Writing a Grant Application: An Informal Guide

1. **Essentials**
   a. Significance
   b. Sound, clear hypotheses
   c. Productivity and demonstration of feasibility -- high quality results and figures
   d. Logical development of experimental design – experiments address stated hypotheses
   e. Can you do everything you propose to do in the time requested -- “Overly Ambitious” is one of the most common criticisms of young investigators.

2. **Before you start**
   a. Is it really time to write this grant application? Is it premature?
   b. Should you write that paper first?
   c. Plan ahead and don't rush -- give yourself 2-3 months to prepare the grant application.
   d. Arrange with colleagues or mentors to review a first draft of your specific aims early (6 weeks or so). You want the harshest critiques before you submit.

3. **Specific aims**
   a. Do the aims address interesting and significant issues?
   b. Are they hypothesis-based?
   c. Are they "win-win" – i.e., will an outcome consistent with the null hypothesis still be a contribution to the field?

4. **Background**
   a. Clear, well organized -- use subheadings. Make sure the significance of the topic is explicitly stated.
   b. State clearly where the gaps in knowledge exist in the field that your results will address.
   c. Make sure your references reflect an updated knowledge of the field.

5. **Preliminary results**
   a. Draw as much as possible on your past productivity; emphasize how your previous work leads up to the present proposal or at least demonstrates feasibility of methods to be used.
   b. Do not show preliminary results that are not of high quality -- this is your chance to represent yourself.
   c. Make sure that the major methods to be used in the proposed work are reflected by preliminary results. If you do not have expertise or preliminary results with a technique, make sure you list a solid, experienced consultant or collaborator and include a letter agreeing to the collaboration, and a specific statement about what the collaborator will contribute.
   d. Show detailed numbers and representative raw data where necessary, especially if this is work that is unpublished.
e. Put time and effort into preparing meticulous figures, graphs, or tables; this is your chance to demonstrate rigor and organization that will increase the reviewer's confidence that you can carry out the project. This cannot be overemphasized: a high quality application reflects high quality work (and vice-versa).

6. **Experimental design**

   a. This is one of the most common places where the text is insufficient. This is not just a place to tediously list group sizes, detailed methods, etc. This is the place to demonstrate your ability to think knowledgeably and logically.

   b. Develop your aims; of all the sections this may well be the part of the grant application upon which you spend the most time.

   c. What happens if your first specific aim doesn’t work out as you have predicted? Will aims 2, 3 and 4 then be rendered useless? Where do you go if the first step fails? Have multiple working hypotheses.

   d. One method that often works is to divide this section into subheadings after *each* specific aim is restated, as follows:

   - **Specific Aim #**
     i. **Rationale:** How does this design relate to your hypotheses? What is your reasoning (in detail)?
     ii. **Methods:** List general approaches first, explaining why the methods you propose are the best available for your questions. (*caveat:* if you realize that you do not have the best, most direct methods for your questions, you need to rethink your aims or incorporate collaborators or new preliminary data showing feasibility with the necessary techniques.) **Don't forget to address statistical analysis.**

     iii. **Anticipated results:** You need to devote a great deal of thought, and text, to potential outcomes and their likelihood of realization. Explain how you will interpret the different outcome scenarios and how these results relate back to your hypotheses. This is an opportunity to demonstrate creativity and enthusiasm for the data to be obtained, and show that you have considered the interpretation of alternative outcomes.

     iv. **Problems and pitfalls:** Be honest with yourself. If this section feels horribly uncomfortable, it is because you are probably trying an experiment that is not feasible. All experiments have pitfalls, but extraordinarily large pitfalls are likely to be unreasonable; hence, this section should serve as a reality test. Explain the pitfalls, and how alternate approaches will be used to overcome them if they occur. Do not think that avoiding mentioning a pitfall is a good strategy - it usually doesn't work. The reviewer will very likely notice the pitfall and believe that you are not aware of it, decreasing confidence in your ability to manage the data.

7. **Timetable**

   This is a worthwhile exercise, but does not need to take up an inordinate amount of space. The idea is to take a serious look at the amount of work you’ve proposed and demonstrate to reviewers that this amount is appropriate.