BIOMEDICAL ENGINEERING PH.D. DISSERTATION RESEARCH PROPOSAL GUIDELINES
WEST VIRGINIA UNIVERSITY

I. Overview of Written and Oral Dissertation Research Proposal Requirements

The goal of the dissertation research proposal (DRP) is to provide an overview of the proposed plan of work, including the general scope of the project, the basic hypothesis or research questions, proposed research plan or methodology, the significance of the study, and the anticipated novel contribution of the research.

The student must submit a copy of a formal research proposal to all Advisory and Examining Committee (AEC) members for their critical evaluation. All students must complete this written proposal and an oral presentation on their research within a maximum of one semester after passing the PhD Qualifying Examination or entering the PhD program, whichever is later.

The format and length of the written portion of the DRP will follow the guidelines set forth by the National Institutes of Health (NIH; See guidelines for R01 grant preparation – Section V Application Review Information) or the National Science Foundation (NSF; See NSF PAPPG - Part I, II. Proposal Preparation Instructions). The Research Advisor and student will predetermine the format of the DRP. The specific contents of the proposal are outlined further in Section II of this document. Additional requirements set forth by funding agencies, such as supplemental information and page limits, will be enforced. Examples of previous proposals can be requested from the Research Advisor or Graduate Academic Advisor. The completed proposal is to be submitted to the AEC no less than seven days prior to the oral defense date. Failure to submit it in advance will result in a delay of the defense.

Oral defense of the DRP will be open to all members (students and faculty) of the Chemical and Biomedical Engineering Department. During the oral defense, students will be required to defend the importance of the project, show how the project contributes to existing research and also what is novel about it, justify the research plan proposed, and present their preliminary data. Further, the students should demonstrate that they understand how to conduct project-specific research in a reasonable time frame. Questions from the AEC will probe not only the specific plan, but also the student's level of understanding of the underlying concepts of their project and the techniques (experimental or computational) proposed. The defense will be geared such that the responsibility of answering questions falls on the student, and the role of the Research Advisor will be limited to clarification rather than direct response to questions posed by members of the AEC. The quality of the DRP, both written and oral presentations, will be assessed using standardized rubrics to ensure every DRP presented is meeting the expected levels of quality. The AEC shall deliberate in private to evaluate the merit of the research proposal and shall then inform the student of the decision. The AEC shall communicate the reached decision in writing to the Graduate Academic Advisor, Department Chair and Dean's Office. If necessary, a recommendation procedure for re-evaluation and re-examination must be made by the AEC.

During the course of the dissertation research, it is the responsibility of the student and Research Advisor to keep the entire AEC informed of progress made. Each AEC member is expected to maintain an active interest in the student's work.

II. Guidelines for Preparing the DRP

The DRP should present 1) the aims/objectives and scientific significance of the proposed work, 2) how the proposed research is creative/original/transformative, and 3) the suitability of the methods to be employed. It should present the scientific merit of the proposed project clearly and convincingly, and should be prepared with the care and thoroughness of a paper submitted for publication.

	NIH guidelines	NSF guidelines
Margins	0.5 inch margins	1 inch margins
Font	• 11 pt font or larger using Arial, Georgia, Helvetica, or Palatino Linotype	• Arial (not Arial Narrow), Courier New, or Palatino Linotype at a font size of 10 points or larger • Times New Roman at a font size of 11 points or larger • Computer Modern family of fonts at a font size of 11 points or larger
What to submit	The DRP should be typed and assembled in the following standard sequence: • Title page (1 page) • Specific aims page (1 page) • Research strategy (12 single spaced pages including graphs, tables and figures) • Safety (if applicable) • Bibliography (unlimited pages) • Appendices (e.g. publications, computer code)	The DRP should be typed and assembled in the following standard sequence: • Title page (1 page) • Project summary (1 page) • Project description (15 single spaced pages including graphs, tables and figures) • Safety (if applicable) • Bibliography (unlimited pages) • Appendices (e.g. publications, computer code)
Title page	The title of the DRP should be brief, scientifically valid and intelligible to a scientifically literate reader.	The title of the DRP should be brief, scientifically valid and intelligible to a scientifically literate reader.

Project summary	The DRP must contain a 1-page summary detailing the specific aims of the proposed research. The specific aims page should include 4 sections: 1) an overview including project motivation by addressing what is known, the gap in knowledge and the critical need to be addressed, 2) your proposed solution detailing what you want to do, why are you doing it, how you want to do it, and your central hypothesis, 3) a brief description of each specific aim, and 4) expected impact the completed project could have on society. It should be informative to other scientists in the same or related fields and, insofar as possible, understandable by a scientifically literate reader.	The DRP must contain a 1-page summary of the proposed research. The summary should include 3 sections: 1) an overview including project motivation and a statement of research objectives, 2) intellectual merit of the proposed research to the advancement of scientific knowledge, and 3) broader impacts the research will have on benefiting society. It should be informative to other scientists in the same or related fields and, insofar as possible, understandable by a scientifically literate reader.
Project description	The research strategy of the DRP should be 12 pages single spaced and include: 1) significance of the proposed research detailing project motivation, a brief literature review of current research in the field, identification of the gap in knowledge/critical need to be addressed, the proposed solution to the critical need, and how the proposed research can positively impact society; 2) innovation of the proposed research outlining how the research utilizes new concepts, methods, instruments or interventions; 3) detailed approach of the proposed research for each aim by addressing rationale, hypothesis, preliminary data to validate the approach, experimental design, anticipated results and criteria for success, potential challenges and alternative strategies, scientific rigor, sample size selection and statistical analysis; and 4) a timeline presented as a Gantt chart to show the sequence, expected duration, and expected completion dates of all tasks proposed.	The project description of the DRP should be 15 pages single spaced and include: 1) intellectual merit of the proposed research with a detailed statement of objectives and expected significance; 2) a brief literature review of current research in the field and how the proposed approach is creative/original/transformative; 3) preliminary results to validate the research approach; 4) a detailed research plan addressing what will be done, why it should be done, how it will be done, anticipated results and criteria for success, and potential challenges and alternative strategies; 5) broader impacts of the research to benefit society; and 6) a timeline presented as a Gantt chart to show the sequence, expected duration, and expected completion dates of all tasks proposed.

Review criteria	See NIH Review Criteria Table below for more detail on: • Significance • Innovation • Approach	See NSF Review Criteria Table below for more detail on: • Intellectual Merit • Broader Impacts
Safety	If applicable, the student should evaluate the appropriate safety hazards associated with research being proposed and indicate strategies to maintain a safe working environment.	If applicable, the student should evaluate the appropriate safety hazards associated with research being proposed and indicate strategies to maintain a safe working environment.
Bibliography	A bibliography of pertinent literature cited in the proposal is required. It should be listed in numerical sequence in order of appearance in the proposal document.	A bibliography of pertinent literature cited in the proposal is required. It should be listed in numerical sequence in order of appearance in the proposal document.
Appendices	If applicable, include publications, computer code, etc.	If applicable, include publications, computer code, etc.

NIH Review Criteria (directly from NIH Parent R01)	
Significance	Does the project address an important problem or a critical barrier to progress in the field? Is the prior research that serves as the key support for the proposed project rigorous? If the aims of the project are achieved, how will scientific knowledge, technical capability, and/or clinical practice be improved? How will successful completion of the aims change the concepts, methods, technologies, treatments, services, or preventative interventions that drive this field? Are the scientific rationale and need for a clinical trial to test the proposed hypothesis or intervention well supported by preliminary data, clinical and/or preclinical studies, or information in the literature or knowledge of biological mechanisms? For trials focusing on clinical or public health endpoints, is this clinical trial necessary for testing the safety, efficacy or effectiveness of an intervention that could lead to a change in clinical practice, community behaviors or health care policy? For trials focusing on mechanistic, behavioral, physiological, biochemical, or other biomedical endpoints, is this trial needed to advance scientific understanding?
Innovation	Does the application challenge and seek to shift current research or clinical practice paradigms by utilizing novel theoretical concepts, approaches or methodologies, instrumentation, or interventions? Are the concepts, approaches or methodologies, instrumentation, or interventions novel to one field of research or novel in a broad sense? Is a refinement, improvement, or new application of theoretical concepts, approaches or methodologies, instrumentation, or interventions proposed? Does the

	design/research plan include innovative elements, as appropriate, that enhance its sensitivity, potential for information or potential to advance scientific knowledge or clinical practice?
Approach	Are the overall strategy, methodology, and analyses well-reasoned and appropriate to accomplish the specific aims of the project? Have the investigators included plans to address weaknesses in the rigor of prior research that serves as the key support for the proposed project? Have the investigators presented strategies to ensure a robust and unbiased approach, as appropriate for the work proposed? Are potential problems, alternative strategies, and benchmarks for success presented? If the project is in the early stages of development, will the strategy establish feasibility and will particularly risky aspects be managed? Have the investigators presented adequate plans to address relevant biological variables, such as sex, for studies in vertebrate animals or human subjects? If the project involves human subjects and/or NIH-defined clinical research, are the plans to address: 1) the protection of human subjects from research risks, and 2) inclusion (or exclusion) of individuals on the basis of sex/gender, race, and ethnicity, as well as the inclusion or exclusion of individuals of all ages (including children and older adults), justified in terms of the scientific goals and research strategy proposed?

NSF Review Criteria (directly from NSF PAPPG)	
Intellectual Merit	The Project Description must contain a section labeled "Intellectual Merit". The Project Description should provide a clear statement of the work to be undertaken and must include the objectives for the period of the proposed work and expected significance; the relationship of this work to the present state of knowledge in the field, as well as to work in progress by the PI under other support.
Broader Impacts	The Project Description also must contain a section labeled "Broader Impacts". This section should provide a discussion of the broader impacts of the proposed activities. Broader impacts may be accomplished through the research itself, through the activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to the project. NSF values the advancement of scientific knowledge and activities that contribute to the achievement of societally relevant outcomes. Such outcomes include, but are not limited to: full participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM); improved STEM education and educator development at any level; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a diverse, globally competitive STEM workforce; increased partnerships between academia, industry, and others; improved national security; increased economic competitiveness of the U.S.; and enhanced infrastructure for research and education.