

Molecular and Human Genetics Graduate Student Qualifying Exam

Overview

Upon completion of the first year of study students will be evaluated on the basis of their academic performance and by completion of the Qualifying Examination. The format of this examination is the definition of a novel research problem and the development of a proposal to address the stated question and hypothesis. The significance, feasibility, and the relationship of the proposal to the literature will be important criteria for evaluation. The Qualifying Examination determines, in part, the student's eligibility for admission to candidacy for the Ph.D. degree. The examination is designed to test the student's basic knowledge of molecular biology and genetics, as well as assess creativity and rationality of research design.

The Qualifying Examination will be held near the end of Term 1 of the second year, unless the student petitions the GEC for a delay due, for example, to the need to make up courses that were not passed in year 1 or other extenuating circumstances. Students must take the qualifying examination by the end of their 2nd year of enrollment. Any exception must be approved by the program director and the Dean.

The Qualifying Examination Committee will consist of five (5) members; four are faculty (primary or secondary appointees) in the Department of Molecular and Human Genetics and one member is from outside the Department. The composition of the Qualifying Examination Committee will be formulated by the Director of the Qualifying Examination Committee in consultation with the Director of Graduate Studies. The student's advisor may not serve on the student's Qualifying Examination Committee, but is encouraged to attend the examination as an observer only.

The Qualifying Examination is comprised of four parts: 1) Preparation of two written abstracts; 2) Preparation of a written proposal based on the abstract selected by the Qualifying Examination Committee; 3) Oral presentation of the proposal; and 4) Oral defense of the proposal. Please note that sample abstracts and proposals will be made available to each student in advance.

Abstracts

Instructions for Students

Each student will prepare two separate abstracts describing unrelated proposals. One abstract will be selected by the Qualifying Examination Committee for preparation of a full-length proposal. The abstract must be prepared using 11 point Arial font, with 1.5 line spacing, and 1-inch margins and may not exceed two pages in length, including references (which should be single-spaced). At least one but no more than three of the most relevant references must be included with each abstract. At least one Aim of each abstract must utilize a genetic approach. Generating a knockout of your favorite

gene does not satisfy this requirement. An abstract that is exclusively biochemistry and/or cell biology will be rejected. An emphasis on genetics is highly recommended. *No Figures in abstracts please.*

Students may not choose a topic that is directly related to work being conducted in his/her thesis laboratory and are strongly discouraged from choosing topics related to rotation projects. Of course, the definition of "directly related" is subjective and exactly which topics would be allowed can be confusing. The key is to remember the overall goal of this process: to give you the opportunity to independently create and develop a good research topic and proposal. We encourage you to solicit the advice of your advisor and any other members of the scientific community. Nevertheless, it will not serve you well to have the overall framework and ideas of your project already laid out before you because they have been well developed by a close colleague during a rotation project or by your advisor. It will be your own loss if you choose a topic with which you are already very familiar - for whatever reason. *Each abstract should be unrelated to the other.*

There should be four sections clearly marked with bold headings in each Abstract:

1. **Background and Significance**
2. **Hypothesis to be Tested**
3. **Specific Aims**
4. **Literature Cited**

The '**Background and Significance**' section should provide a basic introduction to the research problem. In addition, this section should highlight the gap in the field that your proposed research will address. That is, make it explicitly clear what is not understood in this system and why filling this gap is important. This section should not exceed 1 page.

The '**Hypothesis to be Tested**' section should clearly define the specific hypothesis or hypotheses that your proposed research will address. Your hypothesis(es) should propose an answer or answers to fill in the gap(s) of knowledge outlined in the previous section. This section should not exceed one paragraph. Your hypothesis should be mechanistic and provide significant insight to the problem you are studying.

The '**Specific Aims**' section will list the specific questions that your proposed research will address and provide a basic statement of the experimental procedures you plan to utilize to answer your questions. Typical grants usually have 3-5 Specific Aims. Keep in mind that most NIH grants are for 3-5 people working for 3-5 years, so plan appropriately. *Please be sure to clearly state what model system you are proposing to use in your experiments.*

'**Literature Cited**' should be presented in the *Cell* format (include title).

Students must present six (6) **collated** copies of each of the following to Gigi Weaver in Room 910B by 11 AM, Monday June 30, 2008:

1. Two abstracts. Please be sure to mark each page of each abstract with your name and as "Abstract 1" or "Abstract 2")
2. Student C.V.
3. A list of current research topics in your advisor's lab
4. A list of rotation labs and a one-sentence summary of your project in each
5. A single PDF file containing all these documents, in this order should be sent via email attachment to jmweaver@bcm.edu on the same day.

Please be aware that you may not copy text (even one complete sentence) from existing publications and use this directly in your abstracts or proposals. This is plagiarism and will constitute immediate failure.

Students are strongly encouraged to discuss their abstracts and proposals with their advisors early and often. In addition, you should seek the advice of other students, postdocs and faculty. This examination is intended to also serve as a learning experience on how to create an effective research proposal.

Instructions for Committee Members

Primary and secondary faculty will be selected by the Director of the Qualifying Examination Committee to review both abstracts from a student. All faculty are expected to be available to review abstracts. Note also that the more students you have in your lab, the more likely you will be asked to serve on more than one Qualifying Examination Committee. Faculty without any Genetics graduate students in their lab will in general not be asked to serve on more than one examination.

Reviewers will provide brief (1 paragraph) written comments on each abstract by e-mail. This review will be used to select one abstract for the student's proposal and to provide constructive feedback for the students, so please read the abstracts critically and provide comments on the following items: background, hypothesis, appropriateness of the Aims to address the hypothesis, and the overall feasibility and quality of the abstract. Other comments are also welcomed.

Approximately ten days after submitting their abstracts, students will be notified of the committee's decision on the choice of topic. Approximately five weeks after the date of notification, the student must submit six (6) copies of the written proposal to Gigi Weaver (Room 910B). Because occasionally faculty are traveling the week prior to the exam, it may be necessary to deliver the proposal electronically. The students need not turn in a PDF version of their proposal, but should be ready to if asked later. The Director of the Qualifying Examination Committee will consult with the examiners and the thesis advisor to set a time, date, and location for the exam. The student will be notified of the exam date and time within one week of submission of the proposal and must stand for the exam within four (4) weeks of the proposal submission date. Failure to meet any of the examination deadlines constitutes failure of the exam.

Proposals

Instructions for Students

The proposal must be prepared using 11-pt Arial font, with 1.5 line spacing, and 1-inch margins with a total of no more than 20 pages, including figures and excluding references. Each page is numbered at the bottom, center. Proposals deviating from this format will be returned to students for immediate correction and not sent to the committee. *Also please include a cover page with your proposal that shows your name, the title of your proposal, and the time, date, and location of your exam.* A typical proposal will encompass 15 to 20 pages. Submit six (6) copies of your proposal to Gigi Weaver (Room 910B) by 11 am on Tuesday August 19, 2008.

The proposal will be prepared 'in the spirit' of an NIH-R01, and will therefore include the following sections:

1. **Specific Aims**
2. **Background and Significance/Preliminary Studies**
3. **Research Design and Methods**
4. **Literature Cited**
5. **Figures (preferable embedded in the text as appropriate)**

Specific Aims. This section will list the specific questions that your proposed research will address and provide a brief statement of the experimental procedures you plan to utilize to test your hypotheses. Typical grants usually have 3-5 Specific Aims. Keep in mind that most NIH grants are for 3-5 people working for 3-5 years, so plan appropriately. The Aims listed in the proposal are generally the same as those listed in the original abstract. However, you should carefully consider the reviewers' critiques and revise the Aims accordingly. This section should not exceed 2 pages. *You must include at least one Aim that uses a genetic approach.*

Background and Significance/Preliminary Studies. This section of the proposal should expand upon what was prepared for the abstract. Be sure to include sufficient information so a reviewer not familiar with this area of research can understand the findings that are the impetus for the proposed research. In addition, the proposal should clearly state what questions in the field will be addressed by the proposed research. *Finally, be sure to state why this research is important (i.e., "significance").* This section should not exceed 5 pages. Preliminary data (figures) can be presented from the most recent published literature.

Research Design and Methods. *This section should describe the methods, procedures, expected results, potential problems, and contingencies for each Aim.* The proposal should clearly describe the methods and procedures that will be employed to address the Specific Aims. Sufficient information should be provided to demonstrate your understanding of the selected techniques without describing every detail. This section should also indicate what the anticipated results will be if the proposed model is correct, figures illustrating anticipated results including necessary controls, how the findings will be analyzed, and what their significance would be. Be sure to include types

of statistical analyses when necessary. You should carefully consider the prospect that the data might demonstrate your initial model was incorrect. Note that usually more than one procedure or experiment needed to complete the Aim. In addition, for each Aim, this section should describe how the experimental design will address any limitations and possible problems with previously published studies. Finally, be very careful with proposing "fishing" expeditions. For example, do not make a genetic modifier screen, a two-hybrid screen, or a microarray screen your first Aim such that the feasibility of all subsequent Aims depends upon the success of your fishing trip. Such Aims, if they must be proposed, should be last. Remember, this section should describe work that would take 3-5 people 3-5 years to complete.

Literature Cited. Please use the format as it occurs in *Cell*.

Figures. Every successful grant proposal includes a suitable set of Figures that make clear each key point in the grant. There should be at least 3-5 Figures in the Background and Significance/Preliminary Studies section and a similar number in Research Design and Methods. *Please make the figures large enough to be easily understood without a magnifying glass and are high resolution! Please print out each copy of the proposal using a high-quality color (if appropriate) printer so that images in Figures can be easily interpreted.* If Figures are reproduced from published work, please cite that work in the Figure Legend. Low-resolution figures captured from web sites are unacceptable. No pixels should be evident.

Again, any plagiarism will result in immediate failure.

Outside committee Member

Once an abstract has been selected to be developed into a full proposal *and you have been notified of your exam date and time*, each student should begin a search for a suitable outside committee member to serve on the Examination Committee. The outside committee member is nominated by the student and should be an expert in the area of your proposal or at least well familiar with the topic. Once you have identified such a person, you must obtain approval of your choice from the Director of the Qualifying Examination Committee (rkelly@bcm.tmc.edu). This requires that you e-mail the following information concerning the proposed outside committee member to the Director as soon as possible after your exam time and date have been set:

1. Name
2. Department and Institution
3. Contact information (phone and e-mail)
4. URL for a website describing his or her work
5. Brief description of the area of expertise and how this relates to your proposal

After your outside member is approved, it is your responsibility to provide him/her (and your advisor) with a copy of your completed proposal and that he or she knows when and where your exam will take place.

Instructions for Faculty

Primary and secondary faculty will be selected by the Director of the Qualifying Examination Committee to review student proposals and serve on the Examination Committee for that student. All faculty are expected to be available to participate. Note also that the more genetics students you have in your lab, the more committees you will be asked to serve on.

Role of the Advisor

Mentors are expected to play an active role at all levels during the students qualifying exam. Mentors should provide assistance to the student as if s/he were helping a colleague put together an R01 application. For example, advisors should NOT write the proposal for the student in any way. However, if the advisor believes that an Aim is fundamentally flawed or is not feasible, then s/he should most certainly inform the student and explain why this is the case. We wish this exam to be as much of a learning experience as it is a required step toward candidacy. Mentors are expected to be present during the student's presentation of the proposal and subsequent examination, but will not be present during the evaluation. Mentors should keep in mind that abstract preparation occupies approximately 50% of most students' time. Preparation of the full proposal will be their primary task from early July through mid August. Please plan accordingly.

Evaluation and Possible Outcomes

Rationale and Procedure

At the end of the first year of graduate school, students should have a comprehensive understanding of all areas of the biological sciences. Beyond simple textbook knowledge, this should include an understanding of major concepts, experimental approaches, and commonly employed techniques.

Prior to the examination, the Chair of the Qualifying Examination Committee briefly reviews the examination procedure with other Committee members, the student's advisor (if present) and the student. The student does not need to leave the room before the exam. The student will then be expected to make a ~25 min presentation (strictly enforced), describing the proposal, goals, and the approaches to the problems outlined. During the presentation, faculty will ask questions only for the purpose of clarification. The Qualifying Examination Committee then directs questions to the student that may cover all areas of genetics and molecular biology relating to the proposal and all required coursework offered during the first year. The examination is not open to the public.

The student is expected to be able to apply this knowledge to the research topics of his/her choosing for the qualifying exam. Clearly, a good understanding of the

biological sciences in general is a prerequisite for a successful qualifying examination. Accordingly, the Qualifying Examination Committee evaluates not only the quality of the student's written NIH-style grant proposal and the ability to defend this proposal in an oral examination but also the student's basic knowledge of the biological sciences, *particularly genetics*. The student should be prepared to defend the choice of organism used and understand the advantages and limitations of other model systems.

The student's performance is evaluated by the Qualifying Examination Committee in the absence of the student and the advisor. Based on the criteria outlined above, the following guidelines for evaluating the students' performance and specific outcomes have been developed:

"Pass"

You're done! Congratulations. Time to get to work in the lab.

"Incomplete"

(1) Weak presentation of some Specific Aims. For example, one of the Specific Aims may be poorly developed in the grant or poorly defended.

(2) Poor background knowledge in some aspects of the biological sciences relevant to the proposal. For example, the student may be unable to explain essential techniques of the grant proposal or may not display a full grasp of the background literature.

In case of an "Incomplete", several options will be considered by the Qualifying Examination Committee. Depending upon the nature of the perceived weakness, the student may be asked to take a specific course, write a focused paper (i.e., five pages), or to present a revised research grant proposal including a second oral examination which would be limited to the revised portion of the proposal. Generally, a second oral examination should not last longer than 30-40 min. An "Incomplete" should not be considered as a conditional pass. If the student does not adequately fulfill the conditions requested by the Examination Committee, an "Incomplete" will be converted to a "Fail."

Upon successful completion of all course requirements and the qualifying exam a student may be admitted to candidacy provided that all other requirements have been met. Admission to candidacy must be approved at least nine (9) months prior to the expected date of graduation. The "Admission to Candidacy Form" will require approval of the Department chair and the Dean.

"Fail"

(1) Very poorly prepared proposal. Most or all Aims fundamentally flawed or not feasible.

(2) Poor defense of most or all Specific Aims during the oral examination.

(3) Poor background knowledge in the biological sciences relevant to the proposal. This includes a significant lack of understanding of the "big picture", the major concepts, and the experimental approaches or commonly employed techniques.

In case of a "Fail", the student may be allowed to present and defend an entirely new proposal starting with a new pair of abstracts. A second failure will result in the recommendation of dismissal from the graduate school.

Paperwork

There are 2 Graduate School forms that must be completed to document your Qualifying Exam.

A **Qualifying Examination Date** form must be submitted to the Graduate School prior to your exam. Please complete a QE Date form and submit the form to Judi Coleman at least a week before your exam. Complete the top section and list your outside committee member in the "QE Committee Members" section. Judi will fill in the remaining names. Make sure you ask your Major Advisor to sign the form before leaving it with Judi.

You also need to submit a **"Qualifying Examination Results"** form to the Graduate School Office immediately following your exam. The form should be submitted to the Graduate School the day of your exam, regardless of the outcome. In case of any outcome other than "pass" a new QE Results form will need to be submitted as soon as you are notified of the outcome of your exam.

Timetable for 2008

Submission of abstracts:	11 am, Monday June 30, Room 910B
Notification of selection:	Monday July 14
Submission of written proposals:	11 am, Tuesday August 19, Room 910B
Oral Examinations:	Tuesday September 2-Friday September 19

Every effort will be made to notify you of your exam's date and time by late July so that you can schedule your outside committee member. You will be notified at least one week before your exam regarding the room. The department provides a digital projector and a laptop (PC), or you may use your own computer. The department provides light refreshments.