the exam. 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 may designate a chairperson for the examination.

## TIME LINE

Students must choose a **7 week** period during which to take the preliminary examination. All other commitments (research, TA-ships, courses) should be minimized during this period.

The process begins with the formation of the Prelim Committee and the student's declaration of their intent to take the exam. The student must inform the Graduate Secretary (Human Genetics Dept Office, Rm 2100 EIHG) and fill out the necessary paperwork.

**The timeline begins** when the student meets with the Prelim Committee to choose a proposal from two written abstracts. One abstract is expanded into a written research grant proposal, as described below, and distributed to the Prelim Committee **six weeks** after the topic selection meeting. The oral examination occurs **one week** after the submission of the written grant application, **seven weeks** after the initial abstract meeting. Students are strongly encouraged to schedule both meetings (topic selection and exam) well in advance, to ensure that all committee members have reserved both times on their calendars. One handy way to do this is using a web-based scheduler, such as Doodle ([www.doodle.com](http://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 exam extend beyond a 7 week period. Students may choose to spend less than 7 weeks if desired.

Students who pass their preliminary exam will meet for the first time with their Ph.D. Thesis Supervisory Committee **within 4-6 months of completion of the prelim exam**. One week before the thesis meeting the student will present their committee with a 10-15 page description of their thesis research project, as described below.

## FORMAT

The general format of the preliminary examination will consist of one scholarly written proposal that focuses on a topic approved by the Prelim Committee. This proposal should be in the general format of an NIH grant application. Each proposal will normally be for a research project that can be accomplished by a single investigator, plus a technician and 1-2 students, over a 3-5 year period. The suggested format is specified below. The written proposal will provide the basis for an oral exam, during which the student's knowledge of the subject area and general biological concepts will be explored.

The goals of the prelim process are:

- To formulate relevant, important testable models or hypotheses based on existing data and devise experiments that specifically and directly test these models or hypotheses.
- To achieve a thorough understanding of the key experiments 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 express a line of experimentation in grant application format.
- To develop critical skills in evaluating the benefits and risks 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 all fundamental aspects of modern biology, including, but not limited to, a deep 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.

During the preparation of the written proposal the student is encouraged to contact other scientists to discuss the model to be tested, experimental ideas, technical questions, or questions on grant writing. This includes colleagues, faculty, and scientists off campus (see Helpful Hints below). The student is encouraged to seek input from the Prelim Committee regarding specific aims and the overall logic of the proposal, but not to discuss details that could impact the final exam. **The student should not obtain any input from their Ph.D. thesis advisor. Overall, the basic direction and overall logic of the proposal must originate from the student.**

Presentation of abstracts of potential proposals

The preliminary examination process begins with a meeting with the Prelim Committee to discuss **two** potential proposals. Normally the student will have thought about potential topics for several months prior to declaring their intent to take the prelim exam. The student should write an approximately two page abstract (with a few key references) for each proposal and distribute these to the Prelim Committee members several days before the meeting. Each abstract should include a brief introduction, state the scientific problem being addressed, present a specific hypothesis, and propose experiments to test this hypothesis. Including a figure can sometimes be helpful. These proposals must be on research areas outside of the student's thesis research. The abstracts need not be polished treatments of the subject. They should, however, both represent significant and meaningful proposals. The student may be asked to rewrite one or both abstracts if they are not considered by the Committee to be properly designed or written.

The student will briefly present each proposal to the Prelim Committee. This should consist of a 5-10 minute verbal presentation with PowerPoint figures. The Committee will then select one topic to be developed for the preliminary examination. The Committee may steer the proposal into specific areas of research and may recommend that specific experimental approaches be abandoned in favor of alternative strategies. The student should remember that this is not the exam, and that the Committee is there to help the student refine their proposal into a form that can be developed for the final written proposal.

It is possible that the Prelim Committee will decide that the proposal topic or specific aims need to be significantly modified before the student is ready to begin writing their 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 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 their committee during this one week period as they reshape their proposal. 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.

Copies of abstracts and written proposals from students who successfully passed the exam are available from either the Graduate Secretary or Patty Lisieski (5200 EIHG). They can be borrowed and copied, but should be returned so that other students can use them.

### Written proposal

The written proposal should be modelled on NIH research grant applications. Students are encouraged to obtain successful prelim proposals from other students that have passed their preliminary exam. As a rule of thumb, the research proposed should be a reasonable goal for a principal investigator working with a technician, plus 1-2 students, over a 3-5 year period. The research proposal must be 20-25 pages in length, double-spaced, Times 12 point font, 1 inch margins all around, and should stay within the guidelines below. Do not waste precious space on trivial details, only to fail to communicate central ideas. The student is expected, however, to understand all aspects of the experimental procedures that are proposed, and questions addressing experimental protocols may be raised during the oral exam.

## **Guidelines for organization of written proposal. Page limits are double-spaced text.**

- **Abstract (1 page):** This section should concisely summarize the main points that will be developed within the body of the proposal (e.g., what is the purpose of the study, why is it important, what is the general strategy, etc.).
- **Specific Aims (2 pages):** The proposal should have a small number (3-4) of well-chosen specific aims addressing a carefully constructed model. This section should clearly state the hypotheses to be tested and concisely describe the experiments that will be used to address these hypotheses.
- **Introduction (6 pages):** This section should provide sufficient background information to allow the reader to understand the current knowledge in the field, the context for the proposed experiments, and their significance. References to pertinent literature should be included.
- **Research Plan and Methods (11 pages):** This section must describe in detail the plan for pursuing each specific aim. In general the research plan will include the following topics:
  - a) Rationale for the experiments (specific data supporting the hypothesis, and how the proposed experiments will address/test the hypothesis).
  - b) Description of experimental procedures, with sufficient detail to indicate that the proposed experiments are feasible. Avoid unnecessary experimental detail (i.e. common procedures and reagents)
  - c) Expected outcomes, interpretation of results and discussion of possible pitfalls and alternative strategies. Use text, avoiding figures of idealized experimental outcomes.
  - d) Overall conclusions that may be drawn from the experiments and future directions for research.
- **Literature Cited (no length limit):** References should be provided for all statements not considered common knowledge. For each paper cited, include last names and initials of all authors (up to a total of 4-5), full title, journal, volume, and inclusive pagination. See Cell Press articles for examples.

### Oral examination

The oral examination will take place one week after submitting the final written copy of the research proposal. During the oral examination, the student will briefly summarize the pertinent background of the research proposal and outline the research plans - this should take approximately 30 minutes. The Prelim Committee will then ask questions designed to discover whether the student: a) understands the significance of the research 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 the proposal; c) can defend the rationale of the experimental design of the proposal. Note that questions will not be limited to the written

proposal, but are likely to cover all aspects of modern biology at a level appropriate to a second year graduate education. The oral portion of the examination will typically last 1.5 -2 hours.

### Preparing for the Exam

The student is strongly advised to have their written proposal read critically by other students and/or postdocs (not faculty), but 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.

A spell checker is an essential computer 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.

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 the use of 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.

DO NOT prepare your proposal without input from experienced scientists - find colleagues to help you think through your ideas. Discuss the science over and over again; pick at the flaws in your hypotheses and experiments and correct them through successive iterations of presentation and critique. This process is best done with colleagues or faculty (not on the Prelim Committee and not your advisory) who are willing to be critical. You are encouraged to contact experts outside of the University who are working in the field. Remember, this is how real research is done. All input from faculty, however, 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.

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. You may be asked basic questions about principles and methods –be prepared!

Most importantly, present a practice oral exam in front of trained and critical colleagues (anyone except faculty). This will give you an opportunity to get experience thinking on your feet, and could uncover critical flaws in your thinking or presentation.

### Evaluation

There are three possible outcomes for the exam: (1) **pass** with permission to start thesis research, (2) **conditional pass**, in which a restricted deficiency is uncovered, correction of which will, considering the exam overall, provide a valuable learning experience for the student, or (3) **failure**. Any of these three decisions requires the approval of a majority of the Committee (i.e. three out of the five members). The student must obtain the appropriate signatures and inform their advisor and the Graduate Secretary of the outcome of the exam.

The student should meet again with their Committee within 4-6 months after passing their exam

to discuss their Ph.D. thesis research proposal (see below).

Students who receive a conditional pass meet with their committee immediately after the oral exam to discuss the strengths and weaknesses of their presentation. It is critical that the student understands what they did that was good, and what deficiencies need to be addressed before they can be given a passing grade. The student should immediately arrange for a time within the next 2-4 weeks to meet with the committee to complete the exam. The exact time frame can be decided by the committee in consultation with the student, but is not to exceed 4 weeks. Upon meeting the second time, the committee will vote for either a pass or a fail. A conditional pass cannot be given a second time. The student may not appeal a failing grade and may either leave the Ph.D. program or obtain a Master's degree.

Students not performing to the satisfaction of the Prelim Committee will fail the exam. Under these circumstances the student has the option to retake the exam, meeting again with their 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". As such, in cases of extreme deficiencies, the option of retaking the exam will not be offered. Once the student has attempted to meet 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 Ph.D. program or obtain a Master's degree.

#### First Thesis Supervisory Committee Meeting

Upon passing the Ph.D. preliminary exam, the student should begin to prepare for their first Thesis Supervisory Committee meeting. **This must take place no later than 4-6 months after the prelim exam.** The student should prepare a 10-15 page, double-spaced description of their thesis research (Times 12 point font), following the general format of a NIH grant proposal as outlined above for the prelim exam proposal. The Research Design and Methods section could include Preliminary Results, if appropriate, to describe what the student has already accomplished in the lab. The emphasis, however, should be on the larger scientific questions being addressed, the significance of the proposed research, and how it will impact the field. The student is encouraged to work together with their Ph.D. thesis advisor to produce this document. The thesis research proposal is to be distributed to the Supervisory Committee members one week before the meeting (note that the thesis advisor is a member of this committee). The goal of this first Ph.D. Thesis Supervisory Committee meeting is twofold: (1) to get feedback on the proposed thesis research, and (2) to discuss progress and plans for fulfilling Ph.D. degree requirements, such as TAing and course requirements. This is not an exam (that is over!), but rather the first opportunity for the committee to discuss student progress and help prepare the student advance to the Ph.D. degree.