

Grant Writing Issues (emphasis on NIH applications)

J. Neale, Department of Biology, GU, 2/04 version

1. If your ideas are not significant to the field, your expertise not appropriate, and your methods not sound, a clear, concise and well organized, application will not get you funded. Conversely, a poorly written proposal will substantially contribute to a lack of appreciation of otherwise significant research. You must be self-critical of both elements.
2. How to write any proposal? Read instructions, then read again and follow precisely.

Assume **readers' perspectives**, generically and specifically:

- a. When the reader completes your grant, they should feel compelled to argue for its funding based on the rationale and preliminary data.
- b. Look up membership list of likely study section.
 - i. Use key words in abstract to target study section
 - ii. Cite likely reviewers, if possible, don't slight your competitors since they are likely ad hoc reviewers. Never hurts you to acknowledge others positively.
- c. Assume study section reviewer is **tired** (and irritable), in general, and tired of reading proposals.
 - i. This is work without much compensation.
 - ii. Reviewer may be reading applications late at night, on airplane trip to study section meeting, the night before the meeting, while being pressured with other professional responsibilities that more directly affect the reviewer's well being.
 - iii. Reviewer may be speed reading 10-15 other proposals.
- d. Assume one or more of the 3 reviewers has only generally familiarity with the specific elements of your proposal or even your field.
- e. Reviewer may have attitude: if your ideas are so good and the topic so significant, why didn't someone else already do these experiments.
- f. What is the benefit to the reviewer for serving on a study section?
 - i. status of being on study section, not want to look bad in front of study section (multiple reviewers will have individual views of your proposal),
 - ii. this can be a great learning experience, so the reviewer will be very happy if s/he learns something useful from your application (reviewing as an intellectual/professional development process).
- g. You are the expert in this topic and the reviewer may not be. Therefore you must educate the reviewer and not assume knowledge.
 - i. You want to give the reviewer all of the information related to your **hypotheses** that will result in a positive outcome in a **highly ordered and reiterative manner** so that the application is easy to read.

- ii. **Abstract**. Precisely makes your case, set the reader up and provide an ordered summary that can be used as reference later.

- iii. **Specific Aims**. Try to restrict to one page, **most important page in the application**.
 1. Begins with one sentence summary of long term goals of the program.
 2. Then sentence stating the overall goals of this immediate proposal.
 3. Then a sentence that emphasizes the significance of these goals. Where are you and where are you going, if not compelling, you have a problem.
 4. Next section of Aims: Shoot for 3 actual aims (each in one paragraph), each based on one key **hypothesis** (which should be stated as such) with rationale and an indication of the experimental approach for each hypothesis.
 5. If you have any aims that are potentially weak, don't include them even if someday you might want to possible explore the point within the grant. Once funded, grants don't typically restrict your potential to explore highly related experiments that were not covered in the original application, because good science is not so predictably linear. More importantly, I have never heard a study section criticize a grant for being insufficiently ambitious, but I have hear many applications criticize as **naïve for being overly ambitious** and within these there are always some aims that are great targets for criticism and they become the focus of the critique that kills the application.
 6. Make sure that the three aims are integrated or well related to each other and to the overall goal, if not obvious, point this out in concluding few sentences on that page. If you have not sold the reader into continued interest by the end of the SA page, you may not get a good read of the rest of the application.
 7. The reviewer must be able to refer back to this page frequently for reference when writing the critique and this page must sell the proposal effectively in the broad sense.

- iv. **Background and Preliminary Data**.
 1. Begin with a half page numbered outline of each of the key conclusions of this section that will be supported by the section/references.
 2. Write each paragraph and section with the goal of directing the reader toward one of your aims/hypothesis. Point out these relationships at the end of paragraphs and/or sections.

3. **Break up** this section frequently using clear bold headers to separate elements and use bold/underline/italics to highlight important sentences, data or conclusions to facilitate speed reading and review by the readers as they write their critiques.
4. Again, remember that after reading the proposal the reader is forced to write a critique. Your use of the outline, discrete sections, concluding sentences, and highlighting will assist the reader in organizing their thoughts in a manner that is consistent with your goals and rationales.
5. If there is a method that is considered advanced or new to your lab, point out in this section how this is so and how you will be able to do it or have done it. This can never be left vague. (also see below, how your listed **collaborators or consultants will work with you**...this will give your methods credibility)
6. **Use clear, even forceful, statements at the end of paragraphs** or sections to summarize the relevance of the section to your aims/hypotheses, experimental approach or the significance/uniqueness of your work/goals.
7. After writing this section **look to cut out** words, sentences, paragraphs that are unnecessary and that will distract the reader from your central points. Don't review everything related to your topic! Focus the reader.
8. In the last paragraph of your background and preliminary data section, **summarize your hypotheses, rationale and approach.**

v. **Experimental Approach:**

1. Organize by Aims
2. This is less about details of methods than demonstrating that your research group can do the work technically and without question.
3. Outline your experiments and point out where you have or are currently executing similar experiments. For any significant method that you have not executed before and/or for which you have provided no data, it is wise to **obtain a letter of collaboration** (or consultancy) from a colleague in your institution or elsewhere who currently publishes using this method.
4. Indicate the type of data that will be obtained and how it will be analyzed. Then reflect on the strengths and weaknesses of the approach and the likely data. Almost all methods and data have weaknesses. If alternative methods are available, indicate why the one selected is the best or the circumstances under which you might shift to the

alternative (be careful here, it might suggest that you really don't know what you are doing and are just listing methods randomly).

5. **Be your own best critic.** It will indicate to the reviewer that you really do understand the complexities of the science, that you are a critical investigator; even **compulsive** about your science....this is good. If you point out a flaw in your approach, but it is nonetheless the best approach available, this will not hurt you so much as demonstrate that you understand the science. If you don't do this and the reviewer identifies this weakness, it will be held against you twice: first for having a weak element in the proposal and secondly for not seeing this yourself. I have observed many applications praised for seeing their own weaknesses.
 6. Provide time line for completion of various projects within the 3 aims, note contingencies where they exist.
 7. Write a specific critique of each aim at the end of that Aim in the Expt Design Section. ...you can use this to diffuse the reviewers' critiques and to defend the issues. The reviewer can often use much of what you write and it helps them critically understand the work!
- h. Look up the elements and **criteria that are required in each reviewer's written assessment** for the study section and "pink" sheet (now white sheet). **You must speak explicitly to each item because the reviewer is required to do so.** As the reviewer reads your proposal they will be looking to answer these questions, indeed they are required to answer them so..... use your proposal to feed the reviewer the answers that you feel best reflect your proposal along with the rationale that the reviewer can use for each assessment conclusion. Typically, in NIH reviews the elements are:
- i. **Significance** of work: This may be obvious to you, but not everyone, so you need to clearly identify the significance in the abstract, specific aims, and background sections. You need to draw the relationships directly from the data you will obtain to its importance in the field. This does not mean curing a disease, necessarily, but rather to the research area that is itself already recognize as an important area.
 1. This is the first element that your reviewers will present to the study section and they need to be able to restate your rationale for this significance.
 - ii. **Innovation** – is the proposed research simply repeating known research or questions in yet another system or is it innovative in concept, hypothesis, goals, and methods? Abstract and Specific

Aims should provide the answer in short, while the Bkg section should amplify.

- iii. **Experimental Approach**. Second element required in reviewers written comments.
 1. Note strengths and appropriateness of this experimental design relative to other approaches that the reviewer may believe are relevant.
 2. Note clearly in your proposal where specific methods are ongoing in your lab.
 3. If they are not and could be interpreted as complex, find another lab that is currently executing these methods and have the lab director sign on as a “**consultant**” to your project—requires only a letter from that person—**make sure** that they have read the relevant methods section with respect to the experimental objective. This strategy **obviates a common critique** that the PI’s lab has never executed the protocol and that it can be difficult.
 - iv. **Investigator**. Have you demonstrated that your research group has the competence and expertise to do the work? This speaks to your experience in the field, your publication record, and more importantly the competence that you demonstrate via the application itself.
 - v. **Environment**. Generally, you should be able to demonstrate that your facilities are consistent with the proposed methods, if there are any issues here, address them clearly in the Experimental Approach section. Here again collaborative letters on facilities can be used to cover potential inadequacies, for example a critical instrument at a nearby institution that you will use.
 - vi. **Likelihood of Success (no longer a formal required element of the NIH review, but important nonetheless)**. Think about this as you write, convey high likelihood with specific preliminary data or by giving emphasis to published work from your lab and/or from others.
 - vii. **Strengths and Weaknesses** - would it not be best for you to formulate an objective statement of this yourself in the experimental design section. Often occurs that when there is a weakness that the PI recognizes, this mutes greatly the reviewer’s criticism of this point, particularly if it can be justified by the significance of the aims or the absence of a demonstrably better approach. Further, if one approach may fail, indicate the alternative approach that you would take.
3. Edit full document several times and be prepared to slash and burn on first two editings. **If possible, drop your weakest aim!!** Charge a colleague with examining the application to determine if it “leads the reader” clearly and

concisely to the desired conclusions. Have them simply mark without further detail areas that fail with respect to clarity, precision, organization, logic, and flow. Don't ask for line by line edit or they won't do it at all or in a timely manner. Ask them only to indicate points or areas that were not very clear to them. If they know the science, ask them to give you the **three harshest things** a not very knowledgeable, hostile reviewer could say about this proposal. There will be some truth to what you hear. Have someone in your research group or your significant other (if you have a strong ego) do the line by line editing for grammar, style, typos, etc. If you can get a scientific read from someone in the field, this is optimal.

4. Pink Sheets, triage, rejection, and resubmission. **“Those idiots just didn't get it!!!”**
 - a. Read your review comments **very** carefully (**each sentence is important**) with the attitude that to be successful, you will need to bring each reviewer around to your perspective by persuasion. This starts by **again** assuming their perspective as re-reviewers. Do they want you to tell them that they are idiots? So, tell them how cogent their comments were and attack your original application with each line of the review in mind.
 - b. Create a list of each reviewer's comments, possibly verbatim. Note on this list each place in the revised application where you have made a change in response to this comment.
 - c. On the (rare) occasion where the reviewer may have missed a point that you made in the original proposal, expand that original point slightly and point out that you may have failed to give sufficient emphasis to this excellent point made by the reviewer.
 - d. All(?) successful scientists have had many grant applications rejected, sometimes for good reasons, sometime for less reasonable critiques, but almost always because there are elements that needed fixing. Drop experiments, explain yourself more clearly, rethink approaches, but respond to each and every element of the reviews and do so in a positive manner. You will have 3 pages to list each element of the critiques and each element of your response at the beginning of your resubmission.
 - e. **Be careful about adding new aims** to a resubmission since the reviewers have not had a chance to critique them, they could be the substrate for a second less than successful review.
 - f. If you get triaged once, it is not the kiss of death, triaged twice by the same review panel, gives a low probability of a fundable score on third submission. On the other hand, any review that is within 100 points of a fundable score has the potential to gain that amount of ground in one resubmission, particularly if all of the reviewers' comments can be answered well.
 - g. If you get a poor score and there is very little substance for rebuttal in the reviewers' comments, this suggests that they simple did not view the work as significant or perhaps even credible. It is hard (perhaps impossible) to answer such review on resubmission. It may be that the proposal is indeed

not for very significant research in the context of that field or it may be that the proposal was reviewed by a less than appropriate study section.

- h. If you have any unanswered questions, call the executive secretary of the study section for assistance, (assume a very polite and cordial demeanor, even if you are angry, this person is not responsible for the review, just the messenger). Tell this person that you appreciate the comments in the review and that you are trying to answer them most effectively. Ask you questions directly, ask if this person had any insights that might not be obvious in the written critique and do not complain about your review, perceived mistreatment etc. unless there is some egregious and obvious issue that is worth noting....even then, be careful.
- i. **Giving up is not an option, look for a niche over the long term, submit often. Also remember that this stuff does not define your life as good. That life is good is determined by your ability to wiggle your toes each morning when you wake up. Other than that, it is a relatively short trip and you should enjoy.**

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