Grant-writing Advice

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Source: http://www.sdstate.edu/sites/default/files/engr/research/facilities/upload/Hints-for-Writing-Successful-NIH-Grants-by-Ellen-Barrett.pdf

Timeline: Allow at least three months to write the grant after you have collected all (or most of) your preliminary data. It takes longer than you think to assemble all the needed information and organize it clearly, secure appropriate letters of collaboration and consultation, etc. READ THE PUBLISHED NIH INSTRUCTIONS AND FOLLOW THEM TO THE LETTER. There is a law or a scientific rationale for every piece of requested information, and the funding of a grant can hang on what appear to be small details.

Self-directed peer review: Write your entire grant application, then set it aside for a few days. After that, re-read it in its entirety; you'll be surprised how many errors of repetition/poor logic/inconsistency you will find in the early drafts. Then give your revised draft to outside readers, allowing two weeks for their reading and critique, and then an additional two weeks to incorporate their suggestions. Give these outside readers your best draft, not your first draft. Don't waste their time, patience, and expertise by giving them a draft that is incomplete or full of mistakes you could have fixed yourself.

Who should critique your application?

1. A non-specialist in your field (preferably a funded scientist with study section experience) should read Budget with Budget Justification, Abstract with Specific Aims, Background and Significance, and Preliminary Data, to be certain that these sections are understandable and logical to a non-specialist. **At least one of the two-three persons who reviews your formal grant application will likely be a non-specialist.**
2. A specialist should read Preliminary Data and Experimental Methods, to make certain that the experimental plan is efficient and compelling, using the best available techniques to answer the questions proposed.

Look upon grant writing as the rigorous intellectual challenge that it is. You can learn a great deal in preparing a good grant application, and that learning can not only help get you funded, but also help you do better work once you are funded.

Concerning ABSTRACT and SPECIFIC AIMS

These two very important sections should mesh well together (avoid excessive repetition). They should be the first sections you write, because it is always good to outline what you plan to do before beginning your detailed writing. They should also be the last sections you revise, because it is imperative that they agree with what you have written in the Experimental Design and Methods section.

These sections should introduce the reader to:

1. The problems you are addressing, with some minimal background to orient the non-specialist.
2. The overall hypotheses you are testing, and the corollaries of these hypotheses that are being addressed by specific sets of proposed experiments,

3. The main techniques you will be using (to help study section personnel decide which reviewers to assign to your grant),
4. Your overall experimental plan. Indicate how the results of the various proposed experiments will mesh to form a cohesive whole that will advance significantly your field of research.

Most good research is hypothesis driven. Make certain that you understand what a hypothesis is: It is an overview of the mechanisms underlying the process you are studying, not merely your prediction about how one particular experiment will turn out. Design experiments that will test various predictions of your hypotheses from multiple angles. Make certain that your experimental plan never assumes that your hypotheses are true. This error has doomed many applications. Include only experiments that you have the expertise to do, and for which you have some preliminary data demonstrating feasibility.

Concerning BACKGROUND AND SIGNIFICANCE

The Background section should convince the reader that you have a good command of the current research literature in your field, and that you can be objective and thoughtful in your analysis of data. Don't dodge controversies, but make certain that you are diplomatic and non-dogmatic in your treatment of opposing hypotheses/points of view. You need to convince the reviewer that you are planning to test hypotheses, not simply to collect data to confirm your favorite hypotheses, and that you are open-minded enough to reject your hypotheses if the experimental results so indicate.

Make certain that your background discussion remains focused on the issues your experiments will address. Identify relevant published papers to which you or your laboratory contributed. Cite the work of as many different laboratories and points of view as possible, consistent with clarity and space limitations. At the end of each topic, point out to the reader how your proposed experiments will help resolve important issues in the field.

Your Significance section should be thoughtful, but brief. If your project concerns basic research, don't overstate its clinical significance.

Concerning PRELIMINARY RESULTS

This section helps demonstrate to the reviewer that:

1. You have experience (hopefully published) with most of the experimental techniques proposed in the application,
2. You can design logical, well-controlled experiments, and
3. You will present your results in a clear and thoughtful manner.

Show data demonstrating your ability to conduct the most difficult of the proposed experiments. Present your results, even if they are preliminary, in as professional a manner as possible, with clear and complete figures and table legends, calibrations, statistical analyses, etc. **Don't just show raw data. Show only results that are relevant to the proposed experiments**, and explicitly point out their relevance.

Present your preliminary data as objectively as possible. Don't overstate your claims or ignore different possible interpretations.

Publish as much of your work as possible in the most rigorous journals in your field. Their reviewers will provide expert commentary on your work, and the study section reviewers inevitably pay attention to the journals you publish in.

Concerning EXPERIMENTAL DESIGN AND METHODS
Indicate how you will design and execute experiments addressing each of your Specific Aims. Propose only experiments that are directly relevant to testing your hypotheses and that you have the expertise to execute successfully. Be aware of the limitations of each technique, e.g., don't use a qualitative method to address a quantitative question. Include appropriate controls. Don't propose more than your laboratory can reasonably do within the allotted time.

It often helps to divide this section into Detailed Methods (where you give all the important specifics) and Experimental Strategy, where a clear narrative indicates the rationale and design of each experiment, and the interpretation you would give to each possible experimental outcome. Address the most basic issues first. For specific representative experiments, indicate not only how you will execute the experiments, but also how you will analyze the data, interpret various possible results, and revise your experimental plan as results unfold. Indicate important specifics, citing appropriate literature. Minimize your use of abbreviations, and always explain the abbreviations you do use.

Address detailed attention to the techniques with which you have the least published experience, checking with experts to make certain your plans are realistic, state-of-the-art, and rigorous. It is helpful to state that you will consult with an expert concerning techniques in which you have less demonstrated expertise, but remember that all relevant techniques must be explained in your application. **Remember that you are trying to sell yourself as a person qualified to oversee the entire project.** If you do mention using expert consultants and collaborators, make certain that their Biographical Sketches and Support pages are included, as well as letters signed by them that specifically agree to do the things indicated your proposal. It is a good idea to send these experts a sample letter indicating the specific statements you would like them to include.

Avoid repeating yourself—it can make a tired reviewer angry.

Try to close Methods with some overall enthusiastic statement about the importance of your experiments, rather than just petering out leaving the reader exhausted by details.

Concerning BUDGET and BUDGET JUSTIFICATION
Ask for the minimum amount of money you need to do the work. If you pad the budget, the reviewers are likely to cut it by more than the amount you padded.

If you are just beginning as an independent investigator, don't ask for megabucks. Show the agency that you can complete a good small project for relatively few dollars, and they will be more willing to entrust you with more dollars to do bigger projects in the future.

Make certain your application is internally consistent. Your budget must agree with the experiments you propose.

JUSTIFY EVERYTHING. DON'T ASSUME THAT ANYTHING WILL BE OBVIOUS TO THE REVIEWER.
Personnel: Justify the amount of effort you propose to spend on the project; **less than 20% raises concerns about your commitment to the study. Don't ask for more than 50% if you are on tenure-track.** Indicate in detail how each salaried person (including yourself) will contribute to the project, including their experience and established expertise.

Consultant expenses: These are very hard to get. The request should be minimal and very well justified.

Equipment: Justify why you need each requested piece of equipment. If you are requesting a specialized item of equipment that costs more than standard, then you must specify in a convincing way which features of the deluxe model are vital for your project (i.e., why the standard, less expensive model isn't suitable for your project). Indicate, in both the justification and in your experimental methods, the specific experiments that need the requested pieces of equipment.

Study sections award equipment to beginning investigators just setting up their own laboratory, and to experienced investigators who need to replace equipment that has worn out or become obsolete. They will not give you an expensive item of equipment in an area in which you have no demonstrated expertise, so acquire the expertise on borrowed equipment before you apply.

Supplies: Design your experimental plan to make efficient use of supplies and labor. Think carefully about all the experiments you will need to do to accomplish your objectives, and plan your supply budget accordingly. Each year's requested budget must agree with the number and type of experiments you propose to do in that year. For example, don't ask for funds in years 1 and 2 for supplies for experiments that will not be performed until the third year. A carefully detailed supply budget helps convince reviewers that you are capable of directing the project.

If your university has made or will make a financial contribution to your project, e.g., funding a graduate student or helping you buy a piece of equipment, make certain that is noted. Study sections like to see a university commitment to the success of your research project.

REVISIONS
You will likely need to apply more than once. If your first application is rejected, read the reviewer's comments carefully. When you first read them, you will be sad and angry, so spend a week being angry—write nasty rebuttal letters, but DON'T SEND THEM TO ANYONE—they are for therapy only! Don't call anyone at the funding agency. Then a week later, after you have calmed down somewhat, re-read the critique and your application. Gauge whether or not the reviewers show any enthusiasm for your study—a senior investigator skilled in reading critiques will be helpful for this. Consider the reviewers' suggestions for change and their requests for more preliminary data. Figure out what parts of your application might have confused or misled them. Then decide whether your application is fatally flawed or fixable.

If you decide to fix the application and re-apply, respond explicitly to each criticism and suggestion, indicating how and where you have revised your application. If you disagree with the

reviewer on certain points, state your arguments in a logical manner. NEVER impugn the intelligence or motives of the reviewer. Add any additional improvements that you have thought of yourself, and point these out as well. Reviewers may have found twenty problems in your first application, but only commented on the ten that they considered most important. They will be impressed if you find and fix the other ten on your own.

Page limit requirements for NIH R01 grants: see more here https://grants.nih.gov/grants/how-to-apply-application-guide/format-and-write/page-limits.htm

Section of Application	**Page Limits** [if different from Funding Opportunity Announcement (FOA), FOA supersedes]
Introduction to Resubmission and Revision Applications	1
Specific Aims	1
Research Strategy	12
Commercialization Plan	12
Biographical Sketch	5

General advice for the entire process

(adapted from: http://gi.org/wp-content/uploads/2011/07/research-GrantWritingTutorial.pdf)

1. Make sure you are actually eligible for the award.
2. Follow directions.
3. Minimize the number and complexity of your hypotheses.
4. Be clear about your proposed study design.
5. Follow the suggested structure, and include all sections of the grant in the recommended order.
6. Try to answer a question that will have broad significance in the field.
7. Design a win-win proposal, i.e., ask questions that have publishable results, no matter how your study turns out.
8. Work with a statistician.
9. Check if the unit of analysis is the same as the unit of observation.
10. Make sure your terminology is clear and consistent throughout the grant.
11. Make sure your budget is appropriate and makes sense.
12. Proofread.
13. Make sure that your letter writers and collaborators have read your grant and understand what you need.

Useful links:
https://report.nih.gov/ — Research Portfolio Online Reporting Tools (RePORT): Search a repository of NIH-funded research projects and access publications and patents resulting from that funding

https://grants.nih.gov/grants/how-to-apply-application-guide.html — The NIH official website for the grant application process.

All applications must be submitted in response to a Funding Opportunity Announcement (FOA). Funding opportunity announcements can be found at Grants.gov/FIND and in the NIH Guide for Grants and Contracts. In addition, NIH and other HHS Agencies have developed omnibus Parent Announcements for common grant mechanisms that have transitioned to electronic submission, for use by applicants who wish to submit what were formerly termed “unsolicited” or "investigator-initiated" applications.

Application due dates: https://grants.nih.gov/grants/how-to-apply-application-guide/due-dates-and-submission-policies/due-dates.htm