Securing Grants as a First-Year (Computer Science) Faculty Member

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My view

- Currently 5th year faculty in Computer Science
- Primary focus in networking and systems
- This presentation is tailored to this setting

The right advice can vary by field and even by area

- Amount of funding needed
- Sources of funding
- Style of grant-writing
How much money do you need?

Per Ph.D. student

- ~ $25-30,000 per year
- ~ $50-60,000 per year with overhead

So you have to raise $300,000 per year

- for a group of 5 students
- + travel, equipment, summer salary ($30k + overhead), ...
- – internships, teaching, fellowships
- – no overhead if paid from gift money (from companies)
Major grant sources

National Science Foundation
  • Primary source of most CS funding

DoD

Companies

Special awards
Major grant sources

National Science Foundation

DoD

Companies

• Google Faculty Research Awards
• IBM Faculty Awards
• Cisco
• Verisign
• Intel
• ...

Special awards
Major grant sources

National Science Foundation

DoD

Companies

Special awards

- Microsoft Faculty Fellowship
- Intel Early Career Faculty Honor Program
- Sloan Research Fellowship
- Packard Fellowship
- ...

Major grant sources

National Science Foundation 71%
DoD 19%
Companies 7%
Special awards 3%
Common NSF grants

**Small:** $500k or less over 3 years
- Typically one or two faculty
- Due late fall each year (in CNS)

**Medium:** $1.2M or less over 4 years
- ≥ 2 two faculty
- Due early fall each year (in CNS)

**Large:** $3M or less over 5 years
- Larger collaborative groups
- Due mid-fall each year (in CNS)
**CAREER:** $400-500k over 5 years

- One early-career PI
- Three chances
- Deadline varies by area (summer)
- Significant emphasis on education component
- Considered prestigious, important for tenure
The NSF Review Process

Professor -> Program Manager

Panelist -> Panelist -> Panelist -> ... -> Panelist

Panel discussion

advisory ranking of proposals

Program Manager -> Program Manager

final decision

Result

1 page summary + 15 page proposal + misc. for your area

~ 10 panelists reading ~10 proposals each among ~20 submitted

4-6 months
Do you believe in this?

- Will your work really improve peoples’ lives or understanding? Or is it just some papers?
- Do you have a realistic chance of achieving your goal?
- Will you personally be fulfilled after working on this project for 3-5 years?
- Will you find students who are excited to work on this for multiple years out of their life?

Biggest value of writing a proposal is forcing you to think about long-term impact.
Do you believe in this?

Tell a story

- Not just a collection of disjointed problems
- Articulate cohesive mission in one sentence
- Work towards the mission in components of proposal
- Keep proposed work focused (more ≠ better)
High level advice

Do you believe in this?

Tell a story

Confront related work in depth

- Don’t try to hide related work
- Demonstrate understanding and clearly address differences
High level advice

Do you believe in this?

Tell a story

Confront related work in depth

Be specific in proposed work
Do you believe in this?

Tell a story

Confront related work in depth

Be specific in proposed work

Get feedback!

- Especially the introduction
- Start early
Summary 1 page

Introduction 2-3 pages

Background / Related 2-3 pages

Proposed work 1 6-9 pages

... 

Proposed work \( n \) 

Education, work schedule, past results \( \sim 2 \) pages
Compressed version of Introduction

Required to describe

- **Intellectual merit:** “potential to advance knowledge”
- **Broader impacts:** “potential to benefit society and contribute to the achievement of specific, desired societal outcomes”
Introduction

My rough outline

• Context and importance of the problem
• Why it is not solved by past work
• **One-sentence mission statement**
• Approach to accomplish the mission
• Why the approach is different than past work
• Specific proposed work

• Intellectual merit
  - Summary of contributions, maybe integrated w/above
• Broader impacts
  - Real-world code use, data, education, ...
• PI qualifications
Background

Related past work

- Thoroughly explore past work in preparation (one of the most time consuming jobs in preparing a new proposal)
- Organize into major approaches
  - Hopefully you introduce a significantly new approach
- Clearly describe each past work and why your approach is different and more promising

Your own past published work

- Highlight published past work here
  - Save unpublished preliminary work for later
  - i.e. clear separation with *done* vs. *proposed*
- Advertises your cred and potential of the direction
Proposed work

Clearly identify what is the proposed work

• Put it in section title
• Separate from your past work

Clearly identify what you are going to do

• Highlight specific contributions for the busy panelist (== all panelists)
• Then go into detail
Scope of proposed work

Mix of risk

- Some with preliminary results
- Some longer-term
- Some ambitious, might fail

Tough balancing act...

- It’s groundbreaking yet will definitely succeed!
- It’s new research but I’ve already shown I can do it!
Tough balancing act...

- I have failed in both directions:

“Contrary to what the proposal states, I do not see the beginnings of [the research result] in this proposal.”

“The idea of [research area] is novel and creative, however, that is previous work.”
Education initiatives

How much emphasis?

• Less than the research initiatives
• But always given some weight
• In CAREER, given significant weight – take it seriously!

Content

• Connect with research if possible
• Courses, outreach, survey papers, ...
• As always: Write only what you believe in
The famous Gantt chart...

<table>
<thead>
<tr>
<th>Task</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software test suite: core and final release</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hardware prototype</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optimal topologies &amp; benchmarking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity and cabling</td>
<td></td>
<td></td>
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<tr>
<td>Traffic engineering</td>
<td></td>
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<tr>
<td>Course module and e-book</td>
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</tbody>
</table>

Figure 3: Three-year research program timeline.
Results of past NSF support

Not much, if you’re first-year faculty...
Questions you might have.....

How can I have novel education initiatives?
Should I serve on a panel?
What is the target audience (panel composition)?
What happens after I submit?
How should I balance preliminary & new work?
Should I get letters of support/collaboration?
What’s the right volume of work to include?
Final disclaimer

Advice here is what has often worked for me

- In the area of Computer Science networking & systems
- Expectations vary across areas and fields
- Other styles of writing seem to work for other people

And there are never guarantees

- I’ve ceased trying to predict whether a grant will be funded (or whether a paper will be accepted)
- Best you can do is the research you truly believe in – and make sure your beliefs are based on careful thought