Tips & Templates for Writing Successful Grant Proposals During Surgical Residency

Pamela Derish
Scientific Publications Office  •  UCSF Department of Surgery

1. 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. You must also understand the focus of a training grant is for you to

- Gain needed knowledge in specific areas (through coursework, tutorials)
- Learn and apply research skills, techniques (through hands-on, mentored/supervised work carrying out the aims of the proposed study)
- Publish the results; establish “track record” (essential “product” of grant funding)

2. Understand What Reviewers Look For. They will evaluate both your potential as a researcher and your mentor’s involvement in getting you where you need to be in terms of the training activities/plan and the research aims. In other words, it’s about the training as much as the science! The grant application needs to convey key information about both! It takes time and revising to do this well.

3. Allow Enough Time to Prepare a Great Application. The biggest mistake is thinking a proposal can be put together at the last minute (= a few weeks). Not allowing enough time (2-3 months minimum) for the iterative process of thinking, writing, getting feedback from mentors and collaborators, 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, training activities, and mentor involvement.
- Typos, grammatical errors, and sloppiness reflecting poorly on how you would carry out research.

4. 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.

5. Know Where to Find Resources and Get Help. The Department of Surgery’s Resident Research website http://residentresearch.surgery.ucsf.edu/resources/resources/grant-writing--publications.aspx is the place!
• Slide presentation prepared by the Department’s scientific editor, Pamela Derish, goes into more detail about writing and revising grant proposals, illustrating each aspect of the proposal with real-life examples.

• “Library” of different types of proposals written by DOS residents

• Pamela’s “Resource Guide for Scientific Writing and Presentations”, which is intended to help you succeed in writing, publishing, and presenting your research, preparing fundable grant proposals, and preparing CVs and personal statements for surgery fellowships.

• Links to other resources, including for NIH NRSA proposals

Many residents find it helpful to work with Pamela as they develop their proposals:

• Help with developing the Research Plan to make a straightforward case for your work

• Help with the Biosketch and Training Plan

• Help with revising to create a reviewer-friendly proposal that meets the word/space limits, is tightly organized and tells a compelling and concise story.

She’ll need to know what agency you are applying to, the deadline, and who your mentor is. If you have any questions call her at 415.885.7686 or send an email message to pamela.derish@ucsf.edu.

6. The “Typical” (non-NIH) 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 and/or Career 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. Roberts, 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 (e.g., the NIH has a 4-page limit; the American Cancer Society has a 2-page). In general, the biosketch covers these topics: Education and Training, Positions and Honors, Peer-reviewed Publications, Research Experience. For an example of an NIH biosketch, see DOS resident Nicole Conkling’s NIH proposal (pp 31-33) on the Resident Research Website: http://residentresearch.surgery.ucsf.edu/resources/resources/grant-writing--publications.aspx. Another NIH example: http://grants.nih.gov/grants/funding/phs398/biosketchsample.pdf.

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. 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. See sample resident proposals to see the various ways this is done: http://residentresearch.surgery.ucsf.edu/resources/resources/grant-writing--publications.aspx

7. Writing a “Reviewer-Friendly” Research Plan

To write an effective proposal, you have to know who your audience is. For many society awards, a committee of members reviews your proposal. 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 (also be sure to see sample proposals: http://residentresearch.surgery.ucsf.edu/resources/resources/grant-writing--publications.aspx):

• 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

Each section of the research plan 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/intervention.

Start developing your hypothesis and specific aims early on because they are the heart of the research plan. They should be “vetted” by your mentor (and maybe other collaborators) before you write the rest of the proposal. The first step is usually to come up with your overall research goal for the funding period. That goal needs to be realistic for the timeframe and resources that you will have to carry out the research (1 year for some agencies; 2 years for others). 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.

The specific aims describe concisely and realistically what the proposed research is intended to accomplish. Often, 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
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 part of the proposal that introduces the aims (The Specific Aims section).

The general template for the Specific Aims section is the same, whether you are allowed half a page or a full page. The difference lies in how much detail you can provide, given space constraints (see templates later in this document).

See how others have written the Specific Aims section (samples 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 may need to re-visit it again later), go on to write the other parts of the Research Plan. Depending on the agency’s instructions, the next section is likely 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 (for more on this, see slide presentation and Pamela’s Resource Guide for Scientific Writing – both are on 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.

* The Preliminary Studies section shows 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, 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.

*The Research Design and Methods section describes how you will carry out your specific aims. Usually, it is the longest section; approximately half of the research plan, because it covers a lot of ground:

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

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• expected results
• alternative approaches

*Important:* Describe in detail all methods *that have not been published.* Give a brief overview of methods that have been fully described previously in published articles and cite the reference.

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

• Specific Aim (restated verbatim from the Aims section)
• Hypothesis for this Aim (restated verbatim from Aims section)

  1) Rationale
  2) Experimental Design & Methods (including statistical evaluation)
  3) Expected Results
  4) Pitfalls & Alternative Strategies

Describe in detail all methods *that have not been published.* Give a brief overview of methods that have been fully described previously in published articles and cite the reference.

**For clinical research, you can organize as follows:**

• Study population: eligibility criteria, rationale for inclusion and exclusion criteria, rationale 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, (possibly presented by aim if appropriate) 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

**8. Abstract & Title**

The abstract is read by all reviewers and is their first contact with you and your ideas. It should include the following:

  1) brief background that sets up the key gap in knowledge your study is designed to address
  2) hypothesis and specific aims
  3) unique features of the project
  4) main methods to be used
  5) expected results
  6) description of how results will affect other research areas
  7) significance and health relevance of the proposed research  (for NIH, this goes in a separate section called “Project Narrative”)
  8) Avoid abbreviations and unnecessarily technical language (even for technical abstracts!). Use active voice and concise verbs to describe what you will do. If a “lay” abstract is required, avoid abbreviations and technical terms. This often requires using *more words* to explain concepts because technical terms are “shorthand”.

The title should be informative, not overly technical or disconnected to health relevance. Use the template “Effect of X on Y in Z” to describe the dependent and independent variables under study, and the material or population being studied.
Templates for the Specific Aims Section

*Use this one to create a ½ page Aims section for applications to SUS, AAS, etc.*

Succinct statement regarding the unmet need and/or gaps in our knowledge and why this is an important topic of study. 

*Our overall goal is to understand ____.* The *specific objective of this proposal is to ____.* The *central hypothesis is that ____.*

We formulated this hypothesis, in part, based upon our strong preliminary data, which shows that _____. The rationale for the proposed research is that once it is known how ____ we can _____. We will pursue these studies in three Specific Aims:

**Aim 1.** *To verb (define, establish, determine, etc).*

Our *working hypothesis for this Aim is that ____.*

**Aim 2.** *To verb (define, establish, determine, etc).*

Our *working hypothesis for this Aim is that ____.*

**Aim 3.** *To verb (define, establish, determine, etc).*

In these studies, we will examine the *prediction that ____.* The proposed work is significant because it ______, and is innovative because it capitalizes on _____. We expect that the combined work proposed will establish _____. By conducting this study, I will gain hands-on experience in ___, _____, and ______, as well as ______, all of which will provide a valuable foundation for my development as a surgeon-scientist.
Use this one to create a one-page Aims section for applications to the NIH
(You can find it on page 15 of the NIH F Award Handbook from UT Austin, on the Resident Research Website)

Overview/construction of typical Specific Aims page

Specific Aims

Succinct statement regarding the overall research area in relation to human health and disease. For example: Cardiovascular disease is the leading cause of death and disability in developed countries and is highly associated with numerous risk factors. These factors include genetics, diet, obesity, cigarette smoking, hypertension, blah blah blah.

What’s known (this section should include references!)

Gap in knowledge (i.e., what’s missing). For example: Despite advances in the diagnosis and treatment of occlusive cardiovascular disease, the mechanisms involved in ____________ remain to be established.

The proposed studies will address this gap by _________________. The combined results of these investigations will _________________.

The long-term goal of these research efforts will examine the hypothesis that ________________. The following Specific Aims will address this hypothesis as follows:

Specific Aim #1: To __verb__ (define, establish, elucidate etc)

Hypothesis:

Rationale and/or Approach:

Specific Aim #2: To __verb__ (define, establish, elucidate etc)

Hypothesis:

Rationale and/or Approach:

Specific Aim #3: To __verb__ (define, establish, elucidate etc)

Hypothesis:

Rationale and/or Approach:

Summary paragraph with restatement of the problem to be addressed and the area/approach of study. For example: In summary, the proposed studies will _________________. The proposed studies are significant because _________________. The planned approach is innovative because _________________. As a result, these studies will have a significant impact on our understanding/approach to _________________. and will lead to improved treatments for ________________ to reduce the death and disability associated with these devastating disorders. Completion of the proposed studies will also insure the comprehensive research training of the applicant and contribute to the development of a successful career as an independent (clinician) investigator.
Template for NIH “Project Summary”

(You can find it on page 14 of the NIH F Award Handbook from UT Austin, on the Resident Research Website)

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Overview/construction of typical Project Summary/Abstract

SELF-CONTAINED, CONCISE, AND POWERFUL SUMMARY; must fit within the space limitations in the form (30 lines)

Introduction - ~2-3 sentences to set the stage about the area of research and the nature of the problem to be studied, i.e., why do we care about the problem? <<<<THESE FEW SENTENCES MUST ADDRESS THE IMPORTANCE OF THE AREA TO BE EXAMINED IN THE PROPOSED STUDIES>>>>>>>

Statement of the problem / gap in knowledge that will be filled in the planned studies, i.e., what do you want to learn?)

Overall hypothesis

The following aims will address this hypothesis:

Specific Aim #1

Specific Aim #2

Specific Aim #3.

<<<<<Methods/approaches to be used to address the Specific Aims are usually BRIEF (or not mentioned) and are summarized at the end of the aims, e.g., molecular and genetic studies will be accomplished using an in vitro cell culture system, i.e., primary cultures of human umbilical vein endothelial cells

blah blah blah)>>>>>

Implications of the results to be obtained: Significance/Innovation/Impact, e.g., a statement of how will the results of the planned studies add to the body of knowledge to potentially change our understanding. For instance, “these studies are significant because” or “these studies are innovative because” or “these studies will have impact because”

And, brief concluding comment regarding how this training will prepare you for the next step in your career development, e.g., faculty or postdoc, towards your ultimate goal to become an independent investigator