Graduate Group in Biochemistry and Molecular Biophysics

Candidacy Examination Guidelines for the 2011/2012 Academic Year

All graduate students affiliated with BGS (Biomedical Graduate Studies) are required to pass a Candidacy Examination in their second year. In BMB, this examination consists of both a written research proposal (in the style of an NIH fellowship application) and an oral defense of the proposal. Only students in good academic standing are eligible to take the Candidacy Examination. Dr. Mark Lemmon, Director of the Candidacy Examination this year, will oversee the administration of this examination in the 2011/2012 academic year.

1. Candidacy Examination Committee
A Candidacy Examination Advisory Group, consisting of members from the BMB Graduate Group will administer the Candidacy Examination. One member of this Advisory Group will serve as chair of the student’s Candidacy Exam Committee, which will consist of a total of three faculty members.

The student’s Candidacy Exam Committee will be selected approximately six weeks prior to the oral exam. The students will choose the chair of their committee from the Advisory Group, in consultation with Mark Lemmon. Students will be asked to suggest faculty for inclusion on their Candidacy Exam Committee; however, the final committee will be chosen by Mark Lemmon in consultation with the committee chair and Graduate Group director. Students will be notified of their committee and may contest one member of the committee.

2. Purpose of the Candidacy Examination
The purpose of the written part of the Candidacy Examination is to examine the ability of graduate students at the end of their first year to:

1) identify an important problem in biochemistry and molecular biophysics;
2) review the literature;
3) formulate a testable hypothesis; and
4) write an NIH-style research proposal that tests the hypothesis.

Although most proposals will be hypothesis-driven, technology-driven proposals are also acceptable if they clearly address a major need in biochemistry and biophysics. If a technology-driven proposal is selected, the proposal must clearly articulate how this technology will address a specific scientific problem, and it must clearly appraise competing technologies.

The purpose of the oral part of the Candidacy Examination is to examine the ability of students to:

1) defend the design and feasibility of the written proposal;
2) explain basic concepts in biochemistry; and
3) explain both the theory and practical application of various biophysical techniques.

3. The Written Proposal
The student may choose a topic for the research proposal that is either thesis or non-thesis related. If a student chooses a topic related to his or her proposed thesis research, the proposal must be the original work of the student. The purpose of the written proposal is for the student to independently
consider and formulate research goals. Students can read portions of their advisor’s grants as
eamples. However, in no case should portions of the advisor’s grant be reproduced or narrowly
paraphrased/plagiarized in the student’s proposal. In preparation, the student must conduct a very
thorough review of the literature relating to the proposal topic, and must also become familiar with
the fundamental theory and practice of techniques that they propose to employ. Students are free to
seek the advice of their advisor, other faculty, postdoctoral fellows and students to help select a
topic and to formulate aims, and to provide input on early drafts of the entire proposal. However,
detailed feedback and editing assistance on the written proposal from the student’s advisor are very
strongly discouraged and go against the spirit of the exam.

The proposal should provide a succinct account of the literature and a detailed experimental plan.
The proposal should represent a logical series of experiments that will provide a solution to the
stated problem. The proposal should also briefly describe the anticipated results. The level of
quantification and data analysis proposed should match the level of the question being asked. It is
also recognized that certain experiments and/or techniques may fail, so students are directed to
describe alternative approaches as appropriate.

The proposal (excluding references) should not exceed 10 typewritten pages and should have the
same structure and format as an NIH postdoctoral fellowship grant.

**Font Requirement follows that of the NIH**: Arial, Helvetica, Palatino Linotype or Georgia
typeface and a font size of 11 points or larger. A Symbol font may be used to insert Greek letters or
special characters; the font size requirement still applies. A smaller font size may be used for
figures, graphs, diagrams, charts, tables, figure legends, and footnotes, but this type must follow the
font typeface requirement and be readily legible. The left and right margin should be set to 0.5
inch, and the top and bottom to 0.7 inch. Proposals that exceed the page limit or use smaller fonts
will be returned without review.

The written proposal will consist of the following. The numbers of pages indicated below are
suggestions, and can be modified somewhat as needed as long as the proposal (excluding
references) does not exceed the 10-page limit.

1. **Specific Aims**: state the specific purposes of the research proposal and the hypothesis to be
tested (1 page). There should be two or more specific aims, and it is sometimes convenient
to break them into sub-aims. Each aim should address a question or a hypothesis! It is not
appropriate to simply state what one wishes to do experimentally without a larger context of
what questions are being addressed.

2. **Research Strategy**: This section should be divided into these headings.
   a. **Significance**: sketch briefly the background to the proposal (<3 pages). State concisely
      the importance of the research described in your proposal by relating the specific aims to
      broad, long-term objectives. Compare your approach to other approaches or related
      studies in the literature, and explain why your study will advance the field significantly
      beyond previous studies.
   b. **Innovation**: Briefly outline how your research course or objectives will be unique (~1/2
      page). You may challenge the current view in the field, or use new methodology, or you
      may innovatively combine existing approaches to investigate new systems.
c. **Approach:** This section includes the research design and procedures to be used to accomplish the specific aims, a tentative sequence for the investigation, the statistical procedures by which the data will be analyzed, and denote any procedures, situations, or materials that may be hazardous to personnel and the precautions to be exercised (<6 pages). Potential experimental difficulties should be discussed together with alternative approaches that could be used to achieve the desired aims. If you have preliminary data it should be incorporated in this section. Presentation of preliminary results is not required. If the proposal is directly related to the student’s thesis research, then preliminary results may be reported, especially when those results will help to establish the feasibility of the proposed experiments.

3. **Literature Citations:** At the end of the research proposal. Each citation must include the names of all authors, title of article, name of the book or journal, volume number, page numbers, and year of publication. Citations do not contribute towards the page count.

4. **Figures:** Figures should be embedded throughout the proposal. They can greatly contribute to the explanation of the background material, preliminary results and how those results will be analyzed. All figures should include a legend that explains the contents of the figure and cites published sources; the legends should be placed with each figure and not on a separate page.

A draft of the specific aims for the proposal is to be submitted by the student to the members of the committee approximately five weeks prior to the exam (this draft will already have been discussed and critiqued in the Candidacy Examination Preparatory course – see below). The exam committee members must approve the final title and specific aims four weeks prior to the exam. If the committee members fail to contact the student, the student can assume that the proposed aims meet the approval of the committee members. If committee members wish for changes to the aims, they should work with the student directly. The completed proposal must be submitted to the committee at least two weeks prior to the scheduled exam date.

4. **Oral Defense of the Proposal**

The student will begin the Candidacy Examination by presenting an approximately 15-minute synopsis of the proposal consisting of not more than eight prepared slides or transparencies. The student should not overload these 8 slides with information. Use of animation to increase the effective number of slides is not permitted. The presentation should emphasize the specific experiments proposed in the written proposal. The faculty may interrupt to clarify specific points, but the questions and answers should be brief to allow the student to complete the presentation within about half an hour. *Committee chairs and the students themselves should be cognizant of the need to keep questions to a minimum until completion of the student’s oral presentation.*

Following the presentation, the committee members will ask questions. The student should field these questions verbally, using a chalkboard or whiteboard to write equations, reactions, or pathways as necessary. In defending the proposal the student should show an in-depth knowledge of biochemistry and molecular biophysics. Since the Graduate Group offers a Ph.D. degree in biochemistry and molecular biophysics, a thorough knowledge of the fundamentals of these disciplines is expected. For example, if a binding assay is used, the student should understand the thermodynamic basis of binding (including basic concepts such as changes in enthalpy, entropy, heat capacity, etc.). If a biophysical technique such as NMR is used, the student should be familiar with the physical principles underlying the technique and what the technique can and cannot
measure. Students are reminded that biochemical and molecular biophysical phenomena are often explained by consideration of rate-theory, thermodynamic considerations, ligand affinities, and kinetic constants, and questions on these topics are generally quite appropriate. Furthermore, students should demonstrate an understanding of the quantities (nanomoles, micrograms etc.) and concentrations (micromolar, nano-molar) of macromolecules they need to perform their experiments and an understanding of the magnitude of changes they may be measuring. The use and understanding of appropriate statistical tools can also not be overstated, and questions about statistical analysis are quite appropriate.

While no topic is off-limits, overly technical questions in an unrelated subspecialty may be unreasonable. For example, a student studying transcriptional regulation would not be expected to understand technical aspects of making spin relaxation measurements by NMR, unless the research proposal incorporates this technique.

Students should also be prepared to discuss in detail literature in their fields describing past work and alternate methods or approaches to solving their biochemical problem.

5. Review and Pass/Fail Procedures
After the oral examination, the committee will ask the student to leave the room while they discuss the student's performance. The committee will decide whether the student has passed or failed (see below), and will unofficially inform the student of this decision immediately.

Each member of the Candidacy Examination Committee will complete a Candidacy Examination Evaluation Form and send it electronically to the chair of the committee within one day of the oral examination. This form includes a formal written review of the oral and written content of the examination, and provides an NIH style score for each of 4 categories: 1) quality of the written proposal; 2) quality of the oral presentation; 3) defense of the proposal; and 4) depth of general knowledge. The committee member will also indicate whether a pass or fail is recommended for the written proposal, and give an overall evaluation – pass, provisional pass or fail. In addition to these reports, the chair of the Candidacy Examination Committee will writes a summary of the discussion that followed the oral examination. The chair collates these reviews and communicates these to the student and the Graduate Group office within two days. These reports remain in the student’s permanent file.

Possible outcomes of the Candidacy Examination:

Pass with distinction: If the student passes, the chair of the committee will notify the Graduate Group Chair immediately. The student will receive written confirmation of passage of the Candidacy Examination from the Graduate Group Chair along with the written critiques from the committee.

Provisional pass: A preliminary pass will be given if the student needs to address one or more deficits identified by the Candidacy Examination Committee. These items might be associated with the written proposal, a problem with the presentation, or a lack of background knowledge. The committee chair will outline a course of action to address the relevant issues (which may or may not require reconvening the committee) and the student will have one week to address the concerns. It is expected that the concerns will typically be addressed, in which case the provisional pass will
convert to a pass, at which stage the Graduate Group Chair will be informed and provide official notification to the student. If for some reason the concerns are not addressed within this time frame, a provisional pass will convert to a fail.

**Fail:** If a student fails the first attempt at the Candidacy Examination, the committee will recommend revising the proposal and/or repeating the oral exam. For the second attempt, an additional member of Candidacy Examination Advisory Group will be added to the student’s committee. The student will have two weeks to rewrite the proposal and/or prepare for the second oral exam, which must take place before May 25. In addition, the chair of the student’s Candidacy Examination Committee will solicit a letter of support from the proposed thesis advisor and will obtain a copy of the student’s academic file to assist in reaching a final pass/fail decision. The chair of the student’s Candidacy Examination Committee will notify the Graduate Group Chair, the Director of the Candidacy Examinations, and the BMB Academic Review/Advising Committee of the outcome of the second examination. If the student fails the second exam, the Graduate Group Chair and Academic Review/Advising Committee are ultimately responsible for reaching a final decision regarding whether the student should leave the graduate program. In the case where termination is deemed necessary, the student may, if all other requirements have been met, be eligible for a terminal Master of Science degree.

**Approximate Timeline for Candidacy Examination Process:**

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<th>January-Early March</th>
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<td>Early March</td>
<td>Candidacy Exam Committee selection</td>
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<td>Early March – Early April</td>
<td>Preparation of written proposal</td>
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<td>Candidacy Examinations</td>
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<td>Mid April - May 25</td>
<td>Rewrites and/or oral exam retakes</td>
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<td>June 1</td>
<td>Advance to Dissertation Status (or register for terminal Masters degree).</td>
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**6. Candidacy Examination Preparation Course (BMB 705)**

This half-semester course is designed to provide assistance in preparing for the Candidacy Examination. All students are required to take this half-credit course at the beginning of the Spring of their second year. The course is designed to instruct the students in how to write and structure of an NIH-style grant proposal. The course begins with a review of the elements of writing. Student will read and critique sample grant proposals and begin formulating and writing the specific aims for their Candidacy Examination. Grading is based on attendance, discussions, and presentations.

**7. Candidacy Examination Committee**

A Candidacy Examination Advisory Group consisting of 12-16 faculty members from the BMB graduate group will administer the Candidacy Examination as Committee chairs. The composition of this group will vary each year depending intended dissertation advisors of the 2nd year students. The examination of each student will be the responsibility of a Candidacy Examination Committee consisting of 3 BMB faculty and chaired by one of the Advisory Group. Dr. Lemmon will select these Candidacy Examination Committees approximately 5-6 weeks before the oral examinations in consultation with the Committee Chairs and the Graduate Group director. The composition of each committee will be based on the student’s specific aims, scheduling, and distribution of effort among BMB faculty. Students will be notified of their committee in the last class of BMB 705 and may contest one member.