
NAME
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Expense Report

Chapter Eight: Research Proposals/Fellowships

When would you write a research proposal?

Even undergraduates may write research proposals for a project, a senior thesis, a fellowship application. NSF and a few scientific societies accept fellowship proposals from seniors who can them use them at any graduate school to which they are admitted (http://www.nsf.gov). Most Ph.D candidates will write research proposals for their qualifying exams and possibly for pre-doctoral fellowships.

General Pointers:

1. Realize that while writing a research proposal might seem overwhelming, with organization and preparation, it doesn't have to be a daunting task.
2. Expect writing a proposal to take work and planning and make sure you allow an adequate amount of time for each step. The level of detail required will depend on the page length and your stage of career development. No one expects a college senior to write the same type of proposal as a Ph.D. candidate writing a qualifying exam proposal.
3. When brainstorming to find a topic, consider looking into ideas from classes, seminars, or something you read that caught your attention.
4. Realize that while it is important that your topic be interesting, your goals should be achievable. This means you must have a sufficient amount of background information on which to base the study and a realistic plan to accomplish the goals. You're not proposing a plan that would take 10 people 10 years to do the project.

Common Components of a Research Proposal:

1. Typical proposal format
   (extent of details included will vary with the page limit)
   - **Aim:** to ask a question or put forward a specific goal, not to suggest a specific experiment. Clearly define your purpose with precise questions you wish to investigate and the techniques that you will utilize. Often having 3-4 aims is an appropriate amount. Be sure that doing the project does not depend on a specific outcome from the first aim.

- **Background:** What is known and unknown about the problem you propose to study? Why is the question(s) you are asking important? What will be gained by answering it? What are the controversies related to the topic?
- **Experimental design:** What experiments will you do to complete the aims, test the hypothesis and answer the questions? For each experiment include a purpose, the techniques you will use and how you will interpret the data.
- **Methods (sometimes combined with experimental design):** What are the specific techniques and procedures you will use in your experiments? Describe the techniques in the amount of detail that is appropriate for the length and sophistication of the proposal. A two page proposal leave limited space for discussing the details of technical issues. For longer proposals you can point out the advantages and disadvantages and the limits of the technique. You should consider limitations like: sensitivity, expense, number of animals, precision of data, amount of computer time required, etc.
- **Conclusions:** What do you expect to learn? What problems could arise? What other approaches might you consider? While the depth to which you can address other approaches varies with the length of the proposal, it's good if you can include at least a statement about alternative ideas.

Common Barricades to Writing:

1. **Don't know enough. Solution:** Read the literature, talk to experts.
2. **Can't get organized. Solution:** Get all your information together and organize it by type of information or the point it supports. Start brainstorming your thoughts in any order, and go back later to organize them in a logical sequence.
3. **Too overwhelmed. Solution:** Break down the project into smaller units, 1/2 hour or 1 hour increments, start typing without being critical about your words so you can get started.
4. **Language barrier. Solution:** If your barrier has to do with the technical language, keep reading the literature and talk to experts for explanations and clarification. If your barrier is that English is your second language, then have a dictionary in hand while you write. Also, be sure to discuss

your project with others, and have them read through it to critique your wording. You might have to write the proposal in your native language, then translate it into English. You may even want to find an organization that helps people improve English skills.

5. **Not in the mood. Solution:** Get over it and just do it! A lot of good writing happens when people aren't in the mood. Often what happens is you'll keep procrastinating until you have so little time to write that you get stressed out and even more overwhelmed. Just start writing. Create an atmosphere conducive to productive writing by eliminating distractions, having the "write" resources (laptop, papers, a quiet place, the right music to help you concentrate. If you get the fellowship maybe you can buy the iPod (not on the grant,) with the money your Dean should give you for being industrious and getting your own money.)
6. **Waiting for adrenalin to flow. Solution:** Never wait too long, even if you "work better under pressure". Pressure can cause you to judge your work inaccurately.
7. **Really blocked. Solution:** Pretend you're giving a talk and start taking notes. Discuss the topic with a friend and have paper or a laptop ready.
8. **Scared of writing. Solution:** The fear is usually much worse than the act. What's the worst that can happen? Someone who sees it will think you are not a good writer. So, learning to write well is part of your education. Not writing will really inhibit your career progress. It's not as hard as you think.

How hard can it be to write a fellowship proposal?

I left graduate school terrified of writing grant proposals. I'd seen faculty hide from everyone for months while they wrote proposals. It seemed like a daunting task. My post-doc mentor, Anthony Means, Ph.D., tricked me into writing a NIH NSRA post-doctoral fellowship by telling me it wasn't a real grant and that I probably wouldn't get it because it was so competitive, but he thought it would be a good experience for me and after all he was funding me. Well, he lied, at least about it not being a real grant. It was a small grant for one person to do in three years. But an amazing thing happened. As I started thinking about how to study protein phosphorylation in a totally new system to me, I started having fun writing the proposal. By the time I had completed the proposal, I had finished something that I didn't do earning my Ph.D. I had developed a logical plan beginning to end to answer a relevant biological question. My Ph.D. dissertation project had evolved so gradually and with so many dead-ends that proposing a new project was a joy. What was even more amazing was that the proposal was funded and my plans worked. The same skills that I used writing the fellowship, I later adapted to writing educational grants. Leaving graduate school I would never have imagined that some day I would write and supervise projects that garner a million dollars a year to train the next generation of scientists. Grant writing phobia – be gone!

Practical Considerations:

1. Inform others that you are preparing a proposal and let them know how much time it will take you to complete it.
2. Grocery shop, pay bills and wash clothes ahead of the deadline so you can focus on your proposal.
3. Don't worry about the small things that don't get done while you are working. You will have to sacrifice some things in order to devote extra time to you proposal.
4. Let people be supportive and recognize the value of constructive criticism.
5. Be cautious about discouragement regarding writing the application. If someone who reviews the applications, tells you that you won't meet the requirements for funding because you have a 2.7 GPA that is different from someone saying you shouldn't bother to write the proposal because no one from your school has ever received one. And if you had that 2.7 GPA, do better in grad school and then apply. Once people get turned on to science and start to meet their full potential, they may receive fellowships based on outstanding proposals.

Fellowship Applications

Purpose and applicant pool

Fellowships provide sources of funding to facilitate scientific training. Organizations seek to sponsor talented, motivated scientists with promise to develop independent careers. Fellowship awards are used for FOREVER in assessing your competitiveness for other funding. There are a few fellowships for which undergraduates can apply before they start Ph.D. programs, including those from NSF, which you then take with you to the graduate school you decide to enter. Realize that the earlier in your training you write the proposal, the less likely you are to do the actual project you describe. Review committees use the proposal to get a sense of what you know and how you think about science or engineering. You are not committed to doing the project you describe in a fellowship proposal.

Most fellowships are targeted toward developing scientists; pre-docs or post-docs or recent M.D.s seeking research training.

Many fellowships are targeted toward specific areas of research, mostly to provide young scientists with an introduction to a field of research, not necessarily a specific project. Others, for example NSF or HHMI, are designed to support phases

of education and training in science in general within broader disciplines. NIH fellowships are a hybrid designed to support training but are administered by agencies with specific scientific goals.

Budget restrictions

Most fellowships provide salary support. Many provide only partial salary, which may be supplemented by the lab or graduate school to bring the recipient to a standard compensation.

Some include funds for travel to conferences, supply money (computers, etc., but not iPods), or pay your health insurance.

Some provide tuition to the institution for pre-doctoral recipients.

Length of award

Varies with organization and purpose of award. Often a 2-3 year duration.

There are special awards for those writing dissertations.

Finding fellowship information

1. Use the web! Find links for NSF for fellowships that you can apply for in your senior year.
   Check websites for NIH and NSF for fellowships once you are in graduate school, the GREAT Group website (http://www. aamc.org/members/great), or those of professional societies that fit your interests.
2. Talk to others in your program and department, discuss opportunities with your advisor.
3. Your undergraduate research program office or career center may have a list of fellowships.

Preparing application materials

1. Get specific information from the granting agency. Follow all directions.
2. Be sure you are eligible for the award; pay attention to types of training covered, times during training allowed, degree plans allowed, area of focus, residency or citizenship requirements, special population requirements.
3. Match the time you can commit to the application requirements. Can you finish by the deadline? Does the application require a 2 page proposal or a 15 page detailed grant?
4. Make a check list of what you need to provide, which will vary between applications.
   Typical information includes some or all of the following: personal

data, GRE scores, transcripts, form pages (with signatures by institution officials), letters of recommendation, list of honors, abstract, proposal, explanation of how the fellowship will enhance your training or other essays, lists of presentations or publications.

5. Letters of recommendation are an important part of the application. The shorter your career the more reviewers rely on letters from scientists who know you and can evaluate your potential.
   Request letters of recommendation at least one month in advance (if possible)
   Inform recommender of the nature of the fellowship in writing
   Diplomatically ask recommender if he/she can write a good recommendation letter
   Provide information on your accomplishments (copies of abstracts or publications)
   Follow-up to see that letter is received
6. Applications may need to be submitted through an Office of Research, with appropriate forms.

Writing a proposal

1. Develop a concept; then clarify ideas
2. Conduct a literature search to find what hasn't been done
3. Assess resources and time for which training will be supported
   What other financial resources will be available to support the project?
   Should you consider involving collaborators?
4. Define the specific aims (what you hope to accomplish)
5. Write an abstract (may be required; good way to organize thoughts even if not needed)
6. Describe the research approach, the problems/limitations anticipated and approaches to solve the problem, achieve the goals, answer the questions
7. Once you know what you will do, get forms and institutional clearance for experiments
8. Emphasize the significance of your work
9. Provide background information that lays a foundation for your proposal
10. Create figures for your preliminary data , if allowed and you have any preliminary data
11. Get others to read and critique your proposal
12. Revise your proposal

13. Proofread your proposal
14. Review your checklist; file application and relevant information
15. Follow-up to be sure the application was received

Inter-, multi-disciplinary research is being emphasized as the key to science of the future. Remember those weird courses you took that weren't really required for your major, you just thought it would be interesting to take them? They may be the launch-point for thinking more broadly about how to approach a problem. Every science and engineering major would benefit from taking biology, chemistry, computer, physics, engineering and statistics courses. Or even better, maybe your campus has developed interdisciplinary courses or seminar series or journal clubs to help students develop broader perspectives on thinking about science and engineering applications. The "Fundamentals and Frontiers of Biomedical Research" daily seminar series offered by the SMART Program presents an overview of biomedical research from a multi-disciplinary approach that features geneticists or cell biologists one day, biophysicists the next, a computational biologist, a physician/engineer working on a biological problem the next day or even scientists who are knowledgeable in so many areas they can't be classified. When I developed a Minority Scientist Seminar Series at BCM, I was thinking about the students' need to connect with scientists from their own backgrounds. What I didn't think about until later was that when minority students came to seminars outside their field to hear inspiring speakers, they would gain broader perspectives on doing research. I'm trying to decide how to analyze whether that broader perspective contributes to the incredible success of minority students in BCM Ph.D. programs, particularly with respect to winning so many of our research awards and national fellowships *(http://www.bcm.edu/diversityprogams.)*

If fellowship is awarded:

- Review critique, if available, to improve outcome.
- Send a letter of acknowledgment.
- Review requirements for progress and final report.
- Outline timetable for work and relevant presentations or trips to conferences.
- Do the work! Or something related enough that it meets the requirements for support.
- Provide highest visibility for support; presentations, publications, letters to Congress.
- Always list the funding source on abstracts and publications
- Personally interact with representatives of the funding agency; email or at meetings.
- Send progress reports and updates.

If you don't get the fellowship:

- Realize that fellowship competitions are competitive. Many good proposals are not funded.
- Read the critique, if available, and learn how to improve the proposal.
- Make some notes on what you would do differently if you were starting over. Keep the notes in a file marked "the next success".
- Decide whether to resubmit the fellowship
    - Can you address the weaknesses?
    - Is there sufficient time to resubmit the fellowship before you graduate?
- If you decide to resubmit, be sure you address the reviewers, comments, update the proposal (check the literature for new papers), add preliminary data you've acquired