

# Biological Engineering Undergraduate Thesis Opportunity

## Thesis Proposal Guidelines, 2017

Upon receiving verbal approval from their faculty research advisor to pursue a thesis, BE juniors may begin writing a thesis application, to be submitted to and approved by their advisor before the end of Spring semester Junior year.

Advisors will evaluate research significance, design, and feasibility, and return a written evaluation, potentially including requests for revision. Student must complete revisions before final approval.

Upon final approval, students must notify the BE Undergraduate Administrator at [be-sb@mit.edu](mailto:be-sb@mit.edu) (cc'ing their advisor) that the student's thesis proposal has been approved.

### Overview

The BE thesis proposal is modeled on a Specific Aims page – a component common to many kinds of grants, which establishes the need for your research and sets forth a clearly defined research plan. A successful thesis proposal will help you to...

- begin a written review of relevant literature in your field,
- articulate explicit and specific research questions,
- and anticipate potential obstacles.

In sum, the proposal can serve both as a research roadmap and as an outline for your final thesis document.

### Guidelines for suggested length and content

The following guidelines are modeled after a Specific Aims page for a grant, in order to give you experience with a relevant form of scientific communication. See the end of this document for additional resources to help you create your proposal successfully.

Individual faculty may make more specific requests as to length and content to be included.

<b>Overall Length</b>	Minimum 3 pages, double-spaced.	
<b>COMPONENTS</b>	<i>Recommended minimum length</i>	<i>Guidelines</i>
<b>Introduction</b>	2-3 paragraphs	<ul style="list-style-type: none"> <li>• Establish the importance of the field or problem being addressed.</li> <li>• Summarize existing approaches or previous research in the field, and their limitations or shortcomings.</li> <li>• Introduce any major methods or approaches to be used in the proposed research, and explain their strengths or advantages.</li> </ul>
<b>Knowledge Gap</b>	1-3 sentences	<ul style="list-style-type: none"> <li>• Concisely state the specific questions or problems to be addressed.</li> </ul>
<b>Research overview</b>	1-2 paragraphs	<ul style="list-style-type: none"> <li>• Provide a brief overview of how the proposed research will be pursued and what the objectives are.</li> <li>• Conclude by describing the impact and significance should the proposed work succeed.</li> </ul>
<b>Specific Aims</b>	2 pages	<ul style="list-style-type: none"> <li>• Describe the goals of your proposed research in the form of 2-4 Specific Aims, e.g., to develop a new protocol, optimize a computational method, use a dataset to test a hypothesis, or test the effect of an experimental treatment.</li> <li>• Specific Aims should be phrased as a 1-sentence objective or hypothesis.</li> <li>• Each Specific Aim should be followed by the following subsections: <ul style="list-style-type: none"> <li>○ <b>Approach:</b> ~1 paragraph explaining how the Aim will be accomplished, stating major methods, parameters, and metrics. Make it clear <b>how</b> and <b>which</b> data would be gathered, and how they would be <b>interpreted</b>.</li> <li>○ <b>Potential Challenges and Solutions:</b> ~1 paragraph describing any major drawbacks or weak points to the selected approach. Suggest at least 1 alternative approach should the approach fail.</li> </ul> </li> <li>• Include an estimated <b>timeline</b> of when you expect to be able to complete each Specific Aim.</li> </ul>

## Evaluation

Faculty advisors can evaluate the thesis proposal and provide feedback according to the following suggested criteria:

<b>Scientific understanding</b>	Does the student demonstrate an accurate and thorough understanding of the research field? Is key relevant background included?
<b>Significance</b>	Is the importance of the research question established?
<b>Scope</b>	Is the scope of the proposed research reasonable, given the time that the student has to accomplish it?
<b>Design</b>	Are the Specific Aims concrete and well-defined? Are the chosen approaches appropriate to the research question, and likely to succeed?

## Resources

- **BE Communication Lab:** At any point while drafting your proposal, feel free to meet with a BE Communication Fellow to brainstorm, receive feedback, and revise. Making frequent appointments in advance can help keep you on track, and avoid a last-minute rush.  
<http://mitcommlab.mit.edu/be/make-an-appointment/>
- The **BE CommKit website** contains several quick how-to articles with relevant guidelines and recommendations:
  - Writing a successful introduction: <http://mitcommlab.mit.edu/be/commkit/journal-article-introduction/>
  - Writing a short research proposal: <http://mitcommlab.mit.edu/be/commkit/nsf-research-proposal/>