

## **Expanded Guidelines for Qualifying Exam Procedures Integrative Genetics and Genomics Graduate Group**

This document covers roles and expectations of students, major professors and examining Committee members.

### **I. EXAM FORMAT**

The primary purpose of the Qualifying Examination (QE) is to validate that the student is academically qualified to conceptualize a research topic, undertake scholarly research and successfully produce the dissertation required for a doctoral degree. The QE must evaluate the student's command of the field, ensuring that the student has both breadth and depth of knowledge, and must not focus solely on the proposed dissertation research. In addition, the QE provides an opportunity for the Committee to provide important guidance to the student regarding his or her chosen research topic. Students will complete all course requirements before taking their Qualifying Examination. Passing this exam makes the student eligible for advancement to candidacy. The QE should be scheduled to take place in the summer or fall after the 5th quarter.

A. The Examination Committee: The QE Committee is comprised of the Chair and four additional members selected based on their expertise in one or more of the four areas of genetics (Molecular, Transmission, Genomics, and Population and Quantitative Genetics). Committee members will examine the student based on the presentation and defense of a written research proposal covering the proposed dissertation research. In addition, all students will be examined in the four areas of Genetics at the same meeting. In cases where a student is completing a Designated Emphasis (DE), at least one committee member must be affiliated with the DE. More than one gender should be represented on each QE Committee.

B. The proposal: The proposal should reflect the goals of the student to provide a substantial and original contribution to the field of genetics. The format of the Research Plan should be that of a Federal grant proposal and should be no more than five pages long (see below). A separate Specific Aims should also be prepared.

By preparing a proposal the student should demonstrate mastery of the following skills: (1) ability to identify and clearly define a research topic that makes a substantial and novel contribution to genetic knowledge; (2) ability to focus the proposed research around one or more testable scientific hypotheses; (3) ability to design and interpret scientifically feasible experiments that will specifically test these hypotheses; (4) ability to review the scientific literature in the proposal field to clearly define the relationship of the proposed research to existing knowledge; (5) ability to integrate, where appropriate and feasible, various genetic approaches (e.g. transmission, cytogenetic, quantitative genetics); (6) ability to apply proper statistical analysis of the data; and (7) ability to relate proposed experiments to the biology of the organism.

C. The oral exam: The oral portion of the qualifying exam will be 2-3 hours in length and is intended to demonstrate (1) general and specific knowledge related to the proposal area, (2) intellectual research skills of the student (e.g. methodological rationale, hypothesis testing and evaluation, etc.), and (3) the student's critical thinking ability, powers of imagination and synthesis covering the breadth of genetics and genomics as reflected by the subject matter of the core courses. In addition to evaluating the student's general potential for carrying out scholarly research, the student needs to demonstrate the communication skills required to allow them to act effectively as an educator, advisor, and colleague.

The exam will (1) be interactive where the examiners ask questions, hear the answers and then follow up questions with another question or comment; (2) be a group activity reflecting the collective wisdom of the participants; and (2) be broadly structured so that candidate can demonstrate sufficient competence that goes beyond the dissertation topic.

The possible outcomes of the exam are:

“Pass” (no conditions may be appended to this decision)

“Not Pass” (the student is required to retake all or part of the examination)

“Fail” (all portions of the exams must be retaken). Having received a “Not Pass” the student may attempt the QE one additional time. After a second examination, only “Pass” or “Fail” is recognized. Should the student receive a “Fail” on the second attempt at the exam, the student will be recommended for disqualification from the program to the Dean of Graduate Studies.

## **II. IGG PHILOSOPHY**

All components of the exam will be assessed in the final outcome. For instance, a successful defense of the dissertation proposal but a deficiency in general genetics knowledge may not be sufficient for a “Pass” and vice versa. This is why it is crucial that both parts of the oral exam take place. During the examination, the emphasis of the exam should focus on determining whether the student has acquired the intellectual research skills and the genetic knowledge base necessary to successfully conduct independent research in the future. In this context it is important to view the proposals as an intellectual exercise that provides one way to measure these skills. The proposal should be used to measure the potential research skills of the student and not the quantity of work already accomplished or the quality of the data that have been generated.

It is critical for students, major professors, and examining faculty to understand that the proposal evaluation should not be viewed as an evaluation of the work of the major professor, or as a contract for the work that will be ultimately completed for the dissertation. The major professor may be involved in guiding the student during design of the overall focus of the dissertation research topic, but the student will ultimately have the responsibility for discussing the dissertation topic proposal in the examination and therefore should also have the responsibility for crafting a proposal of the highest possible scientific quality. The content of the proposal should therefore not be unduly influenced by grant or contract constraints of the major professor that would prove detrimental to the ability of the student to defend the scientific soundness and rigor of the proposed approaches. It is not appropriate to judge proposals using criteria that would apply for extramural grant review panels. The presentation of the proposal is an opportunity for the student to demonstrate their breadth in understanding of the field, ability to analyze the important scientific questions in the field, and ability to propose reasonable approaches to address those questions.

The Dissertation Committee will be formally constituted after completion of the qualifying exam. Definition of the work that constitutes the dissertation is by joint agreement of the student, the major professor and the other members of the Dissertation Committee. In contrast, the QE Committee is evaluating the student’s understanding of the basic science underlying the proposal.

### III. PREPARATION OF PROPOSALS

Students are asked to submit a one-page abstract of their dissertation proposal along with their 5<sup>th</sup>-quarter report forms. This abstract provides guidance for the assignment of examination Committee members. The one-page abstract will be forwarded to the appointed Chair of the QE Committee. If the student subsequently changes the proposal topic significantly, the student should again consult with their examination Chair as to the acceptability of the revised topic(s). Chairs may consult with other Committee members to reach a decision on the proposal topic suitability.

Students should submit their proposal to the Chair of their QE Committee no less than three weeks prior to the examination. This way, the Chair can evaluate the proposal for general problems such as: absence of definition of an appropriate scientific problem, defects in structuring the proposal around testable hypotheses, or definition of one aim with two dependent steps as two aims. These general concerns should be passed on to the student by the Chair, providing a chance to correct these structural errors in the proposal before it is submitted to other committee members. The corrected proposal should be submitted to the Committee no less than two weeks prior to the exam. At this point, members should not provide detailed comments on the specific content of the proposal to the student prior to the examination itself.

### IV. FORMAT FOR RESEARCH PROPOSALS

The proposal should be written in the form of an NIH F31 predoctoral fellowship proposal and describe 2-3 years of work. The proposal should answer the following questions: (1) What do you intend to do? (2) Why is the work important? (3) What have you already done? (4) How are you going to do the work? The proposal will comprise a Specific Aims page (one page); Research Plan (5 pages) and a separate Reference section. Illustrative figures should be embedded in the research plan with figure legends. The proposal should be written in Arial 11 font with bold headings. Margins should be 0.5" and the text should be single spaced. A smaller font can be used for figure legends.

#### 1. Specific Aims: What do you intend to do? (one page)

Start with a paragraph containing a synopsis of the general problem addressed, clearly stating the gap in knowledge and hypothesis to be tested. This paragraph is to be followed by a summary of the specific aims. There are generally 3 aims, although in some cases 2 may be warranted. Type the title of the Aims in bold type. The Aims should be stated as an outcome of the work to be done (e.g. Aim 1: Determine... Aim 2: Identify... Aim 3: Dissect... etc.). Do not include completed work as an aim. For each Aim describe the general experimental approach and include a description of subaims if relevant. The specific aims page should stand on its own and be written so that it is understandable by everyone on the Committee regardless of expertise. A figure that illustrates how the three aims fit together (i.e. a visual abstract) can be informative and provide a useful roadmap for the QE Examination Committee members.

#### 2. Research Plan (five pages)

##### (a) Significance: Why is the work important? (~one page)

This section should describe the positive effect that successful completion of your research project is likely to have as the result of solving an important problem in the fields of genetics or genomics.

- Describe the project's objectives
- Explain the importance of the problem or critical barrier to progress in the field (This is the background section of your grant)
- Explain how the proposed project will improve scientific knowledge, technical

capability, and/or clinical practice in one or more broad 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

(b) Innovation: How does the proposed work seek to shift current research paradigms? (~half a page)

- Explain how the proposed research challenges and seeks to shift current research or clinical practice paradigms
- Describe any novel theoretical concepts, approaches or methodologies, instrumentation or interventions to be developed or used, and any advantage over existing methodologies, instrumentation, or interventions
- Explain any refinements, improvements, or new applications of theoretical concepts, approaches or methodologies, instrumentation, or interventions.

(c) Preliminary Studies: What has already been done? (one page).

Describe the work you have already accomplished that is relevant to the proposal or the work in your Major Professor's lab that forms the rationale for your proposal. Figures showing key data related to the proposal can be included here.

(d) Approach: How are you going to do the work? (2.5 pages).

List the titles of the aims exactly as they are shown in the Specific Aims page. *Take care that your aims are not interdependent. That is, if Aim 2 depends entirely on the success of Aim 1 then the proposal will not be viewed favorably and should be sent back by the Chair of the QE Committee for revision before the exam can take place.*

Include under each aim:

(i) *Background and rationale* for each experiment necessary to accomplish the aim.

Clearly state your hypothesis and overall experimental design.

(ii) *Methods*: Include how the data will be collected, analyzed and interpreted. Describe any new methodology and its advantage over existing methodologies. Include in your description the controls and statistical analysis you will use.

(iii) *Expected outcomes and interpretations*. Consider all possible outcomes. *It is best to design experiments in which either a positive or negative outcome is informative.*

(iv) *Potential problems and alternative approaches*. Describe difficulties and limitations of the proposed procedures. Address the possibility that the working hypothesis for the aim will prove to be invalid when it is tested objectively. What would you do? Address other potential problems in the following way: 1) nature of the perceived problem, 2) the reason(s) why you don't expect the problem will arise, 3) what alternative approaches you will employ should the problem be encountered.

(vi) *Summary*. Summarize how your experimental results will test your hypothesis.

(e) Timeline: Map each Aim (or subAims) on a timeline with expected beginning and ending dates (e.g. Year 1, Year 2). It is expected that the proposed experiments will be carried out over a 2-3 year period.

**3. References:** In the research plan, provide in-text citations (Author[s], date) and then collect them in alphabetical order in the reference section. Each citation must include the names of all authors, title of the article, name of the book or journal, volume number, page numbers and year of publication.

## **V. PRESENTATION OF THE PROPOSAL DURING THE EXAMINATION**

In order to reduce the emphasis on data already collected and to increase the emphasis on the scholarly and general knowledge aspects of the exam, the student will not be allowed to use slides or overhead projectors during their short presentation of the dissertation proposal. Students are allowed and encouraged to use a brief outline on the blackboard to focus and direct their presentation. Students are allowed the option to give a brief 10 minute overview of the background and aims of the exam without interruption. The entire exam should be approximately 2-3 hours with one break. Students are not allowed to bring water or refreshments for the Committee members.

In extenuating circumstances (e.g. in the event of the COVID-19 pandemic), examinations can be carried out with all members in remote locations. If there are government-imposed shelter-in-place orders, the entire exam must be carried out remotely. The student should contact the co-Chairs to find the best resources and accommodations.

## **VI. THE ROLE AND RESPONSIBILITY OF THE EXAM CHAIR:**

All QE Exam Committee Members must be approved by Grad Studies well in advance of the exam. While one Committee member may be absent due to an unforeseeable circumstance, the examination cannot take place without the assigned Chair and must be rescheduled. Absent members, other than the Chair, should examine the student privately within 72 hours and communicate the outcome of their decision to the Chair.

### *For the Chair - Prior to Exam:*

1. Confirm topics of dissertation proposal with student.
2. Communicate general concerns about the design of proposals from exam Committee to the student.
3. Discuss exam format with student.
4. Remind Committee members of the time and place of the exam if student has not already done so; make sure Committee members understand exam format and exam areas.
5. Make sure that you have the appropriate paperwork. This is emailed to you from Graduate Studies at the time the QE application form is approved. Obtain the student transcript from the Graduate Coordinator to bring to the exam. The Committee will use this information to guide questions that convince them students have remedied any weaknesses in their academic record.

### *For the Chair- During the Exam:*

1. Assure a fair examination of the student. Make sure the examination has a break.
2. Bring appropriate student records relating to past academic work to the examination for consideration by the Committee.
3. Assure that all required areas in the examination are adequately covered, by monitoring the time spent in questioning in each area and initiating movement to the remaining topics if necessary during the exam. Make sure there is sufficient time for examination in the four core areas and that approximately 1-1 1/2 hr is spent on the dissertation proposal.
4. Moderate discussion of evaluation of student performance after examination is completed.
5. Allow all Committee members to express their evaluation of the student and vote.

*For the Chair-At the completion of the Exam:*

The Chair shall lead the Committee in reaching a unanimous decision of “pass”, “no pass” or “fail” in private consultation. If the committee cannot reach a unanimous decision. The Chair will inform the student that (i) the majority and minority are making recommendations, (ii) that the recommendations will be subject to further review, (iii) and that the Administrative Committee of the Graduate Council will make the decision as to future action.

Outcomes:

1. Pass: The Committee unanimously decides the student passed the examination with at least satisfactory scholarship. No conditions or additional requirements may accompany this decision.
2. Not Pass: The Committee unanimously decides the student passed some portion(s) of the examination and failed others. In the case of a 'Not Pass' decision, the Chair of the Committee must inform the student verbally and write a statement to the student, with a copy sent to Graduate Studies along with the exam report, assessing the student's performance on each subject area covered during the examination. The statement must specify if the Committee will re-examine the student on all topics or only on those not passed in the first exam. The Committee must determine and state the format of the second attempt and communicate it to the student and provide the student a detailed timeline. It will be assumed that the Dissertation Committee will guide the student in completing a scholarly body of work sufficient for the PhD degree. It is the student, not the proposal, that is being evaluated during the Qualifying Exam.
3. Fail: The Committee unanimously decides the student failed the entire examination. In this instance, the Committee can either: recommend the student takes a second and final examination on all exam topics or; does not recommend reexamination, leading to a recommendation of the student's disqualification from the degree objective. If the Committee recommends reexamination, they must also provide the student with a list of written suggestions for improvement and a deadline by which to retake the Qualifying Exam. If the Committee does not recommend reexamination, they must provide Graduate Studies with a written explanation of reasons the student is not suitable for candidacy. Only one retake of an exam is allowed.

*For the Chair- After the decision:*

1. Immediately after the final vote, communicate the outcome of the exam to the student.
2. Completed paperwork, including the outcome of the exam (“pass”, “not pass”, or “fail”) should be submitted to the Graduate Coordinator who will then forward it to Graduate Studies.
3. In the event of a "not pass", “fail”, or “split” decision, the Chair should clearly communicate to the student verbally and in writing the opinion of the Committee and the requirements for converting a "not pass" to a "pass". In either decision, the Chair must notify the student verbally and write a statement to the student, with a copy sent to Graduate Coordinator along with the exam report, assessing the student's performance and deficiencies in the examination. The Graduate Coordinator will then forward the decision to Graduate Studies.

*The Qualifying Examination can be a stressful experience for the student, especially in the case of a 'Not Pass', 'Fail' or "Split" result. The Chair of the Committee should consider whether the student might benefit from consultation with other faculty and staff advisors or with a mental*

health professional (530-752-2349); see <https://grad.ucdavis.edu/resources/help-and-support>. In rare cases, the student, in consultation with Chair, the Major Professor and the student's academic Advisor, may decide that leaving the program with a terminal Master's Degree is in the best interest of the student. Passing the general knowledge section of the QE is required for the Master's Degree.

#### **VII. THE ROLE AND RESPONSIBILITY OF THE EXAM COMMITTEE MEMBERS:**

Service on Qualifying Examination committees is a regular responsibility of all full-time faculty. Committee members are expected to be flexible with their schedules to accommodate the interests of the student in scheduling the examination in a timely manner and to participate fully in the process. It is the responsibility of all members of the Qualifying Examination committee to facilitate an examination that addresses both breadth and depth of knowledge.

1. Set aside time to meet with the student prior to the examination to provide general suggestions about preparing for the exam, useful material to review during exam study, etc.
2. Review the proposal soon after receipt to evaluate general proposal design.
3. Communicate concerns to the Chair of Committee as soon as possible.
4. Read the proposal carefully prior to the exam date.
5. Conduct a fair and thorough examination of the student, covering intellectual skills necessary for independent scientific research as well as specific knowledge in the areas related to the proposed dissertation work and general knowledge in genetics. It is unreasonable to expect extensive knowledge in your own particular area of expertise, unless it is closely related to the student's exam topics.
6. Remember that you are examining the student, not the major professor. The student's ability should be evaluated independently of any particular characteristics of the major professor.
7. Use evaluation criteria appropriate for the academic "stage" of the student. Do not expect that a large portion of research for the dissertation will have already been completed at the time of the exam.

#### **VIII. THE ROLE AND RESPONSIBILITY OF THE STUDENT:**

1. Arrange for a meeting of your guiding Committee to complete the fifth quarter report form during winter quarter of your second year. For this meeting, prepare a one-page abstract of your planned dissertation proposal, emphasizing the scientific hypotheses/questions that your work will address and the planned approaches to test those hypotheses.
2. Contact the Chair and each Committee member to arrange for a time to hold the examination. Arrange, or request the Chair to help you arrange, a room reservation for the examination. In general, exams do not extend beyond 3 hours but is useful to reserve the room for 1/2 hour preceding and following the projected exam period.
3. Meet with the Chair to verify your choice of proposal topic. Notify Chair if there is a significant change in this topic.
4. Make appointments as needed with each Committee member to update them on your dissertation proposal and to discuss with them suggestions for study areas or resources. But do not expect Committee members to provide you with detailed lists of exact topics or questions to study.
5. Provide Committee members with your proposal no later than two weeks prior to your exam. Do not expect your Committee members to give you detailed feedback on the specifics of your proposal.

Prepared by Educational Policy Committee (April/May 1996)  
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