Writing Successful Grant Proposals for Surgical Research During Residency

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1. The Grant Preparation Process
2. The Application Package
3. Writing a “Reviewer-Friendly” Research Plan: Aims, Background & Significance, Preliminary Data, Design & Methods
4. The Abstract and Title

Understand that Effective Grant Writing Requires 
Lots of Preparation

Start early:
1. Define project
2. Identify funding sponsor
3. Read proposal instructions
4. Know submission deadline

Timeline and Checklist for Grant Submissions

6 months before grant deadline:
- Identify a mentor and discuss grant opportunities and proposal ideas

3 months before grant deadline:
- Complete a draft of your research plan and have your mentor/PI review it
- Ask Pam Derish to review and edit your research plan – allow plenty of time!

2-3 months before grant deadline:
- Contact the Dept. of Surgery’s Research Management Services Analyst to assist with your grant submission (all applications must be submitted through UCSF Contracts & Grants!)

2 months before grant deadline:
- Find the C&G deadline for your grant (usually at least 5 working days before the actual grant deadline!)
- Review submission requirements with your assigned Analyst. Gather supporting materials:
  - CV/biosketch for you & your mentor
  - Letters of recommendation
  - Mentor
  - Department chairperson
  - Other required documents

1-2 weeks before grant deadline:
- Confirm your letters of recommendation have been received, or send reminders
- Submit your final, complete grant application

For more information:
http://residentreresearch.surgery.ucsf.edu/objectives--policies/policies/pre-award-guidance--deadlines.aspx
Understand that 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.

• Identify funding agencies whose priorities are similar to your interests.

Allowing Enough Time Can Help Prevent Fatal Mistakes

Mistake #1: No mastery of the literature

The applicant has not considered the recently published research on determinants of risk behaviors predicting graft survival in transplant patients who have HIV/AIDS infection, whereas the much older literature has been discussed.

Mistake #2: The Research Plan is overly ambitious

There are some concerns as to the likelihood of completing aims 2 and 3 within the allotted time given the pilot nature of the work and the number of techniques that need to be mastered.

Mistake #3: There are problems with the hypothesis, study design, experiments, data analysis...

• Hypothesis is ill-defined, lacking, faulty, diffuse
• Methodology is questionable, unsuited or flawed
• Inconsistency in level of detail from one experiment to the next
• Agents, clinical interventions, high tech procedures are not adequately described
• Are there alternatives worth mentioning
• Data collection procedures are not clear
• Power calculation isn’t included
• Data management plan is unclear

It is unclear that the analytic techniques will yield the anticipated outcomes.

Mistake #4: Resources and/or mentorship not adequately described

It appears that the lab does not have established techniques, models related to the applicant’s training and research goals. There is insufficient supervision by the mentor.
Allowing Enough Time Can Help Prevent Fatal Mistakes

Mistake #5. The proposal is messy, ergo the research will be messy too.

The committee commented on the less than stellar grantsmanship throughout the proposal. There were many misspellings, typos, and grammatical errors. Some members commented on whether the investigator would approach research and publication in a similarly sloppy fashion.

Prepare An Outline

Grant proposals are complex pieces of writing.

An outline can help:
- Keep things organized as you develop the various components.
- Ensure that each section contains the required (and appropriate) information.
- Expose gaps in your logic.
- Expose problems with development and flow of ideas and information.

The Typical Grant Application

2. The Application Package

- Application Form
- Cover letter that outlines academic development plans & career goals
- Letters of recommendation
- CV with publications
- Non-technical (lay) abstract
- Research Plan (3-5 pages)

* Slide shows requirements for the Association for Academic Surgery

The Typical Grant Application

- Letter from Sponsoring Mentor
- Letter of support from Department Chair
- Mentor’s Biosketch

The Typical Grant Application

- Research Plan (3-5 pages), usually including the following items:
  - Abstract for the research proposal
  - Significance of the research
  - Background information
  - Preliminary data
  - Experimental plan (methods, materials, limitations, pitfalls)
  - References
The Typical Grant Application: Biosketches

You and your mentor may be asked to prepare a Biosketch using the Agency template and page limit (e.g., 2 pp, American Cancer Society):

**Education and Training:** Include all degrees awarded: list the year conferred, institution, and field of study, and if awarded a Ph.D., the name of the mentor. Also list postdoctoral training, residency programs, internships. List title of position, mentor’s name, institution and exact dates of training.

**Positions and Honors:** List in chronological order, previous positions, concluding with your present position. State duration, title, and institution. List any honors.

**Publications:** Give complete references, including titles for all peer reviewed publications; begin each citation on a new line. If the number of publications is extensive, you may give a partial listing; indicate total number of publications (excluding abstracts, non-peer reviewed articles or book chapters).

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The Typical Grant Application: Biosketches

You and your mentor may be asked to prepare Biosketch using NIH Format (4 pp):

- **Education and Training**
- **Personal Statement**
- **Positions and Honors**
- **Peer-reviewed Publications**
- **Research Experience**


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The Typical Grant Application: Abstract(s)

Some Agencies will ask for a “technical” abstract or summary only. Others will ask for a technical abstract and what is variously referred to as a “lay abstract”, “lay summary”, “non-technical abstract” or “general audience summary”.

Consider writing the abstract(s) last to allow for the most concise description of the research project.

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The Typical Grant Application: Training Plan

Agencies vary:

- Some don’t ask for this.
- Some ask for the Mentor’s letter to describe this.
- Others ask you to include a paragraph about your planned training activities and how they will help you fulfill your research and/or career goals.
- Some ask for a detailed plan (2 pages or more)

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The Typical Grant Application: Abstract(s)

If you are asked for a detailed training plan (2 pages or more):

Write the training plan first. Then you can point to the specific aims in the Research Plan that will help you accomplish the training goals.

Develop a training plan that matches your needs exactly (not “off the shelf”). Propose a combination of didactic and “hands-on” research experiences. A degree-granting program (MPH) may be appropriate, but should still be “personalized”.

See sample (Dr Jon Carter’s NRSA)
3. Writing a “Reviewer-Friendly” Research Plan:

Specific Aims
Background & Significance
Preliminary Data
Design & Methods

Know Who The Reviewers Are

NIH and Surgical Society Awards (SUS, AAS, etc):
Proposal is looked at by a committee of members.

Disease Foundations (American Heart Assoc, American Cancer Society, etc):
Proposal will be assigned to scientific reviewers AND a “lay” person.

Don’t Make Reviewers Work Hard

Explicitly address the Agency’s review criteria.
“This proposed work is significant for three reasons. First, .... Second, .... Third, .....”

Generate excitement about your project.
Use strong active verbs.

Be interesting and clear, even to the non-specialist.
Avoid abbreviations & jargon.

Write a Proposal that is “Reviewer Friendly”

Make your proposal easy to follow:
- leave white space
- include legible figures
- use informative subheadings
- highlight important key points using bold-face type
- edit & proofread

Outline

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/Progress Report: data showing the viability of your proposal
Research Design and Methods: detailed description of your planned experiments
The Specific Aims Section

- introduce the problem you are addressing;
- identify the specific gap in knowledge that your research will fill.
- introduce the aims or objectives of project and the specific hypotheses to be tested;
- briefly describe the main techniques you will use to answer questions;
- outline your experimental plan;
- describe the advance your study represents.

Specific Aims Section: A Template for Writing

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... In Aim 1A we will... In Aim 2A we will... We hypothesize that...

Aim 2 will determine...

Aim 3 will determine...
The results of this study will lead to a better understanding of...

Source: Brian R. Wamhoff PhD

The Logical, Testable, Feasible Hypothesis

For more advice on developing a solid hypothesis, go to the NIH:

http://www.niaid.nih.gov/researchfunding/grant/strategy/pages/2designproj.aspx#d1

Step 1

✔ Develop Your Proposal’s Hypothesis or Objective

A focused objective or hypothesis must be

- Logical
- Relevant to a gap in recent scholarship and/or assessed needs
- Feasible
- Stated precisely

From Description to Hypothesis-Basic Science

1. We hope to observe how tumor cells respond to TGF-beta and if the responses promote angiogenesis and tumor growth.
2. We propose to determine how tumor cells respond to TGF-beta and if the responses promote angiogenesis and tumor growth.
3. We propose to determine the mechanisms by which tumor cells respond to TGF-beta and if the responses promote angiogenesis and tumor growth.
4. We will test the hypothesis that x is the mechanism by which tumor cells respond to TGF-beta and if the responses promote angiogenesis and tumor growth.
From Description to Hypothesis: Clinical or Epidemiological

1. **We hope to observe that** HPV infection is a risk factor for heterosexual HIV infection among women in Zimbabwe.

2. **We propose to establish a relationship between** HPV-mediated cervical lesions and the incidence of HIV infection among women in Zimbabwe.

3. **We will test the hypothesis that** HPV-mediated cervical lesions are not only more prevalent but enhance the acquisition of HIV in HIV+ women.  

*based on Sarah Averbach, MD, “The effect of cervical HPV infection on HIV acquisition among women in Zimbabwe (UCSF Pathways to Discovery Program, 2009)

What are the problems with the following hypotheses? Can you revise them?

**Analogs to chemokine receptors can be biologically useful.**

**A wide range of molecules can inhibit HIV infection.**

**Rheumatoid arthritis patients with active disease show many alterations in their immune profile.**

Step 2

✓ Develop your Specific Aims

A specific aim should describe concisely and realistically what the proposed research is intended to accomplish:

- test a stated hypothesis
- create a novel design
- solve a specific problem
- challenge an existing paradigm or clinical practice
- address a critical barrier to progress in a field
- develop a new technology

Develop Your Specific Aims

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

Develop Your Specific Aims

A general (or long-term) goal is not the same thing as a specific aim:

**General Goal:** Our long-term goal is to elucidate the molecular basis for suppression of innate immunity by type III effectors.

**Specific Aims:**

1. Determine the molecular consequence of ADP-ribosylation on the function of AKRPT and elucidate the role this protein plays in innate immunity.
2. Identify additional substrates of HopU1 and verify their involvement in innate immunity.
3. Analyze the affect that HopU1 has on host-microbe interactions.

Source: NIAID

Develop Your Specific Aims: They should...

✓ be logically connected to the rest of the Aims page (usually through the central hypothesis; each aim often has its own subhypothesis).
✓ go from most developed to least developed.
✓ complement each other and should NOT be contingent on each other.
✓ each have a concrete outcome.
Develop Your Specific Aims

**Write early.** Incorporate feedback from your mentor. **Essential to leave enough time for this!**

**2-3 Aims** are the norm. For post-doc fellowship, ok to propose 3 aims, but be sure the 3rd aim will fit into your timeline (2 years).

**Specific Aims:** Reviewer-Friendly Format

In addition to choosing words carefully, help 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/
- With respect to expected outcomes, the work proposed in Aim 1 is expected to

**No abbreviations** (or as few as possible)
Use *italics and/or underlining* (sparingly) to highlight key points. (Be very sparing of *boldface*)

**White space!!!** (open line after each paragraph, at a minimum)

**Specific Aims: Tips**

Go from most developed to least developed.
Aims should complement each other and should NOT be contingent on each other.
Do not just list experiments or a series of methods.

Avoid vague language:

**Bad:** "To study", "We hope to"

**Good:** "To quantify", "To determine", "To identify"

**Specific Aims Section: Length**

Half a page is typical for short grants = 5 pp or less
One page for NIH
Up to 1.5 pages for longer proposals (e.g., American Cancer Society)
Specific Aims Section: Hook the Reader in 4 Paragraphs...

1. “Set-up” (Introductory) Paragraph
2. Hypothesis Paragraph
3. Specific Aims Paragraph
4. “Pay Off” Paragraph (emphasize significance, innovation if earlier paragraphs don’t do this)

...or Less!
If you’ve got ½ a page, you can’t have 4 paragraphs; instead, think of 4+ sentences:
1. 1 or 2 sentences of introduction
2. 1 sentence of hypothesis.
3. Aims statements
4. Maybe a short concluding sentence about significance, innovation

Specific Aims Section: Remember...

YOUR GOAL: Convince every reviewer that the problem or need that you identify is relevant to the mission of the funding agency.

Provide an overview that frames the problem or need and establishes its significance.

Make sure to make it clear what is known and what is unknown.

Make it clear that your aims are focused, clearly conceptualized, and feasible, (and in many cases, will test a hypothesis).

Organization, brevity, and clarity are critical.

Write your Aims and plan to rewrite them. Send them to whoever is willing to review them. Allow enough time for this iterative process.

Back to that Outline

Specific Aims: goals of the research you intend to conduct

- Background and Significance: importance of the research to science and public health
- Preliminary Studies/Progress Report: data showing the viability of your proposal
- Research Design and Methods: detailed description of your planned experiments

Background and Significance

Is its own section for many funding agencies:

Specific Aims
Background and Significance
Preliminary Studies
Research Design & Methods

Background and Significance

Is sometimes two separate sections:

Specific Aims
Background
Significance
Preliminary Studies
Research Design & Methods

- For some agencies, the Significance section comes before the Background section.

Background and Significance

Not a section of an NIH Proposal. Significance is included in the Research Strategy Section, as is Innovation.

Specific Aims (own page, separate section)
Research Strategy (consists of several parts, total of 6 or 12 pp)
- Significance
- Innovation
- Approach
  - Preliminary Studies (for new applications)
  - Study Design & Methods

source: NIAID
Background and Significance

**Purpose:** Build enthusiasm for your work by establishing several things in more detail than the “capsule” version of this in the Specific Aims section.

**Background:**
1. Brief and focused history of what has been done about the problem
2. Current state of knowledge in the field
3. Gap(s) in the field that your project will fill (the ones you highlight in your narrative should be the ones you address in your proposal!)
4. Theories and concepts that will guide your approach

**Significance:**
Why the study is important.

Position your project in relation to other efforts and show how your project:

- will extend the work that has been previously done
- will avoid the mistakes and/or errors that have been previously made
- will serve to develop stronger collaboration between existing initiatives or
- is unique since it does not follow the same path as previously followed

Not an exhaustive literature review!
You don’t need to show that you’ve read everything.
Be selective, deal with contradictions, cite your own work and that of the reviewers.

In outline form, for all aims (or each one individually), include what you know about the following:

- importance
- existing knowledge
- gaps in knowledge to be filled
- innovation

Outline for Organizing the Key Information

<table>
<thead>
<tr>
<th>Importance</th>
<th>Existing Knowledge</th>
<th>Gaps to be Filled</th>
<th>Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Aim 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specific Aim 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specific Aim 3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

"Research Image", N. Bell
Background: It's about synthesis

There is much more background material than can possibly be included. Content 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).
2. Identify important gaps, discrepancies, questions.
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!

Writing Tips

✓ Write in paragraphs; 1 main idea per paragraph.
✓ Start with a topic sentence. (e.g., The pathogenesis of Acute Renal Syndrome is poorly understood.)
✓ Add the supporting sentences (e.g., the reasons for this poor understanding)
✓ Use transitions within paragraphs to indicate the logical progression (e.g., however, in contrast, next, although, nevertheless, likewise)

Background: Synthesis not Rehash

Example: Topic sentence first, then details:

Currently, the standard treatment for congenital hematopoietic stem cell disorders is postnatal bone marrow transplantation. The treatment efficacy using this approach is often limited by transplantation complications, such as graft versus host disease and graft rejection, by the availability of few HLA-matched donors, and by the morbidity of host myeloablation preceding transplantation (reviewed in *). The induction of donor-specific tolerance to transplanted allogeneic stem cells without long-term immunosuppression would therefore have important clinical applications.

Background: It’s about synthesis

✓ Within (and between) paragraphs, use transitions that make logical connections explicit.

Transitions can be words or phrases:

- therefore * thus * for example
- first * second * third * last
- in addition * in contrast * however
- because * furthermore * moreover
- in brief * although * whereas

Background: It’s about synthesis

✓ Focus on the ideas, not the names & dates

Names break up the narrative flow:

BAD: Jones et al. (2010) first found . . ., then Liu et al. (2011) reported...

Only drop names if it will really help.

Do drop your own name because it gives you credibility:

Your relevant published work gets cited here: ‘We previously showed…’
You can also direct readers “forward” by telling them to “see preliminary data”.

✓ End paragraphs with closing sentences:

“These studies demonstrate the importance of... (elaborate)...”

“These studies provide the important background for this study in...”

“The proposed project will build on this previous work [or address limitations in the previous work by (elaborate)]...”
Background: It's about synthesis

✔ Focus on the ideas, not the names & dates

Example
Numerous studies have shown that inflammation increases SQ RBC adhesion (5, 30, 34, 40) but few have provided direct evidence linking inflammation to vaso-occlusion. In the most convincing study to demonstrate this link (30), platelet activating factor increased SQ RBC-endothelial adhesion and vaso-occlusion in the artificially perfused rat mesentery, and blockade of the pro-adhesive integrin c5b3 attenuated these events.

Describe key findings from previous studies as concisely as possible.

Example
Ectopic expression of nkx2.5 in C. elegans body wall muscle directly activated expression of the endogenous myo-2 gene.

Trick: Describe the method in a sentence that presents the results = 2 for the price (space) of 1.

Regulatory T cells (Tregs) have been implicated as critical regulators of the immune system, responsible for maintaining immune self tolerance 9. Through the production of inhibitory cytokines and/or direct inhibition with cell to cell interactions, Tregs function to inhibit immune activity and thereby maintain self tolerance. Furthermore, recent evidence has demonstrated the ability of Tregs to promote tolerance following allogeneic postnatal bone marrow transplantation 10. Little is known, however, regarding their involvement in allogeneic IUHSCTx and this proposal will address the application of Tregs to improve host engraftment after IUHSCTx.

Source: sample grant from Amar Nijigal

Significance

1. Can your research move the field forward?
2. Will progress in this endeavor make a difference in human health?

Convinces reviewers that your research addresses an important, clearly defined question that pertains to health/mechanisms of disease.

Explains why your proposed experiments are an important extension of your preliminary studies.

Significance of your research is not the same as significance of the disease!
How to Communicate Significance

Establishing the source of tumorigenesis is a fundamental and unresolved issue in pancreatic cancer research. The cells of origin may solely determine pancreatic tumor phenotype. Alternatively, it may be the unique combination of genetic "hits" amassed by pancreatic cells, rather than the cells of origin, that determines tumor phenotype. It is the goal of my proposal to distinguish between these possibilities.

Source: Sample grant provided by Sam Wang

Preliminary Studies

✓ Shows that you know what you’re doing
✓ Shows that the work is feasible
✓ Shows suitable groundwork has been done (by you/your mentor)
✓ For clinical studies, shows pilot data on proposed intervention and availability of study participants

Preliminary Studies: Organization (Basic Science)

In each section describing preliminary data to support a Specific Aim…

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 avoid sweeping claims).

Preliminary Studies: Organization (Clinical Research)

In each section describing preliminary data to support a Specific Aim…

Indicate which studies provided experience with the proposed methods (e.g., study design, intervention, enrollment strategies, assessment tools) of the current study, even if they are on a different topic.

Cite relevant publications and unpublished work.
Both Hedgehog (Hh) and Wnt have long been known to play an important role in embryonic development, but the exact nature of their contributions to cancer development remains obscure. Previous histological studies on human tumor samples and recent work from our laboratory have implicated the Hh and Wnt signaling pathways in pancreatic tumorigenesis [6, 7]. Based on this work, we have developed mouse models of several pancreatic tumors.

In PanIN-PDAC lesions, we found that k-ras activation led to Hh signaling, in turn activated the Wnt pathway. These results imply a step-wise relationship from k-ras activation to PDAC formation, via Hh and Wnt signaling (Figure 1) [8]. This model suggests that Hh or Wnt activation would also produce PanIN-PDAC. While simultaneously activating k-ras and Hh (via GLI2, a downstream mediator of Hh) resulted in PanIN-PDC, triggering Hh alone led to only undifferentiated tumor formation [9] (Table 1).

When we perturbed the Wnt pathway, the results were also confounding. Triggering Wnt alone via an activating mutation of β-catenin (β-cat<sup>ex3</sup>), which is the downstream effector in the Wnt pathway, led to formation of solid pseudopapillary tumors (SPT), a rare and indolent type of pancreatic neoplasm, without evidence of PanIN-PDAC. More interestingly, when k-ras and Wnt were activated together, acinar cell carcinoma-like tumors (ACC) formed without PanIN-PDAC (unpublished data, Table 1). Like SPT, ACC is rare and comprises less than 1% of pancreatic tumors. However, it is more malignant in nature. This finding is notable because k-ras activation in the absence of exogenous Wnt activation results in PDAC formation.

Even though our early work suggested that Hh and Wnt act as intermediaries in a k-ras-PanIN-PDAC progression model, our recent studies suggest a more complicated relationship. Currently, it is unknown whether each type of pancreatic tumor arises from a unique cell type that is transformed when certain signaling pathways are perturbed. Alternatively, the tumors may originate from the same cells but the phenotype is determined by the combination of genetic changes. The objective of the proposed study is to establish the role that each pancreatic cell type plays in the formation of various pancreatic tumors.
Figures should include legends and footnotes.

Fig 2. Experimental Design for Aims 1a and 1c.

1) Fetal stem cell injection

2) Analysis of chimerism

3) Allospecific T cells and their cytokine profiles

Blood from pups is analyzed with FACS for engraftment of allogeneic cells.

Recipient pups

1) Fetal stem cell injection

2) Analysis of chimerism

3) Allospecific T cells and their cytokine profiles

This slide taken from sample grant provided by Amar Nijigal
Design and Methods: Writing
(Basic Science)

Cover Five Items Critical to Each Experiment:
1) Rationale and Design
2) Expected Results
3) Statistical Evaluation
4) Pitfalls
5) Alternatives

Include Power Calculations:
Do you have enough statistical power to find effects if they exist?

If you can, include a concluding paragraph:

Example (from Dr Carter’s NRSA proposal): The single greatest obstacle to widespread clinical practice of islet transplantation for Type I diabetes is a critical shortage of islet tissue. Means to augment islet cell mass in-vitro, coupled with means to efficiently utilize islets obtained from existing donors, would have a major impact on the field. Techniques for in-vitro expansion and cryopreservation adult human islets offer a potential solution for these barriers to transplant, but require further testing in animal models before application in humans. We aim to characterize and test such techniques in a diabetic murine model of human islet transplantation as a prelude to future human trials.

Design and Methods: Writing
(Basic Science)

Methods: Some Rules of Thumb

✓ 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.
✓ Write short paragraphs.

Design and Methods: Writing
(Clinical Studies)

Cover the Following Topics:
- Study population
- Subject recruitment, enrollment, and retention
- Study procedures
- Study measurements
- Data quality & management
- Data analysis
- Potential problems and alternative approaches

Include Power Calculations:
Do you have enough statistical power to find effects if they exist?
Design and Methods: Examples to Follow

- See Inouye and Fiellin article for clinical proposals (e-mailed to you)
- See sample grant proposals from other residents (Research website–Carter, Nijigal, Harbell, etc)
- See sample grant proposals at NIAID website (Tips & Resources handout)

4. The Abstract and Title

The Abstract

1) a brief background of the project
2) hypothesis and specific aims
3) the unique features of the project
4) the methodology to be used
5) expected results
6) evaluation methods
7) description of how results will affect other research areas
8) the significance and health relevance of the proposed research

View the abstract as your advertisement. Be complete, but brief. Use active voice and strong action verbs. Write it so it can be made public without revealing intellectual property. Use all the space allotted.

Look for examples!

- Your mentor’s proposals
- Sample proposals by other residents

Last But Not Least: The Title

Research intent and value should be communicated clearly, in plain English:

Before: G-PROTEIN SIGNALING IN SYMPATHETIC OVEREXCITABILITY

After: THE ROLE OF ABNORMAL G-PROTEIN SIGNALING IN HEART DISEASE

Look for examples:

*N* NIH’s RePORT Expenditures and Results (RePORTER) query tool
Revising: Mentor Review

To submit the most polished proposal possible, allow time for review by mentor(s).

• Have mentor(s) "vet" Specific Aims first.
• Then go on to write other parts of the narrative.

Help with developing the Research Plan component of your proposal so that you make a straightforward case for your work

Help with your Biosketch and Training Plan

Most authors find it easiest to e-mail a file to me at pamela.derish@ucsfmedctr.org

I'll need to know what agency you are applying to, the deadline, and who your mentor is. If you have any questions, call me at 415.885.7686.

Revising: Editing Help from Pam Derish

Available at http://residentresearch.surgery.ucsf.edu/resources/resources/grant-writing-publications.aspx