

**Department of Biomedical Engineering
The George Washington University
Doctoral Preliminary Exam**

Introduction: The BME Doctoral Preliminary Exam is the first of 3 assessments taken by a student in GWU BME doctoral program. The remaining two exams are the Doctoral Dissertation Research Proposal Exam and Doctoral Dissertation Defense. The objective of the BME Doctoral Preliminary Exam is to assess the readiness of the doctoral student early in his/her studies to successfully complete doctoral dissertation research.

Suggested time to complete the BME Doctoral Preliminary Exam: A doctoral student should complete this exam within 6 months after completing his/her graduate coursework (with only doctoral research dissertation credits remaining). For doctoral students that already have an MSc degree this would typically happen after the first year of studies, and for the students without an MSc degree this would typically happen after the second year of studies in the GW BME doctoral program.

BME Doctoral Preliminary Exam Committee: The exam committee consists of the student's primary doctoral advisor(s) and two additional tenured or tenure-track faculty members of the BME department (a minimum of 3 BME faculty is required). The responsibilities of this committee are to: 1) prepare an exam question that is within the general area of the student's doctoral research but significantly different from the student's specific dissertation topic, 2) administer the exam (as described below), and 3) provide an outcome that will indicate the student's exam performance (as described below). The exam begins when the Chair of the exam committee (who cannot be the student's doctoral advisor) provides the exam question to the student. The student's doctoral advisor cannot prepare the exam question. The student will then have 10 days to prepare the written portion of the exam after obtaining the question. At the end of the 10th day the student will submit the written exam report to the committee. The oral exam will be scheduled on the 11th day after the student received the question.

Exam Outcomes: The exam committee will determine the outcome of the BME Doctoral Preliminary Exam after the written portion has been submitted to the committee and after the oral portion has been completed. The outcome is decided by the committee in a private discussion immediately following the completion of the oral portion (as described below). Any student concerns regarding the outcome of the BME Doctoral Preliminary Exam will be referred to the BME Department's Academic Standards Committee.

Outcomes of First Exam Attempt: Pass, Revise, or Retake are the 3 outcomes for a student's first attempt to complete the exam. An outcome of Revise is used when the committee has decided that the student's performance was adequate in most aspects, but deficient in one or several aspects, and that a revision of the written or oral portion (or both) could address the deficiencies. In this case the student will have 10 additional days to prepare the necessary revisions and re-submit the written portion to the committee and/or complete the revised oral portion. If the revision is not adequate for passing then the student will receive an outcome of Retake. An outcome of Retake is used when the committee decides that the student has failed the first exam attempt and/or any revisions. In this case the student will be allowed to take a new exam, with a new question, within 6 months.

Outcomes of Second Exam Attempt: Pass, Revise, or Fail are the 3 outcomes for a student's second attempt to complete the exam. An outcome of Revise will initiate the same process as that of the first exam attempt, except if the revision is not adequate for passing then the student will receive an outcome of Fail. Any student who receives an outcome of Fail will be terminated from the BME doctoral program.

Form: The Doctoral Preliminary Exam form is posted on GW BME web site and requires signatures of all exam committee members to indicate Pass, Retake, or Failure of the exam.

Written Portion: The objective of the written portion of the exam is to communicate, in the form of a document formatted as a research proposal, how a specific research question (i.e., the exam question) could be studied. This document should conform to the formatting and instructions of an NIH R21 proposal (see suggested online resources section below) and should be 7 total pages with 1 page of Specific Aims and 6 pages of Research Strategy (with 1-2 pages describing Significance and Innovation and 4-5 pages of Research Approach), using 11pt Arial font, 0.5 inch margins, and 1.0 line spacing. The 7-page limit includes the proposal body text, as well as any figures and tables. The bibliography is the only section that is not included in the 7-page limit. We encourage students to read and understand the NIH R21 guidelines before beginning the 10-day exam period. A typical exam report has the following structure:

Specific Aims (1 page): The first page should include the student's name, title of the proposal, brief rationale for the research, the proposed hypothesis, and the specific aims of the proposed studies.

Research Strategy (6 pages) comprised of:

Significance and Innovation (1-2 pages): Explanation of the clinical significance of the problem and current understanding, review of the state of the art, and discussion of critical barriers to progress in the field that the proposed project addresses. Explanation of what is novel in the proposed work as compared to currently published literature.

Research Approach (4-5 pages): This is the most important aspect of the written portion of the exam and should primarily contain original concepts and ideas developed solely by the student. This section should describe the theoretical and/or experimental strategies to be used to accomplish the specific aims of the project, including experiment design, animal models, theoretical analysis, numerical simulation/modeling, as appropriate. This section should include specific hypotheses, the specific aims to test those hypotheses, selection and justification of the animal model used, and detailed experimental design. The student must propose specific measurements, data analyses, including statistical models and statistical tests, and must explicitly state what results would constitute acceptance and rejection of the hypotheses. Expected outcomes and evaluation of the results should be provided. Potential pitfalls and alternative approaches should be discussed. The final outcome of the BME Doctoral Preliminary Exam will be heavily weighted by the information presented in the Research Approach section.

Bibliography and References (not included in the 7-page limit): Citation of published peer-reviewed articles that provide background information in support of the hypotheses, Specific Aims, and the Research Approach.

Oral Portion: The student will present to the exam committee a 45-min oral slide presentation that describes the information in the written portion of the exam, with a focus on the Research Approach and how the Research Approach addresses the exam question. The presentation may lead to questions (based on the chosen subject areas and sometimes unrelated to the assigned topic and of a broader nature) related to the concepts within the written portion and the goals of the proposed studies. The duration of the oral portion of the exam is not expected to exceed two hours.

Reporting the Exam Outcome: Immediately after completing the oral portion, the exam committee will deliberate in private to reach a conclusion regarding the exam outcome. The committee may choose to then verbally report the outcome to the student. The exam committee Chair is required to

convey the outcome by email to student, and to the Department Chair and the Associate Chair for Research and Graduate Affairs. All students will be notified in writing of the outcome of the exam by the Department Chair or the Associate Chair for Research and Graduate Affairs within one week after the written and oral portions have been completed. This notification may include conditions that the student must fulfill prior to attaining doctoral candidacy or suggestions on certain skills or areas that the student may be required to strengthen as they progress toward completing their dissertation research.

Suggested online resources:

Formatting and instructions of an NIH R21 proposal: <https://grants.nih.gov/grants/funding/r21.htm>

Examples of successful NIH R21 proposals: <https://www.niaid.nih.gov/grants-contracts/sample-applications#r21>