Dear Students,

As you may know, the Rutgers BME PhD qualifying exams are coming up. The exam is intended to give students an experience that is chiefly educational and that focuses on creative thinking and clear exposition that are vital to your future success in research. However, students should recognize that it is an evaluation of a significant milestone towards completion of the PhD. This document summarizes the exam process, timeline, and resources. Further details will be posted at the qualifier website:

http://biomedical.rutgers.edu/content/educationGraduateQual.php,

and associated Sakai site that you will be enrolled in automatically.

Overview of the PhD Qualifying Process:

Each PhD candidate must select a research topic by the end of spring break. A list of suggested topics is included in Appendix A at the end of this document. The topic may not be the same as the student’s intended dissertation topic. The student must communicate the chosen topic, by email, to the Qualifier Chair (shinbrot@rutgers.edu) and the Graduate Administrator (les42@rci.rutgers.edu) by that time. If a student does not do so, a topic will be assigned. The topic is subject to approval by the Qualifier Chair. If the project topic is not approved, the student will have one week to amend the project or submit a new one for approval. If a student does not do so, or if the second submission is also not approved, a topic will be assigned.

The candidate will have until 3 weeks after the end of the spring semester exam period to complete a written qualifying proposal on the chosen research topic. Details of the qualifying proposal format are included in Appendix B to this document. Several resources are provided to help students with their proposal. These include the following.

1) During the Seminar & Engineering Writing course, there will be several workshops devoted to promoting effective writing, instructing students on the fundamentals of proposal writing, and describing research funding opportunities within the university and beyond. Candidates seeking success are urged to participate actively in these workshops.

2) Faculty members will volunteer to help students with their qualifying proposals. These will be shared with you shortly:

Students are encouraged to make appointments with these faculty members as well as to seek advice and guidance from any other faculty or colleagues for help with their proposal. The proviso to their help is that 100% of the writing of the proposal must be the candidates’ own. Thus advisors may provide general guidance on proposal writing, they may critique drafts, they may help clarify the topic, and they may answer any questions posed, but they may not do any writing for the student. Likewise text from existing proposals may not be included in the qualifier proposal (except for revised proposals as described below).

You must submit your qualifier to TurnItIn at least a week before your defense! This will check the text of your qualifier proposal against a database of sources, including journal articles, web sites, and other documents that were previously submitted to the Turnitin database at this and other institutions. There is information on the Sakai site about how to check your own proposal prior to officially submitting it to your committee. It is highly recommended that you take the time to check your own document and make any modifications necessary to ensure that the work is your own before your defense.

3) Model proposals and guidelines for proposal writing will be posted on the qualifier or Sakai website.

Completed proposals should be submitted within three weeks after the spring semester exam period to the Graduate Administrator, who will distribute them to a faculty panel of 3 examiners. The panel will be selected by the Graduate Administrator. It is the obligation of the student to schedule an oral presentation with the panel members, which must take place within 2 weeks following the submission date. The timeline is summarized below.

The oral presentation should take no more than 30 minutes and will be open only to faculty members: a student’s primary research advisor may attend the presentation, but may not be an examiner. After the presentation, the
examiners will question the student, and based on criteria described in Appendix B may choose one of the following outcomes:

a) pass the student;
b) fail the student;
c) conditionally pass the student subject to criteria that the panel will prescribe - e.g. the student must take certain courses within a year and get a B grade or better, or the student must revise the proposal in specified ways, to be approved by the panel within a prescribed time limit (typically before the beginning of Fall semester).

A student who fails, either outright or by unsatisfactorily completing the conditional outcomes, will be disenrolled from the PhD program and enrolled in the Master’s program with the requirement of completing his or her work within 1 year of the qualifier date.

**Spring 2015 Qualifying Timeline:**

As always, for students with extenuating circumstances (illness etc.), these criteria may be relaxed with written approval from the Graduate Program Director. A contingency in case an examiner cannot be present is that the presentation may be sent electronically and the examiner may participate in the oral examination by teleconference and approve or disapprove the proposal by email to the Graduate Administrator. In exceptional circumstances and with the written approval of the Graduate Program Director, the qualifier clock for a particular student can be delayed by up to one year.

Hopefully this document makes clear the intended process. I emphasize that the goal is to provide you with an educational experience that will help in your future career development - the faculty are committed to providing you with any resources that we can to make this a successful and productive experience for you. If you have any questions, please contact me at shinbrot@aps.edu.

Best wishes,

Troy Shinbrot
Appendix A: 2015 Qualifier Topics:

- Fibrous adhesions are a common result of surgery that can lead to chronic pain, infertility, and intestinal obstruction. However, there are few in vivo or in vitro models to quantitatively study the problem, and our understanding of why they occur and how to rationally treat them is limited. Available devices have been designed to act as physical barriers to adhesion formation, but are not extensively used. Although they have been shown to reduce adhesion formation and severity, the devices do not significantly reduce complications resulting from adhesions. Write a research proposal addressing fibrous adhesions (i.e. developing models to study adhesions; hypothesizing and testing why/how/where they occur, identifying a testing treatments, etc.).

- Biomedical imaging has played a significant role in the characterization, early detection, diagnosis and staging of disease in vivo. Recently, biomedical imaging modalities have begun to be considered in the context of predicting disease outcome (i.e. assessing severity of the disease) and treatment evaluation. Computer-assisted diagnostic (CAD) methods (image segmentation, image registration, computer vision) have evolved to help clinicians better identify and stage disease and also to provide a quantitative interpretation to disease characterization. Discuss how you would design a study to utilize CAD tools in conjunction with biomedical imaging to quantitatively evaluate treatment response in a patient. You may pick any disease, but you need to justify your choice of imaging modality and CAD tools.

- The control of morphogenesis (3D cellular structure) is important for many future technologies. For example, liver cells sandwiched between layers of collagen survive and remain viable for liver assist devices or future artificial liver development; likewise islets of Langerhans are composed of spheroids of 5 different cell types organized in specific concentrations and particular species-dependent cytoarchitectures. Breast cancer and gliomas also have particular 3D structures that affect treatment options. Propose a computational or in vitro study to evaluate conditions under which a desired morphology can be constructed. You are free to propose a self-assembled scheme (e.g. progenitor cells might reproduce to produce the desired concentrations, or fixed concentration cells may reorganize to form the desired architecture), or you may instead engineer a way of placing separately cultured cells at particular locations on a scaffold.

- Potential cancer drugs and drug delivery systems have traditionally been screened using cancer cell lines grown as sub-confluent monolayers on two-dimensional substrates. Yet, it is well established that the architecture and microenvironment of a tumor influence the exposure of tumor cells to pharmacological agents as well as the cellular response. Recently, there has been increasing interest in the use of "tissue-engineered" tumor models where cells are grown in spheroids or other three-dimensional architectures. Challenges in developing a tissue engineered tumor include recapitulation of the cellular composition, the microenvironment and vascularity of human tumors in their disease states, as well as in the (preferably non-invasive) monitoring of cellular processes such as proliferation, migration, metabolism and various modes of cell death. Develop a research proposal in which you design a tissue engineered tumor addressing at least some of these challenges and use it to perform well-controlled studies of tumor cell response to an array of drug treatment condition.

- Candidates are strongly encouraged to adopt a topic from the above list. If, however, you cannot find a suitable topic, you may adopt one from the following resources. **Whatever your choice, you must specify a well defined topic by email to the Graduate Administrator and the Qualifier Chair no later than the first day of Spring break, or we will assign you a topic.**

http://grants.nih.gov/grants/guide/pa-files/PA-10-152.html
Appendix B: Qualifying proposal format

The proposal shall be no more than 10 pages (Specific Aims, Research Strategy), plus 2 pages for references, and must obey NIH guidelines for font size (11 Arial or Helvetica or Georgia), margins (0.5 inch minimum on all sides), line spacing (single) and type density (15 characters per inch maximum) and page layout (8.5” by 11”). Suggested sections for the proposal will be:

**SPECIFIC AIMS** (1 page maximum)
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.

**RESEARCH STRATEGY** (9 pages maximum)
Organize the Research Strategy in the specified order and using the instructions provided below. Start each section with the appropriate section heading – (a) Background and Significance (2 pages suggested), (b) Innovation (1 page suggested), (c) Approach (6 pages suggested). Cite published experimental details in the Research Strategy section and provide at the end a Bibliography and References Cited section (2 additional pages permitted).

(a) **Background and Significance**
• Explain the importance of the problem or critical barrier to progress in the field that the proposed project addresses.
• Summarize the scientific background of the field relevant to the proposed problem.
• 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) **Innovation**
• Explain how the application challenges and seeks to shift current research or clinical practice paradigms.
• Describe any novel theoretical concepts, approaches or methodologies, instrumentation or interventions to be developed or used, and any advantage over existing methodologies, instrumentation, or interventions.
• Explain any refinements, improvements, or new applications of theoretical concepts, approaches or methodologies, instrumentation, or interventions.

(c) **Approach** (Can be broken down into different sub-sections for each Specific Aim, for example, C1, C2, etc)
• Describe the overall strategy, methodology, and analyses to be used to accomplish the specific aims of the project.
• Discuss potential problems, alternative strategies, and benchmarks for success anticipated to achieve the aims.

The panel will evaluate the proposal and presentation based on the following guidelines. Each guideline will be assigned 1-5 points, a score of 5 being best. A total score of 18 out of 25 is passing, and lower scores may be deemed conditional by the committee. The committee will take into account mitigating factors particular to each student’s case in deciding whether to grant a conditional pass – for example a student whose qualifier lacks statistical metrics may be required to take a course on statistics and obtain a grade of B or better within a year, or a student who exhibits another shortcoming may be given a different remedial course or assignment. The committee is traditionally sensitive to extenuating circumstances (e.g. illness, need for additional training, etc.) and will assign conditions for passing in consultation with the Qualifier Chair or Graduate Program Director.

Creativity, thoughtfulness of proposal
Hypothesis Based Scientific Design of Experiments
Feasibility and logic of approach
Thoroughness of literature review
Clarity of presentation