HOW TO WRITE A WINNING CAREER PROPOSAL

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Lucy Deckard

Academic Research Funding Strategies, LLC
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
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
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 return without review.
Project Summary (1 page)

• This may be the only thing the reviewer will read
• State your goals/objectives/hypothesis in 1\textsuperscript{st} or 2\textsuperscript{nd} paragraph.
• Value of your project (research and education) must be clear and compelling!
• Written in 3\textsuperscript{rd} person
• Clearly address \textit{intellectual merit} and \textit{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 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 page 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!