NSF Graduate Research Fellowship Program Research Proposal Assignment

Use the following materials to adopt the NSF GRFP research proposal into your own courses.

Feel free to use the materials as you wish and please reach out if you have any questions. Thanks!

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Syllabus description

Research Proposal Project: You will write a research project proposal in the form of the National Science Foundation Graduate Research Fellowship Proposal (NSF GRFP). This project will require you to write a 2-page proposal addressing a problem in biomedical engineering in addition to reviewing your classmates' proposals in a mock review panel. Please see Canvas for details.

Overall project description (posted on course website)

One of the most useful and valuable skills you can develop as an engineer or scientist is the ability to write a proposal clearly and effectively. Whether you go to industry, graduate school, health professional school, or start your own business, you will need to advocate for yourself and your ideas in writing, so we are going to start learning how to do that well in this course.

Over the course of this semester you will be writing a National Science Foundation Graduate Research Fellowship Proposal (NSF GRFP). Even if you have no plans for going to graduate school someday, this will be an extremely valuable exercise as we will be following the exact specifications for this competitive and highly-sought after award. For this course you will only be writing the (two page!) Graduate Research Plan Statement (and not the other materials). Click here for information on the formatting requirements. Click here for information on how proposals are evaluated based on Intellectual Merit and Broader Impacts. For sample proposals, check out this resource (scroll all the way to the bottom).

This project is worth 50% of your total course grade.
We will be using this rubric to evaluate your proposal, which is based off of the Intellectual Merit and Broader Impacts criteria from NSF.

There will be several deliverables associated with this project to help you develop it in a structured fashion over the course of the semester. An overview of the components are shown below and more detail is provided in each assignment on Canvas.

Assignment	Due Date	Percent of course grade
Research topic and question	Week 3	2.5%
Hypothesis	Week 4	2.5%
Literature review and experimental design	Week 7	5%
First draft	Week 9	5%
Second draft	Week 12	5%
Final proposal	Week 14	25%
Mock panel review	Week 15	5%

1. Research topic and question

Type your research topic and research question in the space below. Submit a maximum of four sentences! :)

You will also need to peer review three of your classmates' submissions and provide feedback. You need to do this in the form of leaving comments and completing the rubric. This is due three days later.

When giving feedback on the research topic and question, be sure to be polite, cordial, and supportive while at the same time giving critical feedback to help each other improve their topics and questions. When providing feedback, consider using the FINER approach.

- Is the research project **feasible**?
- Is the research project **interesting**?
- Is the research project **novel**?
- Is the research project **ethical**?
- Is the research project **relevant**?

Research Topic and Question

You've already rated students with this rubric. Any major changes could affect their assessment results.

Criteria	Ratings			Pts
Quality of research topic	2 pts Full Marks	1 pts Half Marks	0 pts No Marks	2 pts
Quality of research question	2 pts Full Marks	1 pts Half Marks	0 pts No Marks	2 pts
Completion of peer reviews	1 pts Full Marks		0 pts No Marks	1 pts
				Total Points: 5

2. Hypothesis

Type three things in the box below:
1. Your research topic
2. Your research question
3. Your proposal hypothesis (should be a single sentence!)

You will also need to peer review three of your classmates' submissions and provide feedback. You need to do this in the form of leaving comments. This is due three days later.

When giving feedback on the hypothesis, be sure to be polite, cordial, and supportive while at the same time giving critical feedback to help each other improve their hypotheses. Consider if the hypothesis is aligned to the research question and if it is testable.

Proposal Hypothesis

You've already rated students with this rubric. Any major changes could affect their assessment results.

Criteria	Ratings			Pts
Included research topic and question	**1 pts** Full Marks		**0 pts** No Marks	1 pts
Quality of proposal hypothesis	**3 pts** Full Marks	**1.5 pts** Half Marks	**0 pts** No Marks	3 pts
Completion of peer reviews	**1 pts** Full Marks		**0 pts** No Marks	1 pts
				Total Points: 5

3. Literature review and experimental design

In this assignment you need to include some initial references of peer-reviewed scientific papers that relate to your project as well as your initial experimental design. Please upload a single PDF containing all of the following:

1) Five papers that are related to your research question
   - For each include the full IEEE citation (for info on IEEE citations check here and scroll down to periodicals)
   - Briefly summarize each paper and say how it is related to your topic
   - At least one of them should be a review article (label this paper as a review article your submission)
   - At least two of the papers should include methods that you will use to guide your experimental design (label these papers as methods articles in your submission)

2) Include an overview of your experimental design that you will be using to test your hypothesis and answer your research question
   - Write at least one paragraph that describes your experimental plan and include citations (to the above five papers and more) when appropriate
   - Your experimental design should be clearly written so that someone can follow along with your plan
   - Consider the following points to guide your design
     -
       - Change only one variable at a time
         - Modify the independent variable, measure effects on the dependent variable
       - Include control groups
         - Use positive and negative controls if applicable
       - Cite papers that have used similar methods to what you want to do
         - Build off of previously published methods
       - Make sure methods are appropriately aligned with your research question and hypothesis
         - Use methods that actually test your hypothesis
   - Check the Alex Lang website to look for examples of how NSF GRFP proposals write about experimental design

You will also need to peer review three of your classmates' submissions and provide feedback. You need to do this in the form of leaving comments and completing the rubric. This is due three days later.

Lit review and exp design

You've already rated students with this rubric. Any major changes could affect their assessment results.

Criteria	Ratings			Pts
Included five papers with IEEE citations	**2 pts** Full Marks	**1 pts** Half Marks	**0 pts** No Marks	2 pts
One paper is a review article and two papers are methods articles	**1 pts** Full Marks		**0 pts** No Marks	1 pts
Summary of each paper and how related to research topic	**2 pts** Full Marks	**1 pts** Half Marks	**0 pts** No Marks	2 pts
Quality of experimental design plan	**4 pts** Full Marks	**2 pts** Half Marks	**0 pts** No Marks	4 pts
Completion of peer reviews	**1 pts** Full Marks		**0 pts** No Marks	1 pts
				Total Points: 10

4. Proposal first draft

Overview: This is your first opportunity to turn in a full draft of your NSF GRFP proposal! This is a first draft and a work in progress, so don't fret about your proposal being finalized yet in terms of content, writing, style, grammar, or length - we still have plenty of time to make changes and feedback to collect!

Requirements: For this first draft, you should follow the formatting requirements from the NSF GRFP and include all necessary sections including background, research question, hypothesis and experimental design, in addition to separately titled sections on Intellectual Merit and Broader Impacts. Don't forget your references too (and include citations in line where appropriate)! If your proposal is longer than two pages at this point, no big deal, as you will get feedback and ideas on how to cut it down to two pages.

Make sure to check out sample proposals to help you format and guide the development of your own. Last, while we will not be using this until the final proposal is turned in in late April, please keep this final proposal rubric in mind as you are writing.

Peer review: For this assignment, instead of doing anonymous peer reviews on Canvas, you will be doing LIVE peer reviews in class on [insert date]! Please bring three printed out copies of your proposal with you this day. We will have three rounds of peer review, where in each round you will trade copies of your proposal with a classmate, read each other's proposals, and then give each other feedback.

First draft (1)

You've already rated students with this rubric. Any major changes could affect their assessment results.

Criteria	Ratings			Pts
Quality of background, research question, and hypothesis	2 pts Full Marks	1 pts Half Marks	0 pts No Marks	2 pts
Quality of experimental design	2 pts Full Marks	1 pts Half Marks	0 pts No Marks	2 pts
Quality of separate intellectual merit and broader impacts sections	2 pts Full Marks	1 pts Half Marks	0 pts No Marks	2 pts
Followed NSF GRFP formatting requirements (except page length)	2 pts Full Marks	1 pts Half Marks	0 pts No Marks	2 pts
Completed peer reviews in class on Wed March 13	2 pts Full Marks		0 pts No Marks	2 pts
				Total Points: 10

5. Proposal second draft

Overview: This is your second opportunity to turn in a full draft of your NSF GRFP proposal! This is a second draft and a work in progress, but your proposal should be coming together and you should have a better feel for it than you did with the first draft.

Requirements: For this second draft, you should follow the formatting requirements from the NSF GRFP and include all necessary sections including background, research question, hypothesis and experimental design, in addition to separately titled sections on Intellectual Merit and Broader Impacts. Don't forget your references too (and include citations in line where appropriate)! At this point you should have it much closer to two pages but we still have time to give you feedback to help you cut the length down if needed. Make sure to check out sample proposals to help you format and guide the development of your own. Last, while we will not be using this until the final proposal is turned in in late April, please keep this final proposal rubric in mind as you are writing.

Peer review: For this assignment, instead of doing anonymous peer reviews on Canvas, you will be doing LIVE peer reviews in class on [insert date]! Just like for the first draft peer review, please bring three printed out copies of your proposal with you this day. We will have three rounds of peer review, where in each round you will trade copies of your proposal with a classmate, read each other's proposals, and then give each other feedback.

Second draft

You've already rated students with this rubric. Any major changes could affect their assessment results.

Criteria	Ratings			Pts
Quality of background, research question, and hypothesis	2 pts Full Marks	1 pts Half Marks	0 pts No Marks	2 pts
Quality of experimental design	2 pts Full Marks	1 pts Half Marks	0 pts No Marks	2 pts
Quality of separate intellectual merit and broader impacts sections	2 pts Full Marks	1 pts Half Marks	0 pts No Marks	2 pts
Followed NSF GRFP formatting requirements (except page length)	2 pts Full Marks	1 pts Half Marks	0 pts No Marks	2 pts
Completed peer reviews in class on Wed April 10	2 pts Full Marks		0 pts No Marks	2 pts

Total Points: 10

6. Proposal final submission

Overview: This is your opportunity to turn in the final version of your NSF GRFP proposal! Woohoo!!

Requirements: For this final proposal, you should follow the formatting requirements from the NSF GRFP and include all necessary sections including background, research question, hypothesis and experimental design, in addition to separately titled sections on Intellectual Merit and Broader Impacts. Don't forget your references too (and include citations in line where appropriate)! **At this point the two-page limit needs to be met! Going beyond two pages will result in a 10% reduction in your grade (this may seem harsh, but if this was a *real* NSF GRFP proposal, your application would be immediately disqualified if longer than two pages!).** Please keep in mind the final proposal rubric which will be used to evaluate your final proposal.

Upload to Google Forms as well! Please upload your anonymous proposal with no name to this google form. Please name your file LASTNAME.pdf. Thank you!!

Final proposal mock review panel: We will be doing mock review panels to "score" each proposal and to determine if they should be funded or not. More details coming soon on this!

Final proposal (1)

You've already rated students with this rubric. Any major changes could affect their assessment results.

Criteria	Ratings						Pts
Clarity and significance of research question	12 pts Exceptional	9.6 pts Proficient	7.2 pts Competent	4.8 pts Basic	2.4 pts Limited	0 pts Missing	12 pts
Methodology and feasibility	12 pts Exceptional	9.6 pts Proficient	7.2 pts Competent	4.8 pts Basic	2.4 pts Limited	0 pts Missing	12 pts
Integration of broader impacts	8 pts Exceptional	6.4 pts Proficient	4.8 pts Competent	3.2 pts Basic	1.6 pts Limited	0 pts Missing	8 pts
Potential for societal impact	8 pts Exceptional	6.4 pts Proficient	4.8 pts Competent	3.2 pts Basic	1.6 pts Limited	0 pts Missing	8 pts
Clarity of writing and organization	5 pts Exceptional	4 pts Proficient	3 pts Competent	2 pts Basic	1 pts Limited	0 pts Missing	5 pts
Adherence to two-page limit	5 pts Yes			0 pts No			5 pts
						Total Points: 50	

7. Mock panel review

There are two parts of this assignment:
1. Scoring four proposals in class on [insert date]
2. Participating in a group review of the proposals on [insert date]

Mock Panel Review

Criteria	Ratings		Pts
Submitted all four proposal reviews on Apr 26	**5 pts** **Full Marks**	**0 pts** **No Marks**	5 pts
Participation in mock panel on Apr 29	**5 pts** **Full Marks**	**0 pts** **No Marks**	5 pts
			Total Points: 10

Detailed rubric for final proposal (made by ChatGPT-3.5)

Criteria	Exceptional (5)	Proficient (4)	Competent (3)	Basic (2)	Limited (1)
Intellectual Merit					
- Clarity and significance of research question	Presents an exceptionally clear, innovative, and highly significant research question. Demonstrates its impact on the field convincingly.	Articulates a clear research question that holds significance in the field.	Presents a research question, but its clarity or significance may need further clarification.	Presents a research question that lacks clarity or significant impact on the field.	Fails to present a clear or impactful research question.
- Methodology and feasibility	Provides an exceptionally well-designed and feasible methodology for addressing the research question.	Presents a sound methodology that is feasible and well-aligned with addressing the research question.	Provides a methodology, but it may lack certain details or feasibility considerations.	Presents a methodology that is not well-defined or lacks feasibility in addressing the research question.	Fails to provide a meaningful methodology for the research question.
Broader Impacts					
- Integration of broader impacts	Demonstrates an exceptional understanding of and plans for broader societal impacts, outreach, and potential contributions to enhancing diversity and inclusion.	Presents a comprehensive plan for broader impacts, but with minor gaps or less detailed strategies.	Provides a plan for broader impacts, but it lacks depth or overlooks important aspects.	Offers limited consideration or vague strategies for broader impacts.	Fails to provide a meaningful plan for broader impacts.

Criteria	Exceptional (5)	Proficient (4)	Competent (3)	Basic (2)	Limited (1)
- Potential for societal impact	Articulates exceptionally clear and compelling pathways for societal impact, emphasizing potential outcomes and benefits.	Describes potential societal impacts but may lack depth or specificity in pathways for achieving them.	Describes potential societal impacts, but pathways for achieving them may be vague or underdeveloped.	Provides limited insight into potential societal impacts with unclear pathways for achieving them.	Fails to address potential societal impacts.
Communication and Organization					
- Clarity of writing and organization	Writing is exceptionally clear, concise, and well-organized with a logical flow and coherent structure.	Writing is generally clear and well-organized but may have occasional lapses in clarity or organization.	Writing is somewhat clear and organized, but there are notable lapses in clarity or organization.	Writing is unclear or disorganized, hindering understanding.	Writing is incomprehensible or entirely disorganized.
- Adherence to page/word limits	Adheres precisely to the specified page/word limits, demonstrating conciseness and effective communication.	Comes close to the specified page/word limits with minimal deviation.	Exceeds or falls significantly short of the specified page/word limits.	Deviates significantly from the specified page/word limits, affecting the overall quality.	Fails to adhere to any specified page/word limits.