Qualifying Exam Guidelines for the Developmental, Regenerative and Stem Cell Biology Program.

General Knowledge Exam

The Developmental, Regenerative and Stem Cell Biology (DRS) Program’s General Knowledge Qualifying Exam is a 1.5 hour oral exam in which students are quizzed individually by three different faculty members on the following four subjects: Developmental Biology, Genetics, Cell Biology, Nucleic Acids and protein translation. Students are quizzed twice as much on Developmental Biology and Genetics as they are on Cell Biology and Nucleic Acids. This exam typically occurs on the Wednesday before Memorial Day.

Thesis research specific exam:

A COPY OF THE WRITTEN PRELIM DOCUMENT MUST BE TURNED IN TO YOUR COMMITTEE AT LEAST ONE-WEEK PRIOR TO YOUR ORAL DEFENSE OF IT.

The grant writing component of the DRS Programs Qualifying Exam will be replaced by (i) a written document that includes a comprehensive review of the present state of a student’s chosen field of thesis research and one substantive proposed experimental aim that addresses a key outstanding question in the field and (ii) an oral defense of the written document.

The reasons behind the change in the format of the Qualifying Exam arose from (i) student and faculty discontent over the prior format in which students wrote and defended a grant based on a ‘virtual’ set of experiments in a field that was explicitly distinct from a student’s chosen field of thesis research, and (ii) the desire to increase student productivity, decrease time to degree, and maintain the academic rigor of the exam format. The main criticism of the prior format was that it necessitated students expend significant effort on a project totally unrelated to their thesis work immediately after students have had joined their thesis lab. Thus, instead of catalyzing the ability of students to immerse themselves in their chosen field of research, and the literature of this field, the Qualifying Exam, if anything, inhibited such activities. A second criticism of the grant proposal was that its ‘virtual’ nature led to significant variability in examiners’ expectations of a student’s knowledge in that field. The new format of the Qualifying Exam, with its emphasis on reading broadly and deeply in one’s chosen field of thesis research, seeks to provide students a structured mechanism through which to gain a mastery of the literature of their chosen field of research precisely when such a mastery has the greatest potential to impact positively on their thesis research – when they just set foot in their thesis lab. In addition, the new format will likely increase interaction between a student and the members of his/her thesis lab (and PI) as we explicitly note that a student may seek advice from anyone on the crafting of the document, including lab members and their faculty mentor. The rationale behind this decision is that scientific discussion between lab members and colleagues is a critical aspect of the scientific process and the amount of feedback a student receives (or does not receive) on his/her written document from lab members and/or their PI will likely accurately reflect the type of support that student will receive in that lab throughout graduate school.
Overview of Qualifying Exam requirements and expectations

I) Responsibilities of Committee Chair: The chair of a student’s Qualifying exam committee will provide one round of oral/written comments on the Abstract and the entire document prior to the oral defense. It is clear that the higher quality draft provided to the chair for his or her feedback, the greater chance of ultimate success in the exam. For example, it is relatively easy to give clear feedback on rigorous experiments that clearly test a model or hypothesis, but are lacking in a few modest ways. It is harder to give clear, specific guidance on experiments that are seriously flawed, other than to say come up with a new set of experiments. Thus, we note explicitly that it is the student’s responsibility to ensure that their initial draft is of high enough quality, so that the feedback they receive form their chair is most useful.

II) Written Document

A. Length requirements: the document shall not exceed 20 pages double-spaced including figures but excluding references. Margins should not be LESS than three-fourths of an inch. Allowable fonts: Times font size 12 (NOT smaller), or Georgia, Palatino, Arial font size 11 (NOT smaller).

B. Abstract: the Abstract should succinctly describe the general area of study, the main question(s) and central model or thesis tested in the experimental aim, the rationale behind the choice of this experimental approach, the approach, and the significance of the study.

C. Comprehensive review: This section of the document should constitute approximately three-fourths of the entire text of the document (~15 pages) and should be similar in depth and breadth to reviews published in ‘Trends in Genetics/Cell Biology’ journals and to short reviews published in Development, Cell, or Genes and Development. The review should outline the present state of knowledge in the field, preferably with some historical perspective for how the field arrived at this point, and identify key outstanding questions in the field. Critically, the review should synthesize present data and tell the reader what it means of significance biologically. It should also explicitly outline a testable model/thesis that addresses a key outstanding question. This thesis should be explicitly stated in the Abstract and early in the text of the main review in order to provide the reader with a conceptual framework for the review. Towards the end of this section, the student should focus the reader’s attention around one key question (the one addressed in the proposed aim) and restate the thesis – an unproved statement – as a premise for the proposed experimental aim that addresses this question. In this section, the student should also detail the logic and rationale behind their choice of the question on which to focus (justification/significance). This discussion should be made in the context of the preceding points raised in the review, and will thus serve to transition the reader’s attention from the review section of the document to the experimental section.
D. **An experimental approach that addresses a key outstanding question**: This section should be roughly one-fourth of the written document (~5 pages). As noted, the detailed experiments should be organized around a clearly stated thesis. While the precise format of this section can vary, students should discuss the rationale/logic behind each set of experiments (why are you doing this experiment? What do you hope to learn from it? And, why is this important to know?), the experimental or methodological approach, expected/anticipated results, interpretations, conclusions and significance thereof, potential pitfalls, and alternative approaches. Students are encouraged to focus attention on developing a well-argued rationale for each set of experiments, as this is an area often found lacking in NIH Predoctoral Fellowships.

E. Bibliography (≥ 50 papers): **To ensure in-depth knowledge in the proposed field of research, students are required to read at least 50 of the most important papers in the field of interest as a necessary antecedent to writing the paper.** When such papers are referenced within the text of the written document they should be explicitly identified as such in the bibliography section of the paper; when such papers are not referenced in the document (as may occur in some cases), they should be placed in a distinct reference list immediately following the bibliography.

**NEW**: Highlight top five papers. Students should identify the top five scientific papers (NOT reviews) in their reference list and detail why they are so important in one or two sentences (as per Current Opinion Reviews).

III) **Oral Presentation of the Written document** (20-25 minutes). This section of the exam should generally follow the outline of the written document.
A. Introduction – focus audience’s attention on the broad/general question(s) early in the talk.
B. Provide strong and polished overview of the present state of the field of interest while emphasizing significance/importance of this research.
C. Identify key questions in field and explain rationale behind focusing on a specific question.
D. State your thesis.
E. Explain your experimental approach, expected results…
F. Committee Questioning: the Committee may ask questions throughout the talk, but will generally save questions until the end. Questions will focus both on a student’s knowledge of the general field of study as well as the specific experiments proposed.
G. The committee is looking for mastery of the subject. In other words, students should know everything related to their topic, including whether something is NOT known because nothing has been published on it. In other words, answers such as “Hmm, I don’t know if anyone has ever looked at that” are frowned upon, whereas “I don’t know, because no one has looked at that” is fine. Another way to put it is that
students should know at least an order of magnitude more than what is in there written document and oral presentation.

IV) Committee Conference: After questioning has concluded the student will be asked to leave the room and the committee will confer in order to decide whether the student has demonstrated sufficient knowledge in the general area of research and of the proposed experiments.

V) Expectations
   A. The questioning in the exam is expected to be more rigorous than in the past because the area of study now is a student’s chosen field of thesis research and thus the student should be the expert in the room on the subject. See III G above.

   B. The document should be the best paper written to date in a student’s academic career. It is also possible that in some cases the document can be converted into a short review article for a journal.

   C. The proposed experiments must be rigorous, in-depth, and well controlled. The student must show a clear understanding of the experiments, their logic and rationale, how they will be executed, what the likely results will be and why they are likely to be of significance. Proposals that contain superficial or poorly designed experiments that cannot be well defended are likely to fail.

   D. Completion of the newly formatted Qualifying exam will facilitate timely completion of the Thesis Proposal, as the written document will serve as an excellent template for the written thesis proposal itself. The thesis proposal will place greater emphasis on experimental approaches and less on background knowledge.