Tips for Writing Successful Grant Proposals During Surgical Residency

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If you are thinking of writing a grant proposal, keep these commandments in mind:

I. To Write A Clear, Concise, and Focused Proposal, Good Science is not Enough. You must also understand the mission statement of the funding agency to which you are applying. The strongest proposal is tailored especially for the agency it is directed to. The proposal must also be prepared exactly as the instructions say.

II. Allow Enough Time to Prepare a Great Application. The biggest mistake a first-time investigator makes is thinking a proposal can be put together at the last minute. Not allowing enough time for the iterative process of thinking, writing, getting feedback, revising again (and again), and final polishing, is likely to result in one or more “fatal” mistakes:

• Preparing an overly ambitious (and therefore not feasible and fundable) research plan.

• Problems with the hypothesis, study design, experiments, data analysis plans.

• Inadequate description of resources and mentor involvement.

• Typos, grammatical errors, and sloppiness reflecting poorly on how you would carry out research.

III. As Soon as You Think You Want to Apply for a Grant, Contact UCSF’s Office of Sponsored Research. All applications for extramural (= outside of UCSF) funding must be formally reviewed and approved by the Department Chair and by an official in UCSF’s Office of Sponsored Research (OSR). Therefore, as soon as you think you’d like to submit a research proposal, contact a Research Services Coordinator in the OSR who works with the Department of Surgery:

• If you are working with a mentor in the division of Cardiothoracic, Vascular, or Transplant Surgery, contact Mayumi Cutler mayumi.cutler@ucsf.edu.

• If you are working with a mentor in any other division within Surgery, contact Paul Tang Paul.Tang@ucsf.edu.

They will assist you in completing all administrative (as opposed to scientific) components of your application and will read the agency guidelines and let you know exactly the sections you will need to complete for your application and which sections they will complete for you. They will also complete
all internal forms, obtain approval signatures, make copies of hard-copy submissions and submit your final application for UCSF’s Internal Review (formerly known as the Office of Contracts & Grants) or directly to the funding agency.

IV. Know Where to Find Resources and Get Help (*but see Commandment II*). Be sure to see the sample proposals provided by other residents on the Resident Research website: [http://residentresearch.surgery.ucsf.edu/resources/resources/grant-writing--publications.aspx](http://residentresearch.surgery.ucsf.edu/resources/resources/grant-writing--publications.aspx)

Remember, you can ask for editorial help from the Department’s scientific editor, Pamela Derish, at any point in the proposal writing process: [pamela.derish@ucsfmedctr.org](mailto:pamela.derish@ucsfmedctr.org)

A. The Application Package  Most of the funding mechanisms for resident research require these items in the application package:

- Application Form
- Cover letter that outlines academic development plans & career goals
- Letters of recommendation
- CV with publications and/or biosketch
- Abstract
- Training Plan (paragraph)
- Research Plan (3-5 pages)

There are variations, of course, which is why it’s essential to read the instructions for *any* application carefully. There may be an **application form** to fill out, and in some cases, this is all that is required. Other funding agencies or societies will ask you to include a **cover letter** that outlines your academic development plan for the research year(s), and short and long-term career goals. You may be required to submit **letters of recommendation** from Dr. Ascher, your mentor, and in some cases, the sponsoring mentor of the society (e.g., Association for Academic Surgery).

You may be asked to include your **CV or biosketch** and that of your mentor. Formats for biosketches vary (for example, the NIH has a 4-page limit with a specific organization; the American Cancer Society has a 2-page limit, with a different organization). In general, the biosketch covers these topics: Education and Training, Positions and Honors, Peer-reviewed Publications, Research Experience. *(sample: [http://grants.nih.gov/grants/funding/phs398/biosketchsample.pdf](http://grants.nih.gov/grants/funding/phs398/biosketchsample.pdf); ask your mentor too).*

Some agencies will ask for a technical **abstract** (for scientific reviewers) only, but others will ask that you also include a lay summary of the project. Technical abstracts tend to contain shorter background
sections, describe the key preliminary results, the proposed aims, and the research approach that will be used to complete the aims. Lay abstracts are usually required for private foundations (like the American Cancer Society) and should be widely understandable by non-scientist reviewers. Lay abstracts tend to provide more context and emphasize the project’s significance. (samples: ask your mentor for abstracts used for recent proposals from the research lab or group)

Many agencies ask you to describe the training activities that will be part of your research experience. For short proposals, this may be no more than a paragraph, but should be “personalized” with respect to your training needs as much as possible. It can be a good idea to propose a combination of didactic and “hands-on” research experiences. A degree-granting program (e.g., MPH) may be appropriate, but as much as possible, personalize it to meet your research and career goals. (samples: Wang ACS and NRSA proposals on Resident Research website)

B. Writing a “Reviewer-Friendly” Research Plan

To write an effective proposal, you have to know who your audience is. For many society awards, your proposal is reviewed by a committee of members. For many disease foundations, the proposal will be assigned to scientific reviewers, who give scores based on several criteria, and a “lay” person, who also gets to vote. It’s therefore essential to write your proposal with all of these reviewers in mind.

As a writer, your job is convince reviewers that your research is exciting, your questions are important, your research plan will answer these questions efficiently and convincingly, your proposed study addresses an important current gap or problem, and that you have the statistical power to find effects if they exist.

The Research Plan component of most resident grant proposals is 3-5 pages long (up to 6 pages for an NIH NRSA), usually including the following items:

• Abstract for the research proposal

• Aims or goals of the research

• Significance of the research

• Background information

• Preliminary data

• Experimental plan (methods, materials, limitations, pitfalls)

• References

It’s a good idea set up an outline for the sections of the Research Plan. Each section describes something important about the proposed research:
Specific Aims: goals of the research you intend to conduct  Background and Significance: importance of the research to science and public health  Preliminary Studies: data showing the viability of your proposal  Research Design and Methods: detailed description of your planned experiments

Start by drafting your hypothesis and specific aims because they are the heart of the research plan. They should be “vetted” by your mentor before you go on to write the rest of the proposal. The first step here is usually to come up with your research goal for the funding period. The goal needs to be realistic for the timeframe and resources that you will have to carry out the research. Then think about the specific hypothesis or focused objective of the research you hope to conduct. It must be logical, relevant to a gap in recent scholarship and/or assessed needs, feasible, and stated precisely (samples: Nijigal’s CIRM proposal; Harbell SUS proposal, and others).

*The specific aims should describe concisely and realistically what the proposed research is intended to accomplish. Usually, that will be to test a stated hypothesis, but it can also be to create a novel design, solve a specific problem, address a critical barrier to progress in a field, or develop a new technology. Note that a general (or long-term) goal is not the same thing as a specific aim:

- General goal: To improve the quality of alcoholism treatment
- Specific aim: To determine the relative efficacy of Treatment A vs. Treatment B for increasing abstinence among alcohol-dependent patients

Write your aims early so that you can incorporate feedback from your mentor. 2-3 Aims are the norm. It can be okay to propose 3 aims, but be sure the 3rd aim will fit into your timeline. Once your mentor has approved the hypothesis or objective and the aims you can go on to draft the Specific Aims section of the proposal. Whether you are allowed half a page or a full page, the general template for writing this section is as follows:

Phenomena X or disease X is... A characteristic feature of this process is... Although ABC has been shown to...it is unknown whether... Preliminary studies [or Recent studies from our lab] show that... However, it is unknown whether... Therefore, the overall hypothesis behind the proposed research is that... This hypothesis will be tested by the following specific aims:

Aim 1 will determine... Aim 1 will use X and Y methods to... We hypothesize that... Aim 2 will determine... Aim 3 will determine...

The results of this study will lead to a better understanding of Z.

Helping reviewers make the connections you want to make by telling them using explicit language: Our long-term goal is / What is not known is / The overall objective of this proposal is / Our central hypothesis is / The rationale behind the proposed research is / The work proposed in Aim 1 is expected to / No abbreviations (or as few as possible).

See how others have written the Specific Aims section (samples: Harbell, Wang, Nijigal, Carter, on the Resident Research website). Your mentor may also be able to share samples.

Now that the all-important Specific Aims section is out of the way for now (you’ll likely need to fine-
tune it later), go on to write the other parts of the Research Plan. Depending on the agency’s instructions, the next thing might be a section called **Background and Significance**, or single sections called “Background” and “Significance”. Here, your job is to build enthusiasm for your work by establishing several things in more detail than the “capsule” version of this in the Specific Aims section.

* **The content of the Background section** depends on precisely what hypothesis is to be tested, or what objective is to be attained. Be sure to...

1. Define the current state of knowledge in the field (using current, appropriate citations; **refer to recent reviews**, don’t think of this as an exhaustive literature review).

2. Identify important gaps, discrepancies, and questions that pertain to your area.

3. State how the proposed research will address these gaps and increase knowledge by weaving your specific aims into the narrative.

Don’t just **rehash** what’s been written—**interpret** it! Focus on ideas and concepts, not names and dates, which break up the narrative flow. (*samples: Harbell, Wang, Nijigal, Carter, Carter, on the Resident Research website*)

* **The Significance section** answers two important questions in the reviewer’s mind: 1) Can your research move the field forward? 2) Will progress in this endeavor make a difference in human health? First-time investigators often make the mistake of thinking that the significance of the research is the same as significance of the disease. The agency wouldn’t be funding research on that disease if it didn’t already think it was significant. Here, you need to convince reviewers that your research addresses an important, clearly defined question that pertains to health and /or mechanisms of disease. (*samples: Harbell, Wang, Nijigal, Carter, Carter, on the Resident Research website*)

* **Next up is usually the Preliminary Studies section**, where you show what you and your mentor have done and found, and how it serves as a foundation for the work being proposed. Be sure to show data that demonstrates your (and/or your mentor’s) ability to conduct the most difficult aspects of work being proposed. Organize this section by specific aim and present the preliminary data for each of those aims. Describe central experiments and the subsidiary experiments done to advance or exclude alternative explanations. Cite relevant publications and unpublished work. Make it clear why you did the studies and what the results mean, but it’s a good idea to avoid sweeping claims.

If you include tables and figures, note that **legibility is critical** or figures (in particular) are a waste of space and source of frustration for reviewers. A figure or table that accompanies the text should be **inserted after** referring to it in the text. If there’s no room at the bottom of the page after a table or figure is first mentioned, moved it to the top of the next page, with a note on the preceding page that says ‘(see Figure 3, top of next page)’. Figures should include legends and footnotes. In fact, you can fit methodological details in the legends (where you can usually use a smaller font, but don’t use less than 9 pt) and save space in the text. (*samples: Harbell, Wang, Nijigal, Carter*)
**The Research Design and Methods section** describes how you will carry out your specific aims. Usually, it is the longest section; approximately half the research plan because it covers a lot of ground:

- experimental design
- specific methods used (including any new methods & why they are better)
- data collection & analysis
- potential problems & how to mitigate them
- expected results
- alternative approaches

*Important distinction:* Design = the way in which you conceptualize your experiments. Methods = detailed discussion of exactly what you will do to carry out your experiments. Discuss them separately.

**For basic science research, you can organize as follows:**

- Specific Aim (restated verbatim from the Aims section)
- Hypothesis
- Experiment(s)  For each one or for a group of experiments (as appropriate for the science):
  1) Rationale and Design
  2) Methods
  3) Expected Results
  4) Statistical Evaluation
  5) Pitfalls
  6) Alternatives

- Here, describe in detail all methods *that have not been published*. Give a brief (≠ half a page) overview of methods that have been fully described previously in published articles and cite the reference.

**For clinical or epidemiological research, you can organize as follows:**
• Study population: eligibility criteria, rationales for inclusion and exclusion criteria, rationales for control groups.

• Subject recruitment, enrollment, and retention: sources of eligible subjects, methods for identifying, contacting, and enrolling subjects, including obtaining informed consent.

• Study procedures: Number of study visits, where study visits will take place, types of data that will be collected, who will collect data or perform procedures, where specimens will be stored/analyzed.

• Study Measurements, presented by aim or by how they will be used analytically: predictor variables, outcome variables, confounding variables.

• Data quality and management: e.g., staff training, how missing data will be handled

• Data analysis: hypothesis testing, sample size calculations, expected findings, data interpretation

• Potential problems and alternative approaches See sample grant proposals from other residents (Carter, Nijigal, Harbell, etc), and for clinical proposals, see the article by Inouye and Fiellin (citation is in the Resource section below).

C. Resources and Help

Recommended Viewing

Northwestern University’s Bioscience Program: http://www.northwestern.edu/climb/resources/written-communication/nih-grant-and-dissertation-proposals.html

The link takes you to videos that will give you guidance about how you should approach writing key sections of such proposals. Two videos are devoted to the all important aims page.

Samples

In addition to the sample proposals provided by residents (on the Research Resident website: http://residentresearch.surgery.ucsf.edu/resources/resources/grant-writing--publications.aspx), you can look at samples of successfully funded NIH RO1 applications (NIH NRSA applications do not require the 12-page Research Strategy but these NIH examples can still be tremendously helpful): http://funding.niaid.nih.gov/researchfunding/grant/pages/appsamples.aspx.
**Helpful Articles to Read**

A highly edited selection of articles for understanding the grant process and specific grant writing issues is available on the Resident Research website, so be sure to check there. Among them, you’ll find the following:

**Excellent articles for understanding the grant process from beginning to end:**

Chung, KC and Shauver MJ. Fundamental principles of writing a successful scientific grant proposal. *JHS* 2008; 33A, 566-572.


**Essential article for writing clinical proposals: (includes several real examples—clinical examples are very hard to locate so that’s why this article is “essential”):**


**Editorial Review**

The Department of Surgery’s editor, Pamela Derish, can help you develop the Research Plan component of your proposal so that you make a straightforward case for your work. She can also help you with your Biosketch and Training Plan. In general, Pamela will edit your proposal for organization, clarity, consistency, logic, emphasis, grammar, spelling, and style...

- checking that each section is complete and appropriate.
- querying you about statements that are unclear, missing, potentially problematic, or seemingly incorrect.
- whenever possible, providing suggested revisions of material that is ambiguous or discursive.
- cross-checking for accuracy among the different parts of the proposal.
- evaluating tables and figures.
- ensuring the proposal conforms to the style and requirements of the granting agency
- proofreading for spelling and grammatical errors. Most authors find it easiest to e-mail a file to Pamela Derish: pamela.derish@ucsfmedctr.org. She’ll need to know what agency you are applying to, the deadline, and who your mentor is. If you have any questions, you can call her at 415.885.7686.