

# Format for the general examination in the Molecular and Cellular Biology Graduate Program

## Format of the written proposal

Only a single proposal (formerly known as the 'primary' proposal) is to be prepared. This proposal is explicitly focused on the student's thesis research. This proposal **must** be in the thesis committee's hands two (2) weeks prior to the general exam. A copy of this description of the proposal and exam format should be provided to each committee member at the time that the proposal is submitted. The written format is as follows:

*a. An abstract* of not more than 300 words, which encapsulates the primary goal(s) and motivation of the research, the significance of the research, and the choice of experimental approach in broad, general language. This abstract should be written in the style used on 'page 2' of an NIH proposal, and should be accessible to any molecular-cellular biologist. Technical jargon and acronyms should be avoided.

*b. The core of the written proposal.* **Should not exceed 6000 words total**, excluding figure captions and references. The proposal should be 12 point font, 1 inch margins, single spaced with double space between paragraphs. In general, this should correspond to approximately 10 typed pages. The proposal should consist of the following, labeled as shown and in order:

(i) Introduction and background information for the general area of research (~ 2000 words). This section should provide appropriate information and context to understand the importance and significance of the proposed research. The current state of knowledge and art in the area of investigation should be well explained, and the burning question(s) that need to be addressed (both by the student's own work, and more broadly throughout the field) should be clearly summarized.

(ii) Possible approaches and strategies (~ 2000 words). Without presenting unpublished preliminary data (either generated previously by the thesis lab or its collaborators, or directly by the student), a summary of the documented methods available and/or of possible novel approaches should be summarized and critiqued. The following should be addressed:

- a. Relative strengths and weaknesses of methodologies.
- b. Areas of technical and/or intellectual innovation in possible approaches.
- c. Avenues for cross-disciplinary and/or translational potential for various approaches.

(iii) Summary of planned experiments by the student, and related information that indicates feasibility (~ 2000 words). This section should be 'set up' by the presentation in section (2) above.

*c. References, tables and figures. One publication from the field (either by the student, from the student's lab, or from outside the thesis lab) may be appended if desired.*

**After receiving the written proposal, each member of the exam committee is encouraged to provide one or two 'sample questions' to the student, via e-mail, one week before the exam, for the purpose of providing examples of the depth and nature of question and answer topics that might be discussed during the exam. The student is not required to formally write up or present prepared answers to these questions, but should view them as potential topics during the exam. The student is free to contact a committee member, prior to the exam, to clarify or discuss a question. The actual oral exam is not limited to, or required to actually address, these specific questions.**

## Format of the exam

- Two and one-half hours are allotted for the general exam.
- A committee member other than the P.I. or the GSR should chair the exam. The traditional 'discussion period with the student or advisor outside the room' is only held after the exam. The research advisor does not 'set the stage' for the exam with comments about the student's activities and performance in the lab. The P.I. does not ask or answer questions during the exam.
- The basic premise of the exam format is that the first hour is reserved strictly for presentation and discussion of the student's research area (concepts, background, significance, questions, and the current state of knowledge) and of related, basic principles of molecular and cellular biology. In the 2nd half of the exam, presentation and discussion of experimental approaches is encouraged and expected. *Additional questions on background and fundamental areas of understanding are still allowed at any time during the 2nd half of the exam.*

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### The exam should follow the following format:

1. **The student should briefly introduce themselves** and inform the committee of the following:
    - (a) Their academic and research background (years and location of undergraduate training; degree obtained; years and location of research experience)
    - (b) A list of classes and number of credit hours taken to date, with corresponding grades, and the number of credit hours remaining to be taken.
    - (c) T.A. assignments completed
    - (d) The number of slides and anticipated delivery time for the two halves of their presentation.
  2. **A twenty (20) minute presentation** by the student consisting solely of an introduction and summary of the area of investigation in the proposal, corresponding to section 1 ("Introduction and presentation of background information") of the written proposal. *Detailed* discussion of experimental strategies that are intended specifically for the student's research project, and/or presentation of unpublished data, are not allowed at this point. However, summaries of previously published experiments that are key to a general understanding of the research field, and general questions about such strategies, are fine.
- Note:** The student is not interrupted during this 20 minute introduction. Questions may be asked only for clarification.
3. **A forty (40) minute question and answer period**, focused in general principles and concepts in molecular and cellular biology, related to the area of biological study presented in the proposal. No questions about details of experimental methods at this time; rather an opportunity to examine the quality of a student's knowledge and understanding of their general area of study. The committee is encouraged to prepare questions that truly test the breadth of a student's knowledge in the broader areas of molecular and cellular biology that surround their thesis work (for example: basic principles and details of signaling pathways, of chromatin structure and remodeling, of transcriptional regulation and gene expression; of protein structure/function relationships, etc).

-A FIVE MINUTE BREAK IS SUGGESTED AT THIS POINT-

4. **A twenty (20) minute presentation** by the student consisting of:

- (a) A statement of the specific aims of the project, including a definition of the extent to which the work is 'discovery' based vs. 'hypothesis' based.
- (b) Proposed experiments, with a logical sequence and timeline.
- (c) Justification and defense of the chosen experimental strategy relative to possible alternative methods.
- (d) Description of any unusual, novel, or innovative experimental strategies or methodologies.
- (e) Published and/or unpublished preliminary experiments that indicate feasibility, with interpretation of the resulting data as desired.

**Notes:**

- Again, it is preferable to not interrupt the student during this presentation except for important points of clarification.
- If the project is primarily 'discovery' based (a genetic screen, a structure determination, etc), some explanation of if and how the data generated by the project will lead to novel, revised or expanded understanding of the field and the problem is expected and appropriate.
- Preliminary data generated by the student is not a requirement for taking the general exam, nor for evaluation of a student's performance. However, the student should be expected to describe a well designed 'flow chart' of experiments that progress from initial characterization and trouble-shooting of the experimental system to well controlled tests of experimental hypotheses and/or collection of data for long-term analyses. The student is free to describe any recent experiments by others and/or by him or herself that indicate feasibility.

5. **A one hour question and answer session** surrounding the student's understanding of experimental methodologies, and his/her ability to defend and rationalize the choice of experimental system, techniques and strategies. The questions should cover both published precedents and examples of similar studies, and interpretation of any available experimental results. *Questions on general areas of biological understanding are still permitted at this time and for the remainder of the exam.*

6. **The student should leave the room and the thesis committee discusses the student's performance**, focusing evenly and comprehensively on strengths and deficiencies in understanding and knowledge of the research area, and on the student's defense and rationalization of experimental strategies and goals.

**The committee can, at their discretion, require the student to be reexamined in six months for any of the following reasons:**

1. Deficiencies in understanding and/or presentation of basic principles, core knowledge and/or biological context of the project within the boundaries of historical molecular and cellular biology.
2. Deficiencies in rationale and/or defense of experimental strategies, including the ability to engage in a detailed critique of strengths and weaknesses of published and unpublished methods, including proposed thesis experiments.

Reexamination can include all elements of the exam, **or** just the part deemed deficient by the committee. The committee may also request resubmission of a revised written proposal, without an additional oral exam, if only written proposal itself is deficient in quality (including clarity, logic, grammar, organization, or presentation).