NSF-SPECIFIC GRANT WRITING WORKSHOP:
Writing a Compelling Grant Proposal to NSF

Sunshine Consultants, International
… specializing in research competitiveness

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There are Lots of NSF-specific Resources Out There

2011 NSF Grant Proposal Guide

http://www.clarku.edu/offices/research/pdfs/NSFProposalWritingTips.pdf
How to Write NSF CAREER Proposals

http://sciencecareers.sciencemag.org/career_development/tools_resources/how_to_guides/how_to_get_funding
AAAS very useful site. Read: How Not to Kill a Grant Application.

http://imechanica.org/node/588
By George A. Hazelrigg, National Science Foundation program director for 18 years. 12 steps of writing a successful NSF application.

How to Write an NSF Proposal

http://www.nsf.gov/bfa/dias/policy/outreach.jsp#present
NSF Regional Grants Conferences
Positioning Yourself to be Even More Competitive, Especially for NSF Funding

1. Visit your NSF Program Manager
2. Review grants; get on review panels
3. Invite leaders in your field to present seminars at ISU
4. Participate in workshops where “the community” defines priorities and what will be done next

Do all of the above. Do #1 this week.
Outline

Resources and Positioning Yourself to be Even More Competitive
Identifying the Proper NSF Program for Your Application
Understanding the Inner Workings of NSF’s Peer Review Process and what the Rating Scores Mean
Playing to Your Strengths
Generating Specific Aims with an Emphasis on Hypothesis-driven Research
Writing the First Two Sentences
Writing the First Two Pages (Significance, Innovation, Team)
Organizing and Writing the Approach Section
Conveying a Project Timeline
Data Management Plan, Postdoc Mentoring Plan
Writing the Project Summary
Fatal Flaws
Summary and Wrap-up
Outline

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Summary and Wrap-up
Identifying the Proper NSF Program for your Application

http://www.nsf.gov/mynsf/
My NSF

2011 NSF Grant Proposal Guide

NSF Regional Grants Conferences
Hosted by the University of Texas at Austin
October 17, 2011 8:30 AM to
October 18, 2011 4:00 PM
Austin, TX
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Program Director has a Lot of Latitude

Ad hoc Mail Reviews

Review Panels

Excellent
Very Good
Good
Fair
Poor

Combination of Both
Understanding the Inner Workings of NSF’s Peer Review System and what the Rating Scores Mean

- Technical Merit
  - Excellent
  - Very Good
  - Good
  - Fair
  - Poor

- Broader Impacts
- Program-specific Considerations
### Intellectual Merit Considerations

<table>
<thead>
<tr>
<th>Significance</th>
<th>Investigators</th>
<th>Innovation</th>
<th>Approach</th>
<th>Environment</th>
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<tbody>
<tr>
<td>• How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields?</td>
<td>• How well-qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of prior work.)</td>
<td>• To what extent does the proposed activity suggest and explore creative, original or potentially transformative concepts?</td>
<td>• How well-conceived and organized is the propose activity?</td>
<td>• Is there sufficient access to resources?</td>
</tr>
</tbody>
</table>
Understanding the Inner Workings of NSF’s Peer Review System and what the Rating Scores Mean

**Broader Impacts Considerations**

**Integration of Research and Learning**
- How well does the activity advance discovery and understanding while promoting teaching, training, and learning?

**Enhancing Diversity**
- How well does the activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic)?

**Building Infrastructure**
- To what extent will the activity enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships?

**Dissemination**
- Will the results be disseminated broadly to enhance scientific and technological understanding?

**Societal Impact**
- What may be the benefits of the proposed activity to society?
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Create the Aims of your Proposal with an Emphasis on Hypothesis-driven Research

Before You Start: Answer the 3 Key Questions

What are you going to do? STRONG research question

Why is it important to do this? Who cares? So what? What happens if you do this?

Why is your approach innovative? How is your approach creative? How are you going to do it?
Let’s Create our Two or Three Aims
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Let’s Write the First Two Sentences

The objective of this proposal is ...
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Now Let’s Work on the First Two Pages of Your Grant and then Organize the Rest of It

The Secret is to Organize and “Write to the Merit Review Criteria”

Project Summary – 1 page; write last
Background and Significance – 1 page or so
Investigators – 1 paragraph or so
Innovation – 1 paragraph or so
Approach (repeat for Aims 1, 2, and 3)
  Aim 1
    Hypothesis
    Background and Preliminary Data Supporting Specific Aim 1
    Approach to Specific Aim 1, Including Experiments and Interpretations
    Potential Pitfalls and Alternative Approaches
Environment – 1 paragraph or so
Integration of Research and Learning – 2 paragraphs at least
Enhancing Diversity – 2 paragraphs at least
Building Infrastructure – 1 paragraph or so
Dissemination – short paragraph
Societal Impact – 1 paragraph or so
Timetable – 1/3 page
The Cauliflower Method for Developing a Grant

EVERYTHING should relate to the central question: What are you going to do? Pare away anything else.
"I learned from a National Geographic photographer that their articles are structured to tell a compelling story when read in any of several different ways:” – Dr. Kiane McKnight

Pictures only
Pictures and captions only
Pictures and captions and some of the adjacent text
All material from beginning to end, at a leisurely pace

Adapted from Florida CRC Grants Workshop presentation by Bill Landing
Fig 1. Prothonotary warbler.

Fig 1. Increase in the number of prothonotary warblers in Austin correlates with drought conditions (2000-2011)(reference).
Organizing and Writing the Approach Section –
Declarative Headers are Very Important

Preliminary Data

or

Preliminary Data Demonstrating Feasibility of Aim 1

Experiments on Biosensors

or

Biosensor Using “Diving Board” Tip Demonstrates Unusual Specificity
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**Conveying a Project Timeline**
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Summary and Wrap-up
Don’t Forget Your Project Timeline – Here’s a Template

<table>
<thead>
<tr>
<th>Aims and Sub Aims</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
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<tbody>
<tr>
<td>1.1</td>
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Data Management and Postdoc Mentoring Plans

Template for NSF Data Management Plan. In general, the data management plan should answer these two questions: 1) *What data is generated by your project?* 2) *What is your plan for managing the data?*

- Expected Data
- Data Formats
- Access to Data and Data Sharing
  - Practices and Policies
  - Policies for Re-use, Re-distribution of Data
- Archiving of Data

Template for NSF Postdoctoral Fellow Mentoring Plan


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Summary and Wrap-up
A Winning Formula for Writing the Project Summary

The first 4 sentences:

Sentence 1: What will you do?
Sentence 2: Why is it important?
Sentence 3: What has already been done?
Sentence 4: How are you going to do it and how is your approach special?

Don’t forget that the abstract is hugely important for review panels where members who haven’t reviewed the proposal “vote”. Don’t simply copy-and-paste the first few sentences from your proposal.
A Winning Formula for Writing the Project Summary, Continued

The Second Paragraph

Technical Merit

The Third Paragraph

Broader Impacts

a) Integration of Research and Learning
b) Enhancing Diversity
c) Building Infrastructure
d) Dissemination
e) Societal Impact of the Technology or Science
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Fatal Flaws

Summary and Wrap-up
Fatal Flaws

Problems with significance:
• Not significant nor exciting nor new research
• Lack of compelling rationale
• Incremental and low impact research

Problems with specific aims:
• Too ambitious, too much work proposed
• Unfocused aims, unclear goals
• Limited aims and uncertain future directions

Problems with experimental approach:
• Too much unnecessary experimental detail
• Not enough detail on approaches, especially untested ones
• Not enough preliminary data to establish feasibility
• Feasibility of each aim not shown
• Little or no expertise with approach
• Lack of appropriate controls
• Not directly testing hypothesis
• Correlative or descriptive data
• Experiments not directed towards mechanisms
• No discussion of alternative models or hypotheses
• No discussion of potential pitfalls
• No discussion of interpretation of data

Problems with investigator:
• No demonstration of expertise or publications in approaches
• Low productivity, few recent papers
• No collaborators recruited or no letters from collaborators

Problems with environment:
• Little demonstration of institutional support
• Little or no start up package or necessary equipment

From: http://www.ninds.nih.gov/funding/grantwriting_mistakes.htm
Fatal Flaws, Continued

Insufficient innovativeness, creativity, originality

Failure to cite important literature

Problems with protections for human subjects:
  • Inadequate protection of identity
  • Unacceptable risks

Problems with use of vertebrate animals

Annoying the reviewer

From Jelinski observations
Make Sure All Players Are in Your Reference List

Advice from a Member of the National Academy of Science

Q: “Dr. Stern, how did you do it. What is your secret?”

A: “I referenced everybody!”

Melvin Stern, Department of Oceanography, Florida State University

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Summary and Wrap-up
Summary: How to Write a Winning Grant

1. Answer the 3 Key Questions
   - Answers generate hypothesis
   - Answers generate specific aims
   - Answers generate broader impacts
2. Write Elevator Conversation
3. Write first 2 sentences
4. Write first 2 pages
5. Use the “Cauliflower Method” to develop the full proposal
6. Use 4-sentence formula to write the abstract
7. Ask a colleague to read it before submission

Sentence 1: What will you do?
Sentence 2: Why is it important?
Sentence 3: What has already been done?
Sentence 4: How are you going to do it and how is your approach special?
Summary: How to Write a Winning Grant

EVERYTHING should derive from a STRONG research question.

Put yourself in the reviewer’s frame of mind and don’t expose your soft underbelly.