

# BioE Comprehensive Exam

(Revised June 23, 2009)

## ***1. Program Selection***

The Bioengineering Graduate Program provides training opportunities in a variety of bioengineering tracks including: bioimaging, bioinformatics, biomaterials and tissue engineering, biomechanics and neural engineering, biomedical product design and development, and biomolecular engineering. The student selects a research track and then chooses a mentor who conducts research within the chosen track.

## ***2. Student Advisory Committee***

During the first year in the BioE Graduate Program (third year for M.D./Ph.D. students), the student and mentor select a Doctoral Dissertation Committee (DDC). This committee is composed of at least five members of the KU Graduate Faculty, one of which serving as the External Committee Member. Guidelines for the DDC make-up can be found on the BioE Graduate program website (<http://www.bio.engr.ku.edu/graduate/>). If the mentor has Regular Graduate Faculty status, then he/she typically serves as chair for the DDC. If the mentor has Ad Hoc or Special Graduate Faculty status, then he/she typically serves as co-chair. The committee may consist of more than 5 members if there is a reasonable justification. The composition of the DDC is subject to approval by the Director of the BioE Graduate Program.

The student is responsible for convening regular meetings with the DDC. It is recommended that these meetings occur at least once each year. The student, mentor, and DDC shall evaluate progress and address concerns at each meeting. Relevant information concerning the meeting shall be recorded on the "Graduate Student Progress Report Form" (Word Document). A copy of the completed form should be sent to the Director of the BioE Graduate Program.

The first meeting of the student, mentor and DDC should address the following issues:

- a. Review completed course work,
- b. Review the Plan of Study,
- c. Discuss the contemplated area of research, including background and planned experiments, and
- d. Discuss time table for the Comprehensive Exam (see Graduate Student Progress Report).

## ***3. The Comprehensive Exam***

The Comprehensive Examination should be taken no later than the end of the Fall semester of the third Year for graduate students and no later than the end of the 3rd semester in the laboratory for M.D./Ph.D. students (exceptions with approval of the DDC). The Comprehensive Examination consists of two parts: a written proposal and an oral examination.

### **WRITTEN PROPOSAL**

The purpose of the written portion of the examination is to formulate appropriate scientific approaches to the research problem at hand and to clearly express these ideas in writing. This will be accomplished by the submission of an NIH-style research proposal, which describes the proposed dissertation research project.

The scientific problem and general research approaches will be identified, developed, clarified and refined by frequent discussions with the mentor and the student's DDC, discussions with other faculty and students, and reading of relevant literature. Once the scientific problem and general research approaches have been approved by the DDC, the student should arrange for the following requirements to be fulfilled:

**a. Abstract submission:** An abstract 1-2 pages in length, double spaced, must be submitted to the Director of the Graduate Program and to the Student's Doctoral Dissertation Committee. The abstract should describe an original research problem, the experimental hypotheses to be tested, and a brief description of the planned approach to test the hypotheses, without going into excessive experimental detail. The abstract must be approved by all members of the DDC. The student may be asked to explain his/her abstract at a meeting of the DDC. Upon acceptance of the abstract by the DDC, the student may proceed with the written proposal.

**b. Written NIH-style Grant Proposal:** The student must expand the approved abstract into an NIH-style grant proposal. The proposal may not be longer than 20 pages (8 ½" x 11"), double spaced with 1" margins, excluding the title page, Project Summary and Relevance page, figures, figure legends, and references. Use Arial or Helvetica and a font size of 11 points or larger. The student should not feel compelled to use the full 20 pages permitted; conciseness and clarity carry far more value than length in judging these proposals. Examples of written proposals successfully defended by students in the past are available from the Director of BioE Graduate Program. As with an NIH (PHS 398) grant application, the proposal should contain the following sections:

**Project Description (Summary and Relevance, Limit 1 page)**

The first and major component is a **Project Summary**. It is meant to serve as a succinct and accurate description of the proposed work when separated from the application. State the application's broad, long-term objectives and specific aims. Describe concisely the research design and rationale and techniques for achieving the stated goals. This section should be informative to other persons working in the same or related fields and insofar as possible understandable to a scientifically or technically literate reader. Avoid describing past accomplishments and the use of the first person.

The second component is **Relevance**. Using no more than two or three sentences, describe the relevance of this research to public health. In this section, be succinct and use plain language that can be understood by a general, lay audience.

**Research Plan**

**Specific Aims:** This should state concisely: 1. The broad, long-term research objectives, 2. What the research in this application is intended to accomplish, and 3. hypotheses to be tested. Limit 1-2 pages.

**Background and significance:** Briefly sketch the background to the present proposal, critically evaluate existing knowledge, and specifically identify gaps which the project is intended to fill. State concisely the importance of the research described in this application by relating the specific aims to the broad long-term objectives and to health relevance. Limit 3-6 pages.

**Preliminary results (optional):** Depending on progress with your project, you may want to include the relevant data you have generated in this section. Alternatively if the data shows your ability to perform specific protocols/experiments, you may want to include it in the Experimental design and methods section.

**Experimental design and methods:** Describe the research design and the procedures to be used to accomplish the specific aims of the project. Include the means by which the data will be collected, analyzed, and interpreted. Describe any new methodology and its advantage over existing procedures and alternative approaches to achieve the aims. Your own experimental results, if any, may be included in this section. For each specific aim, the aim should be restated and subsections concerning rationale, experiments, predicted results, and interpretations added.

**Innovation:** Describe the innovative aspects to the proposed research and articulate the contributions made by the student.

**References:** Include complete references to all cited literature, including titles of relevant papers.

The written proposal must be the student's own work, though clearly the direction of the research will be determined in conjunction with the mentor. The student can and should seek feedback from faculty and other students regarding the written proposal. Learning to write a clear proposal is an important component of preparation for a research career. The process of preparing the research proposal is designed to:

1. mimic the process of writing and rewriting an NIH grant, and
2. keep the committee apprised of the student's progress.

The student shall submit the proposal to each member of the DDC, each of whom will review the proposal and provide the student comments pointing out issues that need to be addressed. Based upon the comments, the student will revise the written proposal. The revision shall include a preface (2-3 pgs.) with replies to each of the comments provided by all DDC members. A copy of the comments, the student's responses, and the revised proposal will be given to the DDC. If the DDC determines the revised proposal is

satisfactory, the student will proceed to defend the proposal on a specified date. If the revised proposal is unsatisfactory, another round of revision will occur.

## ORAL EXAMINATION

The oral portion of the comprehensive examination is a requirement of the University of Kansas for the Ph.D. degree as described in the graduate catalog:

<http://www.catalogs.ku.edu/graduate/contents/GenInfoGR.pdf>

The purpose of the oral examination is to test the student's ability to defend the research proposal and his/her knowledge of appropriate background material, including all graduate courses. A block of time of no less than 3 hours should be reserved for the examination in order to allow for an adequate question and answer period (though the examination need not last that long).

**Examining Committee and Chair:** The Examining Committee will consist of the DDC and an Examining Committee Chair. The Chair is selected by the student from among the BioE faculty affiliates, but may not be a member of the student's DDC. During the examination, the Examining Committee Chair will act as an **impartial mediator** (though he or she may ask questions) and voting only if the regular members of the Committee find themselves in a tied vote. The Examining Committee Chair will provide feedback directly to the student and mentor as to any deficiencies or areas of strength demonstrated by the student, as perceived by the Examining Committee.

Prior to the start of the oral examination, the Examination Committee meets in executive session (i.e., the student waits outside) and reviews the academic history and laboratory experience of the student. Although the mentor is a member of the examining committee, it is recommended that the mentor serve as an observer and only address the committees' questions/issues/concerns directed at the mentor that may arise during the oral examination or during the committee's evaluation of the student's performance.

At the beginning of the exam, the Examination Committee Chair instructs the student as to the manner in which the examination is to be conducted. The student should be prepared to give an oral presentation in which the essence of the proposal is presented to the examining committee; audiovisual aids are encouraged. The objective of the examination shall be to ascertain the student's facility with the chosen area of research and the ability to defend the rationale and scientific approach of the proposed research. It is fully appropriate for the examining committee to explore the depths of the student's knowledge of basic science and engineering relevant to the research proposal. The examination is not public.

At the conclusion of examination, the student is excused. The examination committee then evaluates the student's performance with respect to the following components: the written proposal, the formal presentation, the defense of the proposed research, and the general knowledge of science exhibited by the student during the examination period. After this discussion, votes will be cast to determine the student's performance. The Chairman will vote only in the case of a tied vote. One of three grades will be assigned: honors, satisfactory or unsatisfactory. The student will be informed of the decision, preferably immediately following this executive session. The student will not be informed of the distribution of voting. Any concern about the student's performance will be communicated by the Chairman to the student as soon as possible after the examination. The "Oral Examination Report" form will be completed by the Committee immediately after a decision has been reached. The Chairman will make copies for the student and the faculty mentor, and will forward the original form to the Director of the BioE Graduate Program for permanent inclusion in the student's file. It is the responsibility of the student and the faculty mentor to address any concerns in the report.

In the case of a grade of unsatisfactory, the student may apply for reexamination on a date to be set no less than 90 days or more than 180 days from the date of the previous examination. The Comprehensive Examination Committee determines the nature of the reexamination. In the event of a second failure, the student will not be allowed to continue in the Ph.D. program.

It is the student's responsibility to consult with the Director of the BioE Graduate Program to ensure that a Request for Approval for Examination ("Progress Towards Degree" form) is submitted at least 2 weeks prior to the oral examination.

#### ***4. Candidacy for Ph.D. Degree***

Prior to the Comprehensive Exam, the BioE student must have successfully passed the Qualifying Exam and satisfied the FLORS and Residency requirement. Upon successful completion of the written and oral portions of the comprehensive examination and submission of the completed "Progress Towards Degree" form which documents the completion of the comprehensive examination, the student is admitted to doctoral candidacy. The student must satisfy Graduate Study's enrollment regulations until completion of all requirements for the Ph.D. degree as outlined in the current edition of the University of Kansas Graduate School Catalog.

#### ***5. Progress Towards Completion of the Degree***

After the student joins the BioE Graduate Program and selects the mentor, the student and mentor will jointly agree on a reasonable time frame and rate of progress for the completion of the student's research program. Within this context, the BioE Graduate Program encourages participation of graduate students in student activities as long as the student's expected performance is not jeopardized.