HOW TO WRITE A WINNING CAREER PROPOSAL

April 13, 2010

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Overview

- NSF Faculty Early Career Development Program (CAREER)
- Before you start writing
- Writing the proposal step-by-step
- If you don't get funded this round

CAREER Eligibility

- Untenured
- Tenure track
- Assistant Professor or equivalent
- Have not applied for a CAREER more than twice before
- Propose to conduct research in an area that NSF funds

CAREER in a Nutshell

- 5 years of funding
- Minimum $400K total ($500K for BIO)
- Must apply to a particular program within a directorate – Key!
- Different NSF divisions and directorates use the CAREER program differently

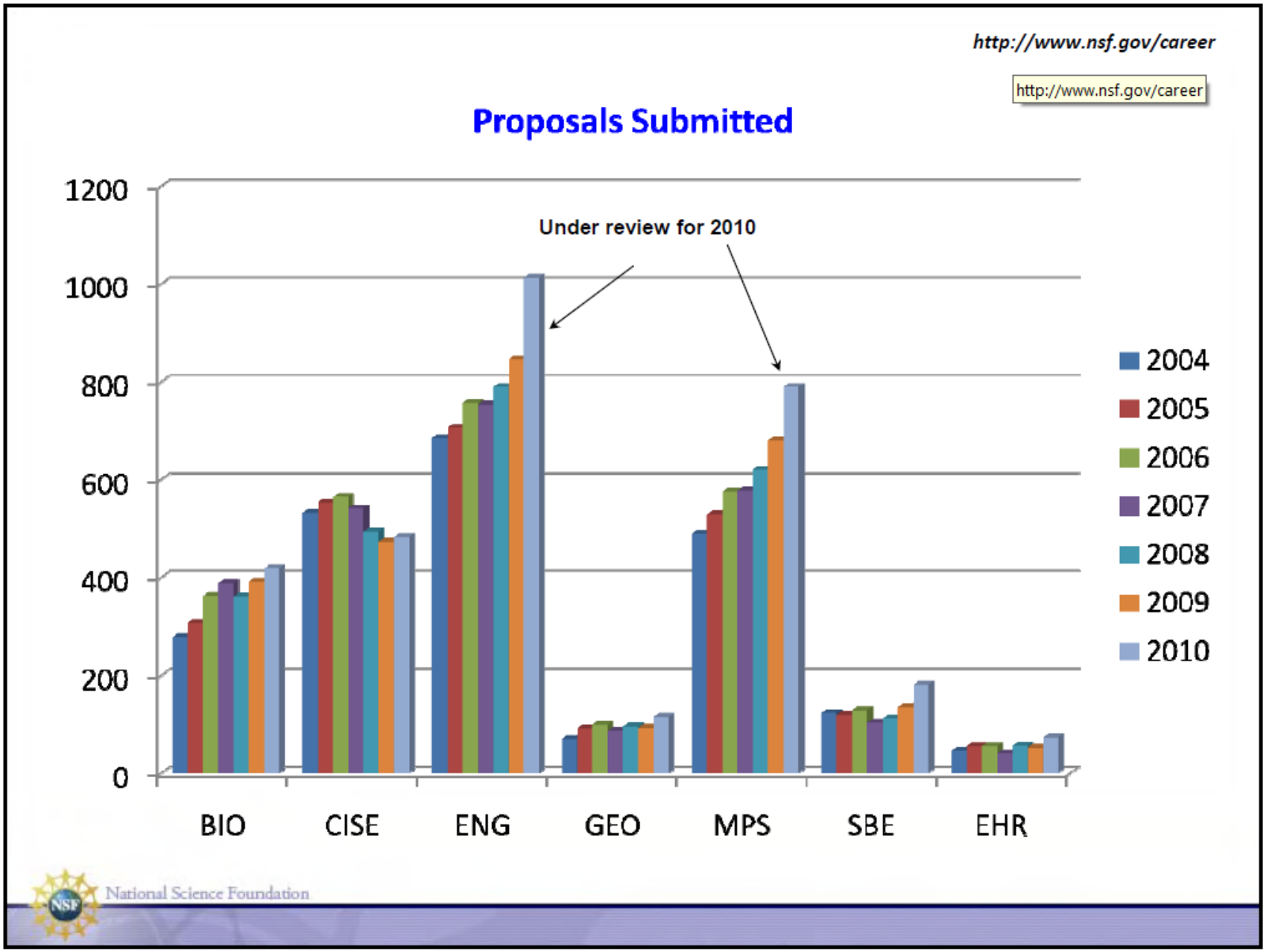
What is NSF Trying to Accomplish with CAREER?

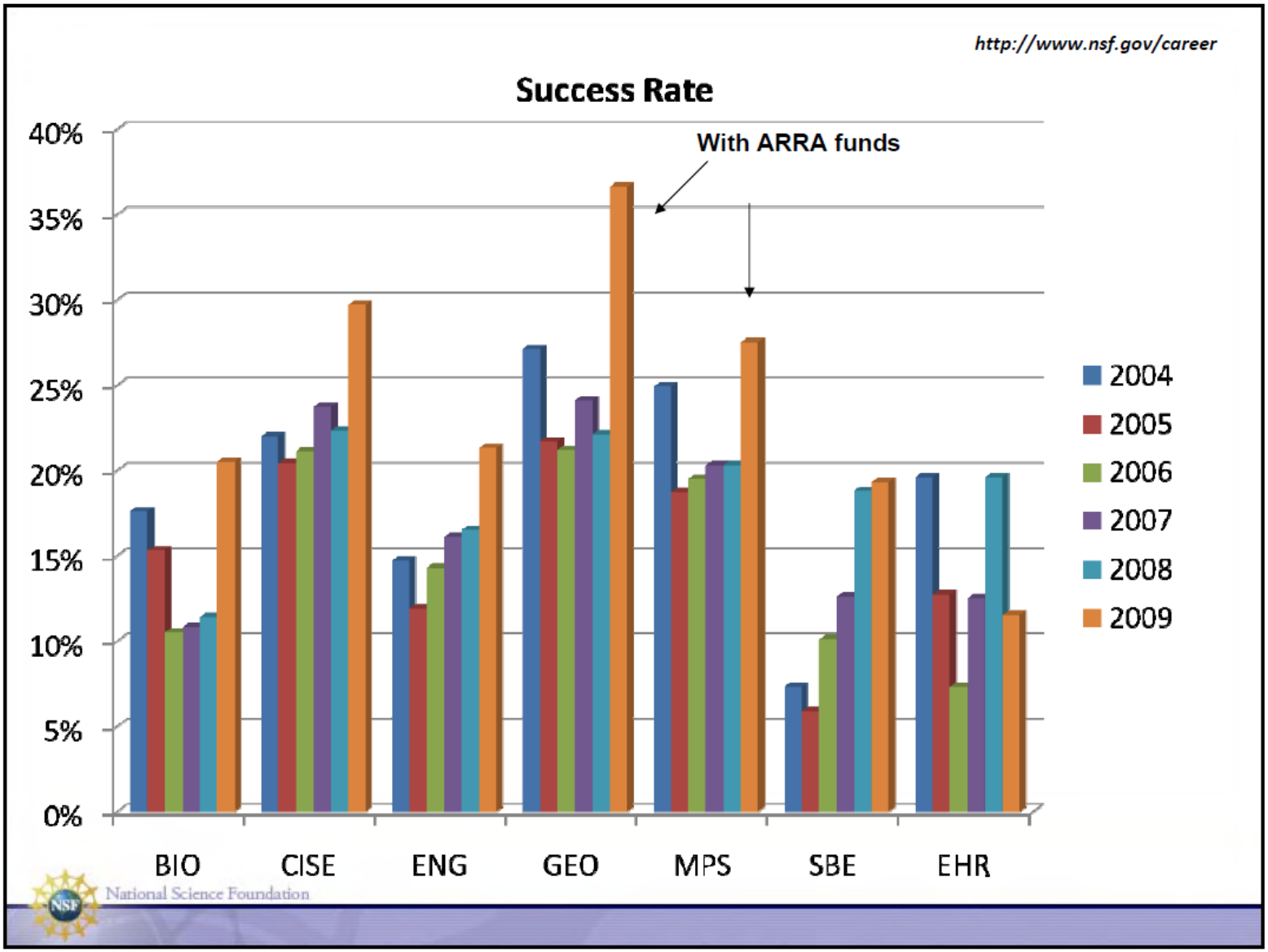
- Nurture the next generation of leading researchers/educators
- Change academic culture
  - Integrate education and research
  - Support diversity
  - Reach out to the larger community
  - Innovate in education

NSF's Organization

- Divided into directorates:
  - Biological Sciences (BIO)
  - Computer and Information Science and Eng (CISE)
  - Education and Human Resources (EHR)
  - Engineering (ENG)
  - Geosciences (GEO)
  - Mathematical and Physical Sciences (MPS)
  - Social, Behavioral and Economic Sciences (SBE)
  - Office of Polar Programs (OPP)
- Each directorate divided into divisions and programs
  - See http://www.nsf.gov/staff/orglist.jsp for description of programs

http://www.nsf.gov/career




http://www.nsf.gov/career
Success Rate
With ARRA funds
40%
35%
30%
25%
20%
15%
10%
5%
0%
BIO
CISE
ENG
GEO
MPS
SBE
EHR
2004
2005
2006
2007
2008
2009
National Science Foundation

Plan to Reapply!

- Odds are you won't get funded with your first application
- Your proposal should get stronger with each application
- Planning and intelligent persistence are key

Key Points for CAREER

Career Development Plan to "build a firm foundation for a lifetime of integrated contributions to research and education"

- **Research Plan**
- **Integrated Education Plan**
- **Plus**
  - Description of how research and education are integrated with each other
  - Results of Previous NSF support, if applicable
  - Department Head letter

Before You Start Writing

Selecting a Research Idea

- What do you want to do?
- Does it address important questions in your field?
- Is it novel and cutting-edge?
- Do you have the background and resources to accomplish your goals?
  - If you're moving into a new but related area, be sure to discuss collaborations that will fill any gaps
- Will it contribute to your career goals?
- Will it contribute to your department's and institution's goals?

Are You Ready to Apply?

- Do you have publications in or related to your research topic?
- How many years do you have until you go up for tenure?
- If applicable, do you have your lab set up and do you have grad students?
- If you need preliminary data, do you have it?

Do I Need Preliminary Data?

- Expectations vary by discipline
- How risky is your research idea?
  - Do you need preliminary data to demonstrate feasibility?
- How strong is your track record?
  - Do you need to demonstrate your mastery of the methodology?
- Are there potential showstoppers that could be explored with some preliminary experiments/calculations?

Have a High Risk/High Payoff Idea?

- But you need funds to generate preliminary data?
- Explore NSF's EAGER (Early-Concept Grants for Exploratory Research)
  - Up to $300K for 2 years
  - Talk to Program Officer
- May go on to submit a standard grant to a core program or a CAREER

Important!

Talk to your Department Head/Chair

- Make sure she supports your research and education goals
- Discuss Department Head letter early

Determine which NSF Program to Apply To

- Submitting to the wrong program can doom a good proposal!
- NSF web site (see handout)
  - Check program goals
  - Search awarded CAREER projects
- E-mail or call program director
- Talk to senior researchers in your area
- Interdisciplinary? Talk to program officers

Develop Your Education Plan

- What are your interests?
- What fits your institution, department, students and discipline?
- What infrastructure do you already have at your institution? For example,
  - Programs with teachers, K-12 students
  - Programs with pre-service teachers
  - Undergraduate research
  - Science camps for middle schoolers
  - Connections with Community Colleges

Typical Education Plans

- Can target various populations

  For example:

  - New or updated undergrad or grad courses using innovative educational approaches
  - Undergraduate research experiences including innovative elements
  - Recruiting activities with underrepresented students
  - Mentoring high school students in Science Fair projects
  - Participating in a science summer camp with middle school students
  - Working with elementary teachers to incorporate elements of your research into their curricula

Education Plan Tips

- Don't reinvent the wheel
  - Talk to education experts at your institution
  - Read the literature (http://www.eric.ed.gov/)
- Identify the need you are addressing
- Have clear goals and objectives
- Address diversity
- Have a strong assessment plan
- Plan how you will disseminate your results

(See Handout #x for more)

More Education Plan Tips

- Be sure to include funding in the budget to support your education activities
- May need to look for other funds you can leverage
- Remember you can apply for a Research Experiences for Undergraduates (REU) supplement if you win – can mention your plans to do that
- Think about how you can enhance even standard activities (e.g., mentoring your graduate students)
- Including undergrads in research is expected

Recruit Your Collaborators

- CAREER does not allow co-PIs or senior personnel
- But you can have a collaborator
  - Can pay for equipment access
  - Can help support a collaborator's student
- Use collaborators to fill a gap in your expertise or capabilities
  - For example, educational collaborator, collaborator from a different discipline, collaborator with facilities/equipment you need

Contact Your Office of Sponsored Projects

- Let them know you plan to submit a CAREER
- They can often help you with:
  - Scheduling and approvals
  - Budgets
  - Fastlane
  - Sometimes with review criteria and text
  - Submission

Understand the Review Criteria

- Intellectual Merit and Broader Impacts equally weighted
- Is your research significant and innovative?
- Do you have the skills and resources to carry out the project?
- Do you have the support of your department?
- Are your research and education integrated?
- Does your education plan go beyond what is expected for all Assistant Professors?
- Is your project likely to be successful ?
- Do you address diversity, benefits to society?

Common Reasons for Not Funding CAREER Proposals

- "Research is either too ambitious or too narrowly focused
- Proposed methods do not address the stated research goals
- Educational component is either limited to routine courses or is unrealistically overambitious
- Integration of research and education is weak or uninspired"

Quoted from J. Tornow presentation at QEM Workshop

Writing Your CAREER Proposal

Proposal Elements

- Project Summary (1 page)
- Project Description (15 pages)
- References Cited
- Supplementary Documents
  - Letters of collaboration
- Biosketch (2 pages)
- Current & Pending Form
- Budget
- Budget Justification (3 pages)
- Facilities and Equipment

Format

Follow NSF's Grant Proposal Guide

http://www.nsf.gov/pubs/policydocs/pappguide/nsf10_1/gpg_index.jsp

Section IIB – Fonts, etc.

http://www.nsf.gov/pubs/policydocs/pappguide/nsf10_1/gpg_2.jsp#IIB

- 1" margins all around
- Pages numbered by sections
- **Allowed fonts:**
  - Arial, Courier New, or Palatino Linotype at a font size of 10 points or larger
  - Times New Roman at a font size of 11 points or larger
  - Computer Modern family of fonts at a font size of 11 points or larger

  AND
  - No more than 6 lines of text within a vertical space of 1 inch

Section II.C.f(i) – Biosketch format (2 pages)

http://www.nsf.gov/pubs/policydocs/pappguide/nsf10_1/gpg_2.jsp#IIC2fi

- Follow this religiously!
- Non-compliant biosketches are a common reason for <u>return without review</u>.

Project Summary (1 page)

- This may be the only thing the reviewer will read
- State your goals/objectives/ hypothesis in 1st or 2nd paragraph.
- Value of your project (research and education) must be clear and compelling!
- Written in 3rd person
- Clearly address **intellectual merit** and **broader impacts** separately (and label them)

Intellectual Merit

- How well does your project advance knowledge and understanding ?
- How creative, original or potentially transformative are the concepts?
- How well conceived and organized is the proposed activity, and **will you have sufficient resources?**
- **How well qualified is the proposer to conduct the project?**

Broader Impacts

- How well does the project advance discovery while promoting teaching, training and learning?
- To what extent will it enhance infrastructure for research and education?
- How well will it broaden participation of underrepresented groups?
- Will the results be broadly disseminated?
- What are the benefits to society?

Project Summary

- Later, look example in packet Handout #6
- Project Summary from Jairo Sinova's successful CAREER awarded 2006
  - Clear goals stated early
  - New knowledge to be generated
  - PI's collaborations, qualifications

Project Description

- Flexible Structure
- Typical Outline
  - Introduction, overview, objectives
  - Background (lit review)
  - Preliminary Results
  - Experimental Plan
  - Education Plan
  - Broader Impacts
  - Timeline

Introduction and Overview

- Provide reviewers with an outline of your proposed project which you will fill in later
- After the first 2 pages
  - Reviewer should be intrigued and excited
  - Should have a basic understanding of your project and why it's important
  - Should be convinced that this research is a great idea
  - Will just be looking for details to confirm you can do what you say you'll do

Background

- What is the current state of knowledge and how does this relate to your project?
- What are the holes in knowledge and how will your research fill them?
- Cite important work but don't provide a comprehensive literature review covering the entire history of the subject
- Keep relating discussion to your project
- Typical length: 3 – 4 pages

Preliminary Data

- Sometimes folded in with Background, but be careful!
- Summarize up front the significance of your data as it relates to your project *(see Handout #6)*
- Beware getting bogged down in too many details
- Be clear who did the work – beware passive voice and the royal “we”

Research Plan

- How will you accomplish your goals, step by step?
- Need enough details to convince reviewers you have a well-developed plan that is likely to succeed
- But don't drown reviewers in non-essential details
- More details needed for the first 2 or 3 years
- Discuss how you will deal with any potential showstoppers

Research Plan

- Give a concise of overview before launching into details.
  - What are the objectives?
  - What are the required tasks?
  - What will be your overall approach?
  - What are the roles of your collaborators?

Research Plan

- If you need special resources (access to an instrument, a special cell line, etc.) explain how you will get them
- Be clear what role your collaborators will play
  - Name them and briefly describe their qualifications
  - Refer reviewers to letters of collaboration

Education Plan

- What are your goals?
- What motivates your plan?
- What is the state of knowledge about this issue, the proposed approach, etc. (cite educational literature!)
- Do you have any preliminary results or prior related experience?
- How will you assess whether you are successful?
- How will you disseminate your results

Education Plan

- Scope and length of section
  - Depends on the mission of your institution
  - Research Intensive: *typically* around 3 pages
  - Predominantly undergrad or community college: can be longer

Education Plan

- Assessment
  - Have clear, measurable objectives
  - Explain how you will assess whether you met these objectives
- Dissemination
  - How will other educators benefit from what you've learned or developed?

See example Education Plan in Handout #x.

References Cited

- Separate section
- No page limit
- Use standard format for your discipline but include beginning and ending pages numbers
- If available online, include url
- Websites may be included in references cited but not in body of the text
- Be sure to cite important works and works of likely reviewers

Collaboration Letters

- If you plan to have collaborators, be sure to include letters and reference them in the text
- Not a letter of support

e.g., "This research is a great idea…"

- Letter of collaboration

e.g., "I will provide the PI with access to my xyz instrument"

Budget

- Typical budget a little over $100K per year (except BIO), including indirect costs
- Typically covers
  - **Research Intensive Universities:** PI's salary for one summer month and a graduate student
  - **Predominantly Undergrad and Community Colleges:** teaching release for PI, support for undergrad researchers
  - Funds to support your educational component
  - Travel to conferences, etc. (include students)
  - Materials and supplies
  - Maybe funds for undergraduate researchers (hourly pay)
- Start early on your budget!

Budget Justification

- Important document
- Many reviewers look at this to see what your real priorities are
- Provides an additional up to 3 pages to help justify your project

Department Head Letter

- Reviewers really look at these!
- Should make it clear that your head/chair knows what you are proposing
- Include required language regarding your eligibility (see solicitation)
- Should discuss support for education and research plan (can include your start-up package, logistical support, etc.)
- Explain how your project will support goals of the department ***(see example in Handout #9)***

Additional Forms

- **NSF format 2-page biosketch** – follow GPG directions!
- **Current & Pending form** – all external funding or pending proposals
- **Facilities and Instrumentation** – use this to reassure reviewers that you have access to needed facilities

You've finished a draft!

- Ask others to read it and give you feedback
- Is it clear? Is it compelling? Did they see any technical weaknesses that should be addressed?
- Include time for revisions

Submitting Your Proposal

- Uploaded into Fastlane (check the file after it is uploaded!)
- Follow the requirements of our institution (check with Office of Sponsored Projects or equivalent)
  - Routing and Approval
  - Quality Check
  - Uploading
  - Submittal (must be done by an institutional representative)
- Try to submit at least a day before the deadline

The Review Process

- Varies by Division
- Most combination
  - Ad hoc (mail) reviews (usually 3)
  - Panel (may be CAREER panel, or may be a general panel)
- Reviewers rate all proposals
  - Excellent, Very Good, Good, Fair, Poor
- Provide recommendation
  - Fund, High Priority; Fund if Possible; Do Not Fund

Program Officer

- Makes a list of proposals would like to fund based on
  - Recommendations of reviewers
  - Portfolio of funded projects
  - Interests of Program
  - Types of institutions
- Works down the list until runs out of money
- Sometimes figures out ways to squeeze out a little more money to fund an extra project
- This process can take a while

The Rest of the Process

- Program Officer will often notify PI unofficially that they have been "recommended for funding"
- Must go through the approval process at NSF
- Must negotiate with your institution's grants office
- May come back and ask for adjustments in your budget
- This can take several months – don't panic!

If you get funded

- Celebrate!
- Think about supplements
  - Research Experiences for Undergraduates
  - Faculty Opportunity Award
  - Research Experiences for Teachers (some directorates)
  - International Science and Engineering Supplements

If you don't get funded…

- Read the reviews
- Get mad/depressed
- Remember that even the most prominent scientists have a drawer full of declined proposals
- Put the reviews in a drawer for a few days
- Read the reviews again carefully

Analyzing the Reviews

- Did the reviewers have particular concerns that you can address?
- Were the reviewers confused or unclear about your project?
- Were the reviewers unimpressed by the significance or novelty of your research idea?
- Were the reviewers generally favorable, with no clear issues brought up?
- Did the project topic not fit the program?
- Be careful about chasing one comment by one reviewer – look at the Panel Summary

Call the Program Officer

- Be nice!
- Ask for clarification of reviewer comments
- Ask for advice
- Should you resubmit?
- Should you apply to a different program?
- What would strengthen your proposal?

Make Your Decision

- Resubmit a CAREER next year to the same program
- Use next year to revamp your project, generate preliminary data, etc. and resubmit the following year
- Resubmit a CAREER to a different program next year
- Revamp the project and submit to a core program
- Revamp the proposal and submit to a different agency
- Start again with an entirely new idea

No Matter What

- Your next proposal will be better than your last
- You have gotten to know an NSF Program Officer
- You have learned from the experience and developed new skills

Good luck!