

GUIDELINES FOR THE Ph.D. QUALIFYING EXAM (Exam I)

THE DEPARTMENT OF BIOCHEMISTRY & MOLECULAR GENETICS UNIVERSITY OF LOUISVILLE SCHOOL OF MEDICINE

PURPOSE

The purpose of the Ph.D. Qualifying exam (Exam I) is to evaluate the student's ability to interpret literature, develop a research plan, integrate material from the graduate curriculum, display core knowledge of biochemical principles, and orally defend his/her ideas. It will help the student to develop the skills necessary for preparation and defense of his/her doctoral dissertations. Successful completion of the Exam I will be a strong indicator for successful completion of the Ph.D.

ELIGIBILITY

The student must have completed all of the graduate course requirements with a GPA of 3.0 or better to be eligible to take the QE. The BIOC 603 Scientific Method and Writing course is designed to guide the students through the proposal writing process. This course is taken in the Spring semester of the 2nd year in the Ph.D. program and successful completion of the course (Pass) is a prerequisite to be eligible for the taking Exam I.

FORMAT

The Qualifying exam will consist of 2 parts: an oral defense of the research proposal and a chalk-talk question and answer session focused on biochemical/genetic principles. The written proposal developed in BIOC-603 Sci Writing course will serve as the starting point for the Qualifying exam.

1. Written Examination Format

Qualifying exam (QE) committee members will review the student proposals after the work has been deemed at least satisfactory by instructors of the writing course. Each proposal will be assigned a primary and secondary reviewer from the QE committee who will provide written critiques. All members of the QE committee will read each proposal and prepare a list of questions that the student may be asked during the oral examination. The student will be given the critiques of their proposal, but no questions, one (1) week prior to the oral examination. The student must address, during their oral examination, all concerns raised in the critiques.

2. Oral Examination Format

The student will prepare and present a 30 minute overview of the proposal to the QE Committee. The committee will then begin a question period focusing on clarifications and weaknesses identified in the proposal and presentation. The purpose is to probe the student's understanding of the rationale, experimental design, and the experimental procedures in the proposal. After this round of questioning there will be a break (no longer than 30 min., time to be determined by the committee) for the committee members to select the topic areas and the questions that will constitute the second part of the exam. A "chalk-talk" format will be used for the second Q & A session. **The questions for the Q & A session will draw from the major topic areas covered in the graduate curriculum:**

Protein, nucleic acid, carbohydrate, and lipid structure and function
Enzyme mechanisms/kinetics
Chromatin structure and gene expression
Molecular cloning and protein expression
Structure -function relationships for RNA and proteins
Mechanisms for RNA and protein synthesis & degradation

Genetics and genomics
Signal transduction mechanisms
Metabolism
Experimental design, hypothesis formation, and interpretation of results

3. Objectives

Exam Objectives:

- To evaluate the student's ability to orally defend his/her scientific ideas with appropriate approaches and sound rationale.
- To probe the student's knowledge of basic biochemical, molecular biological and genetic principles to problem solving in the biomedical sciences.
- To determine the student's ability to integrate their core knowledge of biochemistry, molecular biology, and genetics to address novel questions.

Learning Objectives:

a For the oral defense of the research proposal the student is expected to

- Integrate material from across the graduate curriculum, display core knowledge of biochemical principles, and orally defend his/her ideas.
- Apply the basic principles of biochemistry, molecular biology, and genetics to address questions that extend from the proposal.
- Discuss anticipated results, potential problems, and alternative approaches.
- Evaluate the impact of the proposed study and future direction of the work.
- Explain the advantages and limitations of experimental approaches proposed.

b. For the chalk-talk Q & A session the student should be prepared to explain and discuss

- The consequences of a posttranslational modification(s) of a protein on the structure and/or function.
- Principles driving RNA and protein folding, protein:protein and protein:DNA interactions.
- Mechanisms that control changes in RNA and/or protein expression levels.
- How to determine the mechanism by which a small molecule inhibits enzyme activity.
- The best approach to develop an antibody to a newly identified protein.
- Genetics as it applies to Mendelian disorders and complex diseases.
- Comparative genomics.
- Genomics as it applies to architecture of genomes and personalized medicine.
- The biochemical principles driving chromatin architecture/remodeling.
- Gene organization.
- Biological functions and metabolism of lipids and carbohydrates.
- Experimental approaches to test for changes in RNA and/or protein expression levels.
- Experimental approaches to manipulate RNA and/or protein expression in cells and animal models.
- Principles that control glucose homeostatic mechanisms

4. Evaluation.

a. Oral defense of the proposal

The oral defense of the proposal will be evaluated for clarity, completeness, and handling of general questions. Each committee member will vote on pass-fail and a majority (3 out of 4) pass votes are required to pass this section of the exam. Successful completion of this portion of the Exam is a prerequisite for continuing with the chalk-talk question and answer section.

b. Chalk-talk Q & A Exam

The questions will focus on basic principles of biochemistry, genetics, and molecular biology. The committee members will ask a series of questions to probe the depth of understanding of the fundamental principles in BMG as outlined in the learning objectives. The responses will be evaluated for clarity, completeness, and demonstration of in-depth understanding of the methods and research approaches being addressed, as well as the rationale, principles, and experimental designs that support these research directions. Each committee member will vote pass or fail, and a majority (3 out of 4) pass votes are required to pass this section of the exam.

A student must have a majority of pass votes for both sections of the exam to pass Exam I and enter Doctoral Candidacy

5. PASS/FAIL

The QE Committee Chair will inform the Director of Graduate Studies (DGS) of the results of the examination.

a. Pass: The student will enroll in DOCT600 the following term

b. Fail:

Proposal stage: If a student does not submit a satisfactory final proposal for BIOC 603 Scientific Method and Writing, the Course Directors will make a recommendation that the student either complete his/her M.S. degree or be given the option of retaking the exam during the next exam period. The process for retaking Exam 1 will begin with the student retaking the BIOC 603 Scientific Method and Writing course in the following year.

Oral Defense & Q & A session stage: It is the discretion of the QE committee to determine the student's level of deficiency in meeting the learning objectives for this exam. The committee will make a recommendation that either the student complete his/her M.S. degree or be given a remediation plan. Remediation plans are unique to each student and are developed by the QE committee. The timeline for remediation and the required outcomes will also be developed by the QE committee and approved by the DGS and the Chair. A failure on retaking the exam or a failure to successfully complete the remediation will result in entry into the M.S. program.

For students who fail Exam I on the first attempt, they will remain on the established timeline for completing Exam IIa and IIb. The faculty view the efforts to successfully complete Exam II will significantly help students needing remediation, and enhance the probability of success when retaking Exam I.

EXAM I COMMITTEE MEMBERSHIP

A committee of 6-8 faculty members nominated by the Graduate Executive Committee

(GEC) and confirmed by faculty vote will serve on the Exam I committee. The committee membership terms will be staggered so that there will be 3-4 members who have been on the committee for at least 1 year. The appointments will be for 3 years. Each year, 1-3 members will rotate off and new members will be selected.

PROPOSAL TOPIC AND WRITING

1. Topics will be selected by the faculty. The topic will be given to the student by the Course Directors of BIOC 603 Scientific Method and Writing on the first day of class.
2. The student may seek advice and suggestions from any faculty member or student, including the student's mentor. However, the proposal must be conceived and written independently.

FORMAT FOR FULL PROPOSAL

The written proposal will follow the NIH predoctoral fellowship format. Use 0.5 inch margins, Arial 11 point font, standard single-spacing and organize your proposal as outlined below.

I. *Specific Aims*

Specific Aims are limited to one page.

State concisely the goals of the proposed research and summarize the expected outcome(s), including the impact that the results of the proposed research will exert on the research field(s) involved.

List succinctly the specific objectives of the research proposed, e.g., to test a stated hypothesis, create a novel design, solve a specific problem, challenge an existing paradigm or clinical practice, address a critical barrier to progress in the field, or develop new technology.

II. *Research Strategy*

This item is limited to six pages.

Organize the Research Strategy in the specified order using the instructions provided below. Start each section with the appropriate section heading— Significance, and Approach. Cite published experimental details in the Research Strategy section and provide the full reference in the Bibliography.

(a) Significance

- *Explain the importance of the problem or critical barrier to progress in the field that the proposed project addresses.*
- *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) Approach

- *Describe the overall strategy, methodology, and analyses to be used to accomplish the specific aims of the project. Include how the data will be collected, analyzed, and interpreted.*
- *Discuss potential problems, alternative strategies, and benchmarks for success anticipated to achieve the aims.*
- *If the project is in the early stages of development, describe any strategy to establish feasibility, and address the management of any high risk aspects of the proposed work.*

If an applicant has multiple Specific Aims, then the applicant may address Significance, Innovation and Approach for each Specific Aim individually, or may address Significance, Innovation and Approach for all of the Specific Aims collectively.

SF424 (R&R) Individual Fellowship Application Guide for NIH and AHRQ
Part I: Instructions for Preparing and Submitting an Application I-85- I-86.
http://grants.nih.gov/grants/funding/424/SF424_RR_Guide_Fellowship_VerB.pdf

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Approved by the Graduate Executive Committee

Approved by BMB Faculty

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