Grant Seeking, Proposal Preparation, and Proposal Review: views from both sides

Jim Kurose

Overview

- Introduction: the proposal process (NSF)
- 10 tips for writing a good proposal (personal)
- observations from former NSF’ers (public)
- other federal agencies, industry
- Lunch: the funding landscape
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National Science Foundation’s Mission

“To promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense...”
NSF by the Numbers

- $7.72 billion FY 2016 budget request
- 94% funds research, education, and related activities
- 50,000 proposals
- 11,000 awards funded
- 2,000 NSF-funded institutions
- 300,000 NSF-supported researchers
- 217 Nobel Prize winners
- Fund research in all S&E disciplines
- Fund STEM education & workforce

NSF: 7 Directorates

- Office of the Director
- Biological Sciences
- Computer & Info Science and Engineering
- Education and Human Resources
- Engineering
  - Geoscience
  - Mathematical and Physical Sciences
  - Social, Behavioral and Economic Sciences
Finding funding Opportunities at NSF

- directorate homepages: funding tab
- talk with program directors

Finding funding Opportunities at NSF

Types of Proposals:
- Unsolicited
- Solicited (responding to a solicitation)
  - “core” programs: specific division in directorate (small, medium, large)
  - cross-cutting programs (within Directorate)
  - Foundation-wide (e.g., GRF, CAREER)
- RAPID, EAGER
- Supplements, REU
Finding funding Opportunities at NSF

NSF-wide

FACILITATING RESEARCH AT PRIMARILY UNDERGRADUATE INSTITUTIONS:

CONTACTS

RUI/ROA inquiries regarding this announcement should be directed to discipline-specific contacts found at http://www.nsf.gov/crssprgm/rui_roa/contacts.jsp.

PROGRAM GUIDELINES

Solicitation 14-579

Important Information for Proposers

NSF Proposal Review Process:

NSF Review Criteria

Intellectual Merit
- advance knowledge, understanding?
- qualified proposer?
- suggest/explore creative, original or potentially transformative concepts?
- well-conceived, organized?
- sufficient resources?

Broader Impacts
- advance discovery and understanding while promoting teaching, training, and learning?
- broaden participation of underrepresented groups?
- enhance infrastructure for research & education
- benefits to society?

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1: Pick good problem(s)

- why is the problem important?
  - how does current context make this problem timely?
  - what happens if you do not solve it?
- new fundamentals/principles involved?
  - universal truths (best) versus point solutions (not as good)
- why is this the right problem for you to solve?
  - balance between experience and new directions
- a problem area with “legs”?
  - is this fundamental work leading to lots of future work?

A fool can ask more questions in a minute than a wise man/woman (or a Yoda) can answer in a lifetime

2: Every proposal tells a story

- story is not what you will do, but rather
  - what you will show, new ideas, new insights
  - story pitch may differ between programs and agency
- why is story of interest to others?
  - universal truths, hot topic, surprises or unexpected results
- know your story, practice your “elevator speech”
  - reflect in summary and intro
3: *What will you do? How will you do it?*

- basic questions all reviewers will ask
- so *ask and answer these questions* for the reviewers in your proposal

*what* – questions to be addressed

*how* – methodology to address questions

4: **Specific research questions**

- clear problem statements
  - pose questions, show initial results, demonstrate methodology
  - questions alone aren’t enough
  - how will you address them?

- some near-term problems that you have an idea how to attack

- list longer term problems that you may only have vague idea of how to solve
  - showing longer term issues is important for multi-year efforts (e.g., CAREER)
5: Initial work

- must be done before proposal
- initial results demonstrate feasibility
  - illustrative, explanatory to reviewer
  - provide intuition about what you will do
- but if the problems are basically solved already, then it's not proposed research
- illustrate approach(es) to solving problems
  - show you possess right skill set

6: Past work

- be specific about past related work, how proposed research differs
  - reviewers are knowledgeable, aware of past work [sometimes they did past work you're citing!]
  - establish current state of the art
  - what is the value added of proposed work, not just difference

"What Descartes did was a good step. You have added much …. If I have seen a little further it is by standing on the shoulders of Giants."  
Sir Issac Newton, 1676
7: Submit to a program funding the research you propose

- understand goals of program/solicitation
  - ask people who know, don’t assume or guess
  - essential for cross/special programs
  - what/who has been funded recently
  - communicate with program directors
- if your research fits into more than one program, communicate with relevant program directors before the submission

8: Know the review process

**NSF’s merit review process**

- proposals sorted and assigned to panels based on the summary
- A reviewer may read 10-15 proposals
  - lots of work, tiring
- reviewers will either be panelists present at NSF or participating in a virtual panels

**Other agencies**

- peer review vs. internal review
- may be less transparent
9: Put yourself in place of reviewer

- less is more
  - “I would have sent you less if I had had time”
  - take the time to write less; don’t overwhelm with details
- If reviewer not excited by intro, proposal is lost
  - Intros are fairly formulaic: learn the formula
- reviewers shouldn’t have to do extra work
  - they won’t “dig” to get story and understand context
  - provide enough context & information for reviewers to understand what you write
- page upon page of dense text: no fun to read
  - avoid cramped feeling of tiny fonts, small margins
  - create openness with white space: figures, lists

10: Master the basics of organized writing

- paragraph = ordered set of topically-related sentences
  - sentences should have logical narrative flow
- lead sentence
  - sets context for paragraph
  - usually ties to previous paragraph
- don’t:
  - mix tenses in descriptive text
  - use one sentence paragraphs or sentences with multiple clauses

“No tale is so good that it can’t be spoiled in the telling”
Proverb
10: Write top down

- computer scientists (and most human beings) think this way!
- state broad themes/ideas/questions first, then go into detail
  - context, context, context
- even when going into detail ...
  - write top down!

10: Good proposal writing takes time

- give yourself time to reflect, write, review, refine
- give others a chance to read/review and provide feedback
  - get a reader’s point of view
  - find a good writer/editor to critique your writing
  - you may get contradictory advice
- starting a proposal two weeks before deadline?
  - won’t generate great ideas
  - difficult to tell a cohesive story without iteration
11: Learn from Declinations

- declinations happen to everyone; get used to it
- learn from a declination
  - why was paper/proposal rejected?
  - what did/didn't reviewers see/like?
  - talk with program director, mentor
- A declined proposal does not mean your research is not worth pursuing!

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but first .....
What makes a proposal competitive?

- Original ideas
- Succinct, focused project plan
- Cost effective
- Knowledge and experience in the discipline
- Experience in essential methodology
- Realistic amount of work
- Sufficient detail
- Strong rationale or evidence of potential effectiveness

Adapted from Gisele Mueller-Parker, “How to Get NSF Funding: A View from the Inside”

What makes a proposal competitive?

- Choose a good problem related to your expertise but not continuing the PhD research
- Be enthusiastic and bold about your research
- Get mentoring and help in preparing a proposal
- Understand and follow our tips
- Read the solicitation and watch its webinar
- Know the proper home for your proposal and talk to a cognizant program manager before submitting
- Understand intellectual merit and broader impact

Adapted from S. Hambrusch, “How to Write a Good Proposal,” 2016 CRA Career Mentoring Workshop
Sample reasons for high ratings:

- “This proposal suggests a clear, elegant, well-documented approach to a problem that has plagued this field for decades.”
- “The PI has a beautiful plan. Undergraduates or new graduate students can step right into this work, yet it solves a major problem and will be publishable in a first-rate journal.”
- “This is certainly adventurous, and I frankly would have doubted it could be done. Yet the PI has proven the method in preliminary work AND had it accepted by a peer-reviewed journal!”
- “This reads like a dream. I have rarely seen a proposal, even from long-established investigators, that shows such careful thought and meticulous presentation.”

Adapted from Gisele Mueller-Parker, “How to Get NSF Funding: A View from the Inside”

Sample reasons for low ratings:

- No well defined hypotheses or tests of same. Lack of focus. “Why all the rambling, this seems like a fishing expedition.”
- Extraneous aspects or PIs. “What does that component/co-PI have to do with the central focus of the proposal?”
- Important information on experimental and sampling procedures is omitted. “I really can’t tell what is going to be done and how.”
- The work can certainly be carried out, but it doesn’t address any topic of broad current interest. “I would probably not read a paper describing the results.”
- Scope of the work is out of proportion to the budget and amount of time needed to do the work.

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Other Federal Agencies

<table>
<thead>
<tr>
<th>Agency</th>
<th>Funding (Billions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DARPA</td>
<td>$2.91</td>
</tr>
<tr>
<td>NSF</td>
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<tr>
<td>NASA</td>
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<td>DOE</td>
<td>$27.941</td>
</tr>
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<td>NIH</td>
<td>$30.203</td>
</tr>
</tbody>
</table>

Source: the 2015 Presidential budget request

- NIH: Promoting the nation’s health through research
  - Request for Applications (RFA), Program Announcements (PA)
  - external panel review similar to NSF
- DoD agencies:
  - Broad Agency Announcements (BAAs)
  - typically internal review
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Growing Division Budgets

*Modest, sustained growth across all CISE divisions*
Carry Out Mission by Supporting Basic Research

Basic research … results in general knowledge and an understanding of nature and its laws. This general knowledge provides the means of answering a large number of important practical problems ….

- Vannevar Bush
Benefits of NSF-funded Research

CISE Research: Addressing National Priorities

Big Data R&D

White House Initiatives

National Strategic Computing Initiative

Manufacturing, Robotics, & Smart Systems

Understanding the Brain

Smart Cities

Computer Science Education
Continuing Innovation in Information Technology

From Federally-funded Research to Billion Dollar Industries

Advances in computing, communications and information technologies, and cyberinfrastructure:

- drive U.S. competitiveness, (e.g., IT accounts for 25% of economic growth since 1995), and
- have profound impacts on our daily lives.

Examples of the contributions of federally supported fundamental research to the creation of IT sectors, firms, and products with large economic impact.

... across many industries
10: Introduction

- **If reviewer is not excited by intro, proposal is lost**
- Recipe to follow:
  - **para. 1**: motivation: broadly, problem area, why important?
  - **para. 2**: narrow down: what is problem considered? what is the current state of the art for solving problem? why is it insufficient?
  - **para. 3**: “In this proposal, we ....”: most crucial paragraph, tell your elevator pitch; make it easy to read
  - **para. 4**: how different/better/relates to other work; brief
  - **para. 5**: summarize your contributions at higher level, long-term 10K foot view of contribution: change the world! Brief summary of high level research plan
  - **para. 6**: ... remainder of proposal structured as follows ...
  - **figure**: high-level figure that establishes a mental framework for proposed project can also go in this section
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