Thesis Advisory Committees and the Doctoral Thesis Proposal

Department of Materials Science and Engineering
Johns Hopkins University

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One of the requirements for the Ph.D. in Materials Science and Engineering is the completion of a doctoral dissertation[1] in which you present the findings of an original research project. Your research advisor is your primary mentor in developing your dissertation research, but because such projects are lengthy and complex, the department has developed additional mechanisms — the Thesis Advisory Committee and the thesis proposal — to support you and (hopefully) contribute to successful completion of your degree in a timely manner. The culmination of this process is submission and public defense of your Ph.D. dissertation. Details and requirements about the dissertation and defense can be found elsewhere in the department Graduate Student Handbook.

Thesis advisory committee

Your thesis advisory committee comprises your advisor and two or three additional members who have expertise in technical areas related to your research. In most cases the members will also be part of the examination committee at your dissertation defense. Every year you will meet with your committee to present your progress on your research and describe your plans for the coming year. The committee will ask questions and make suggestions regarding your project. These meetings are not exams; their purpose is to ensure that you are getting formal feedback on your research progress from a group of experienced researchers (in addition to the informal feedback you get from your advisor(s) on a much more frequent basis) to ensure that you are on track to complete your degree.

Thesis proposal

The thesis proposal is a written document outlining your chosen scientific problem and general approach for your research which, if carried through to completion, will provide a satisfactory basis for writing your Ph.D. dissertation. Preparing a thesis proposal at an early stage teaches you to identify and articulate promising lines of inquiry and to place your research in the broader context of the state of knowledge in your field. It gives you experience in writing a persuasive proposal and defending the ideas it contains, and it ensures that the thesis committee is in broad agreement with you about the general course of research to be pursued and what is required for you to successfully complete your dissertation and receive your degree.

The remainder of this document describes each of these components of your Ph.D. research in more detail, including all of the requirements.

[1] Often called a "doctoral thesis." Here we are using the terms *dissertation* and *thesis* interchangeably.

Thesis Advisory Committee requirements and procedures

Composition of the committee

1. The Thesis Advisory Committee (TAC) shall have either three or four members.
2. The primary advisor is one member of the committee.
3. Additional members are chosen by the student in consultation with their primary advisor, subject to approval by the Chair of the Doctoral Committee.
4. One member of the committee must have a primary appointment in DMSE, and a second must have either a primary or a secondary appointment in DMSE.
5. At least two members of the committee must be JHU tenured/tenure-track faculty (professor, associate professor, or assistant professor). Additional JHU members may be either tenured/tenure-track faculty or research faculty (research professor, associate research professor, or assistant research professor).
6. External (non-JHU) members of professional standing comparable to JHU faculty are permissible with the prior approval of the Chair of the Doctoral Committee.
7. Changes to the composition of the thesis committee require approval of the Chair of the Doctoral Committee.
8. Under most circumstances the committee members will be among the five required examiners for the dissertation defense, but note that because the defense is also the GBO examination, the composition of the dissertation defense committee is subject to approval by the Graduate Board.

Timing and meetings

1. The Thesis Advisory Committee should be formed and have its first meeting within six months of the student passing their qualifying examination.
2. Subsequent meetings will be held at least every twelve months.
3. One meeting will be held in conjunction with the thesis proposal, which is required to be completed before the end of the third full year following matriculation.
4. One meeting will be the pre-defense meeting (see below)
5. Every effort should be made to schedule meetings at times when all members can be present. If necessary, a regular meeting or the thesis proposal meeting may be held with one member (at most) absent. In this case the student is required to have a separate meeting with that member. All members of the committee must be present at the pre-defense meeting, except in exigent circumstances (such as unexpected illness).

Regular meeting format

1. At each regular meeting of the TAC the student will present a review of the status of their project, including a discussion of progress towards goals set for the preceding year, any changes or other progress, challenges or problems that have come up, and plans for the coming year.
2. The student should also briefly describe other activities (such as coursework taken, conferences attended, papers/presentations submitted, professional development activities, etc.), projected degree completion date, and career goals.
3. The committee may ask questions and should engage the student in a discussion of their research, progress towards degree completion, and career goals.
4. Following the presentation and discussion the primary advisor (and any official co-advisor) will be dismissed for a private conversation between the student and the remaining committee member(s). This is intended to provide the student with an opportunity to raise issues they may not feel comfortable discussing with the advisor present.

Feedback and reporting from regular meetings

1. At the conclusion of each regular meeting the committee will provide clear oral feedback regarding the student's progress toward degree completion.
2. After the meeting the student should summarize the feedback in an email, send it to the committee, and incorporate any changes/corrections received from the committee as necessary.
3. On their student review, the following information is required:
    a. The date of the last committee meeting
    b. A summary of feedback received from the committee (as described above and checked by the advisor for accuracy and completeness)
    c. The tentative date (month/year) of the next proposed thesis committee meeting.

Pre-defense meeting

1. The last scheduled meeting of the committee prior to the thesis defense will be a "pre-defense" at which the student presents a thorough overview of their research, including all key results and conclusions.
2. Based on the presentation at the pre-defense meeting, the committee may either agree that the student is ready to proceed to the defense, or may ask the student to resolve any outstanding questions or issues.
3. The thesis defense shall not be scheduled until the pre-defense meeting has been held and the committee has agreed that the student is ready to proceed.
4. The thesis defense shall occur no earlier than two months following the pre-defense meeting.
5. No formal feedback or reporting is required for the pre-defense meeting, except that the approval of the committee should be reported to the Academic Program Coordinator who will then assist with scheduling the formal thesis defense.

Enforcement

1. The Academic Program Coordinator will keep a record of committee meetings.
2. A student who has not had a thesis advisory committee meeting within a twelve-month period will be reminded of the requirement by email and be required to hold a committee meeting within three months.
3. A student who fails to hold a committee meeting within three months after receiving a warning will be placed on academic probation. The requirement to be removed from probation will be to hold the committee meeting within an additional three months.
4. A student who fails to satisfy the condition of probation may be dismissed from the PhD program.

Thesis proposal guidelines

Timeline

The thesis proposal is of little use if you put it off too long, so you are encouraged to do it as early as possible, but in any event before the end of your third year. The proposal is designed to show that you understand the context for your research, are familiar with the techniques that you will use, and have a sound rationale for your approach. Preliminary data can be helpful, but are not required.

You must submit your written proposal to the Academic Program Coordinator at least two weeks before the scheduled date of the thesis committee meeting at which you will make your presentation. The Academic Program Coordinator will check your proposal to ensure that it adheres to the format described below and give you the approval to distribute it to the members of your committee.

Sections, length, and formatting for the written thesis proposal

Your thesis proposal must include the following sections, each strictly limited to the number of pages specified:

- Title page (1 page)
- Specific Aims (1 page)
- Research Context and Strategy (6 pages, including figures and tables)
- References (no limit)

You should observe the following formatting requirements:

- All pages must be formatted for U.S. letter size paper (8.5" by 11")
- Margins no smaller than one-half inch on all sides
- Number each page, except the title page, at the bottom center
- Type must be 11 point or larger, using a standard font (*e.g.* Times New Roman, Cambria, or Arial).
- Submit your proposal as a single PDF file (not a Word document or other format)

If your thesis proposal does not meet these formatting requirements, it will be returned to you for correction and re-submission.

Title page (1 page)

The *Title Page* should include the title of your project; your name; your matriculation date; the date, time, and location of the presentation; and the names and email addresses of your thesis advisor(s) and the other members of your thesis proposal committee.

Specific Aims (1 page)

The *Specific Aims* section should provide a concise overview of your project, a numbered list of your specific aims or objectives, and a statement of the expected outcome(s) and impact of your project. Since this is the first section that will be read, it should be clear and concise. Here are guidelines for this section:

1. *First paragraph* — Include sentences that describe: (1) the topic of the research – what is your project about, (2) the current state of knowledge in your field or the state-of-the-art, providing only the details necessary to understand the context of the project, (3) the gap in knowledge or

technology that you will address, and (4) the critical need, i.e. new knowledge, model, technique, material, or process that you will develop or design.

2. *Second paragraph* — Describe how your project will meet the critical need identified in the first paragraph. Having defined the critical need, this paragraph should make the case for your proposed solution. The components of this paragraph may vary depending on your project, but it should include: (1) a description of how the critical need will be met, (2) a statement of the overarching goal of your project, (3) the hypothesis (if your project is hypothesis-driven), (4) the overall objective of your project, and (5) the rationale for your project — how the solution was selected (often based on previous work in the literature or preliminary data).
3. *List of specific aims* — List the aims of your project by which you will test the hypothesis or develop the new technique, material, model or process. Typically there will be two to four aims, and they should be provided in a numerical list to make it easier for the reviewers to clearly identify and understand each aim. In general, each aim should have an active title that clearly states the objective in relationship to the hypothesis and/or overall objective. Ideally, your aims should be related to, but not dependent upon, each other to avoid the failure of one aim preventing the completion of the other aims. For each aim, write a few sentences that describe the experimental approach, the anticipated outcomes, and how each aim will help answer your larger hypothesis. In some cases it may be helpful to divide the aims into sub-aims.
4. *Final paragraph* — Should include a brief statement of the expected outcomes and potential impact of your project as a whole.

Research Context and Strategy (6 pages)

This section should include the following sub-sections. Suggested lengths for each are given; these are only guidelines, but the entire *Research Context and Strategy* section is strictly limited to six pages.

1. *Significance* (~ 1 page) — The *Significance* section should make a compelling case for your project and explain why it is an important problem in the context of current literature and/or the state-or-the-art. Use citations to support specific statements and show familiarity with relevant literature and prevailing concepts. This section should explain: (1) how your project will address an important problem or a critical barrier to progress in the field, and (2) how your project will advance or improve scientific knowledge, technical capability, and/or clinical practice be improved. This section will usually include: (1) a summary of the current literature, (2) your rationale for pursuing the proposed project, and (3) a description of the expected significance of your project — its expected contribution to science, technology, and/or human health.
2. *Innovation* (~½ page) — The *Innovation* section should address: (1) how your project challenges/seeks to shift current research, (2) any novel concepts, approaches, methodologies, instrumentation, and any advantage over existing ones, and (3) any refinements or improvements to existing approaches.
3. *Approach* (~ 4½ pages) — The *Approach* section should include any preliminary data, an overview of the experimental design, a description of methodologies and analyses to be used, a discussion of potential difficulties and limitations and strategies to overcome them, expected results, and alternative approaches if unexpected results are found. Number each subsection to correspond with the numbers of the specific aims. In describing how each aim will be addressed, it is useful to provide an introductory paragraph that describes the motivation, rationale, and/or objectives for each aim.

Within the description of the methodologies for each aim, describe how you will collect, analyze, and interpret your data. Include benchmarks if appropriate. Explain why one approach or method was selected instead of others. At the end of the description of each aim, describe potential problems or high risk experiments, and possible alternative strategies. Preliminary results can be summarized at the beginning of the *Approach* section, or distributed in the individual aims. At the end of the *Approach* section include a timeline for the proposed project, indicating the projected start and endpoints for each aim and/or sub-aim.

References

Cite sources using either numbers or an author-date format. Collect the references in a separate section at the end of the proposal, using any standard format of your choice. References do not count against the page limit.

Figures

Figures should be used as necessary to provide preliminary data or illustrate important points of the proposal. Number the figures sequentially, and insert them in the main body of the text (not collected separately at the end). Place each figure as close as possible to the first place it is mentioned in the text. Each figure should have a brief explanatory caption.

Figures should be legible — take special care if they are reproduced from some other source. Do not be tempted to shrink your figures too much to save space. If color is used, be sure that the important information in the figure can be understood even if the proposal is printed in black and white. Provide appropriate credit or a reference for any figure you do not make yourself or which you adapt from another source.

Oral presentation of the thesis proposal

The second part of the thesis proposal is an oral presentation to your thesis advisory committee and other members of the department. There are no specific requirements for the format of the oral presentation, but you will want to convey the same ideas that are contained in your written proposal. Plan your talk to be approximately 30-35 minutes long, and *no longer* than 45 minutes — rehearse it ahead of time and revise as necessary, anticipating that you may be interrupted for questions by the audience. As a very rough guide, anticipate at least one to two minutes per slide, or a maximum of about 25 slides total (more or less depending on your style). Be sure that your slides are legible, even from the back of the room.

After the public oral thesis proposal presentation there will be a closed examination (of approximately thirty minutes) with the members of the thesis proposal committee, in which they will assess your understanding of the context of your work and your proposed project. For this reason, it is important that you understand and be able to defend your proposal in greater depth than in either your written document or your oral presentation. If the committee is not satisfied with either your proposal or your answers in the examination, they may ask for additional work (such as revision of

the proposal, additional readings or further discussions) to be completed to fulfill the thesis proposal requirement.

Enforcement

1. The Academic Program Coordinator will keep a record of thesis proposal meetings (date and committee members present) and their outcomes.
2. A student who has not completed the thesis proposal requirement (including any additional work required by the committee) by the end of the sixth semester following matriculation will be placed on probation.
3. To be removed from probation, the student must complete the proposal requirements to the satisfaction of their thesis advisory committee. The term of probation will ordinarily be six months.
4. A student who fails to satisfy the conditions of probation may be dismissed from the PhD program.

Additional resources

Here are a few resources with suggestions on how to put together a good presentation:

- Randy Olson, *Houston, We Have a Narrative: Why Science Needs Story*. University of Chicago Press, 2015. ISBN: 9780226270845
  High-level stuff about how to organize your presentation (and your written proposal, for that matter) in a way that tells a compelling story.
- Marilynn Larkin, *How to Give a Dynamic Scientific Presentation*
  https://www.elsevier.com/connect/how-to-give-a-dynamic-scientific-presentation
  Practical advice on the presentation itself.
- Susan K. McConnell, *Designing Effective Scientific Presentations*
  https://youtu.be/Hp7Id3Yb9XQ?si=cYiHZHVgKJBCwxRT
  Lots of good tips on how to use PowerPoint (or Keynote) effectively.

Other references you may want to consult on how to put together a research proposal, and the criteria used in evaluating a proposal:

- Preparing your proposal (National Science Foundation)
  https://www.nsf.gov/funding/preparing-proposal
- Merit review criteria (National Science Foundation)
  https://www.nsf.gov/policies/pappg/24-1/ch-3-proposal-processing-review#a-merit-review-principles-and-criteria-af2
- Peer review framework (National Institutes of Health)
  https://grants.nih.gov/policy-and-compliance/policy-topics/peer-review/simplifying-review/framework