

Writing Proposals to Secure Grants For the Early Career Scientist Assembly

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ABSTRACT

Target audience: Early-career investigators who expect to seek grants to fund parts of their research

I will present opinions on what helps a proposal succeed and what advice might be useful to early-career investigators. My advice is based primarily on my experience as a program officer at the NSF but also from other roles in my career. The talk will have three main parts:

- 1 how to develop the project idea
- 2 how to develop a detailed project design
- 3 how to avoid common problems when writing the proposal.

I'll also discuss ways to use grants to further your career, how to learn about grant opportunities, and how to communicate with program officers.

START BY THINKING STRATEGICALLY

Your Goal? (Don't confuse these)

To Get Funded?

To Advance Your Career?

START BY THINKING STRATEGICALLY

Goals:

- Does the topic fit your 5-10 y career plan?
- Cost/benefit?
- Consider institutional expectations

Seek Advice from Mentors:

- Remember, it is your responsibility to seek advice
- Discuss widely with peers

Important:

A plan can avoid entanglement in unproductive projects.
(*"Map out your life, but do it in pencil."* – Jon Bon Jovi)

- Ask: Is it really worth doing this?
- Avoid the external-funding trap!

IDEAS!

Have many thoughts, some good:

- Think! (Reserve time ...)
- Read widely.
- Talk to colleagues.
- Attend conferences, workshops, and seminars.
- Aspire to originality and creativity in your work.
- Don't hesitate to be ambitious in your goals.

Read proposals

- Ask senior (and other) colleagues for examples.
- Assemble collections (ECSA function?)
- Volunteer to be a reviewer, and offer to provide informal review of proposals of others.

MATCH EFFORTS TO PLANS

Strive for thematic research

Use unsolicited and unrestricted proposal opportunities to develop central themes of your work, in directions of your own choice

Approach targeted solicitations with caution

Use targeted solicitations with a specific research theme to take advantage of special opportunities that match your interests.

Plan ahead

It is often difficult to meet deadlines.

Allow time for revision, internal review, and institutional processing.

Work in anticipation of opportunities.

LEARNING ABOUT OPPORTUNITIES

If you have a general idea of what you want to do, then the sources on this and the following slides may be useful.

The Best Starting Point: GRANTS.GOV

- <http://www.grants.gov> – Everyone should check this.
- Central point of contact for all 26 federal agencies that award grants – information and applications (but, alas, not quite everything).
- Searchable, and you can arrange for e-mail notification of opportunities
- Includes good tutorial information on developing and submitting the proposal
- Has information on non-federal sources also (e.g., foundations)

OTHER SOURCES

Some Useful Links:

- 1 NCAR:
<http://ncar.ucar.edu/budget-and-planning/proposals>
- 2 UCAR:
<http://www.fin.ucar.edu/contracts/homesa.htm>
- 3 NSF:
<http://www.nsf.gov> Subscribe to new announcements by email or RSS reader: <http://www.nsf.gov/mynsf/>
- 4 Federal Register: the official publication
<http://www.gpoaccess.gov/fr/>
- 5 AGU Atmospheric Sciences Section: see Funding Opportunities (for members) under <http://atmospheres.agu.org>

OTHER SOURCES

Continued...

- NASA: NSPIRES:
<http://nspires.nasaprs.com/external/>
- NOAA:
http://www.federalgrantswire.com/national_oceanic_and_atmospheric_administration_department_of_commerce_federal_grants_2.html
- EPA: Research Grant Announcements:
<http://epa.gov/ncer/rfa/>
- Foundations:
<http://www.fdncenter.org/funders/>
- University supported sites: most moving to
<https://www.grantforward.com/index>

OTHER SOURCES

Don't Miss Announcements:

Check Regularly

Share Info

Sign Up: Email, RSS,

Watch especially for new-investigator awards

- Many programs have targets for including new investigators.
- Identify yourself as such when talking to program managers.

BEFORE YOU START

Now You Have An Idea:

Test Questions:

- Is it original and different?
- [Is it (only) incremental?]
- Is it interesting to others?
- Will it result in a publishable result?
- Is your research approach feasible?
- Does it fit your career plan?

Discuss these with:

colleagues: interesting?

mentors: worthwhile?

supervisor: good use of your time?

program officer: for early advice

IMPORTANT (AND OBVIOUS) NEXT STEPS

Review the literature

You must be familiar with what has been done in this area, and you will need to show this understanding in the proposal. This is central to the proposal.

Goals

Develop some specific hypotheses to be tested. A small number, focused on a high-impact idea, is best.

Plan for collaboration

Contact potential collaborators if you need them, and get them involved. (At NCAR, remember to check the rules regarding the need for collaboration or contributions to community facilities and tools.)

KEY FACTORS TO INCORPORATE

A Good Practice: Make Two Lists:

- 1 The submission rules and deadlines
- 2 The evaluation criteria and other factors to address

Rules and Deadlines

- Follow the rules strictly!
- Construct an informal preproposal
- “Discuss” this with the program officer
- Learn what you need to do at NCAR/UCAR

Evaluation Criteria

- e.g., NSF merit criteria
- modify the project if feasible to align with the evaluation criteria
- develop a table of arguments that address the criteria explicitly.
(Help the reviewers and program officer)

EXAMPLE: THE NSF REVIEW CRITERIA

Intellectual Merit

- advances knowledge
- strong proposer qualifications
- creativity and originality
- strong research approach / plan
- resources available

Broader Impacts

- promotes the development of human resources
- addresses diversity in the workforce
- enhances the academic infrastructure
- benefits society
- has benefits beyond the immediate research field

SPECIAL FOR NCAR/UCAR

- See the policies, procedures, and guidelines specific for NCAR and EOL. **Everyone including those experienced with the process should review this new information.** Start here: <http://ncar.ucar.edu/budget-and-planning/proposals>
- Be sure to allow time to comply with these requirements, which include internal review and advance notice.

THE OUTLINE

Some Significant Components

Goals: State the goal and the objectives explicitly.

Hypotheses and Approaches: Formulate your approach and research method, where possible, in terms of hypotheses to be tested. Your research method should lead to your objectives.

Critical Tests: Develop critical tests of those hypotheses. What would refute them? Try to develop confidence that results will be definitive.

The Scope: Estimate how long the project will take and who else will need to be involved.

Focus on the "core" of the project

CONTACTING THE PROGRAM OFFICER

Is This Useful?

- The value of this varies, but it can't hurt and may help a great deal.
- Avoid blind phone calls; start with e-mail and ask for follow-up. The best approach is to send a preproposal with an approximate budget, then request an opportunity to discuss it.
- Many program officers expect this contact and do not welcome blind submissions.
- The PO can help you avoid problems and will often provide advice that can avoid a re-submission.
- Ask reasonable questions, not "Do you think you could fund this?"
- LISTEN; don't try to convince.

FINALLY, WRITING THE PROPOSAL

"If you have done the preceding, writing will be easy"

- Not really: good writing is hard work!
- Don't neglect good construction and organization, even for the five or so people who will read this.

Typical sections (NSF) – *follow the specified format!*

- 1 Project Summary (1 page)– write this last!
- 2 Project Description (15 pages or fewer)
 - (a) Include results from prior NSF support: (say something here if possible)
- 3 References: bibliographic only, referenced in the text; NOT footnotes or expansions of points
- 4 **Biographical Sketches for all senior personnel**

A GENERAL OUTLINE: PROJECT DESCRIPTION

- 1 Introduction: goals, objectives and significance
- 2 Status of this area of research, enough to show understanding
- 3 Recent related work and results of prior NSF support
- 4 The research approach:
 - (a) hypotheses and critical tests
 - (b) relationship of the experimental approach to the objectives
 - (c) justification for the methodology selected
 - (d) project management information
- 5 Work plan and schedule
- 6 Concluding Statement: Results expected, and their significance (referencing evaluation criteria).

GOALS AND OBJECTIVES

One Perspective

The Goal

- the broad thematic area that you will be addressing
- probably too broad for definitive resolution
- you expect to contribute to progress in this area.
- Example:
 - Determine if measurements of ice-nucleus concentrations provide useful predictions of the ice concentrations that develop in clouds.

The Objectives

- what you expect to accomplish
- more limited in scope
- achievable in the period of the proposed grant

EXAMPLES OF POOR GOALS OR OBJECTIVES

Anonymous Real Examples

- The objective of my research is to provide a quantum leap in understanding the roles of clouds in climate.
- The goal of this project is to develop an integrated modeling tool for incorporating microphysical processes in mesoscale models.
- The objective of this project is to develop innovative advances that enhance precipitation forecasting.
- This research will bridge the accuracy gap in measurements of trace gases by developing theoretical and technological means to implement significant gains in accuracy.

GOOD EXAMPLES

- The research goal of this proposal is to determine which processes in clouds are responsible for charge separation in cases of inverted-polarity lightning, and to demonstrate their significance in a numerical cloud model. [followed by specific objectives]
- The goal of this proposal is to determine the concentrations of giant sea-salt particles ingested into trade-wind cumuli over the Caribbean and to test if they are responsible for rapid precipitation formation in such clouds. [followed by specific objectives and tests]

WRITING ADVICE

See the NSF Grant and Proposal Guide

- Funds are provided on the basis of merit, not need
- Projects should be innovative, not catch-up
- Presenting preliminary work is beneficial
- Meet the specific requirements of solicitations
- Tailor your bio sketches to the proposal
- Linki: [NSF Grant and Proposal Guide](#)

Eloquent Science (David M Schultz)

Very good source for improving all aspects of your writing

FOR WHOM IS THE PROPOSAL WRITTEN?

Write primarily for the reviewers

Remember that their expertise may vary.

Secondarily, write for the program officer

- Make it easy to find key information:
 - information regarding review criteria
 - concise summaries
 - clear explanation of the approach to be taken
- The program officer will be particularly interested in addressing the published requirements, identifying new-investigator or high-risk proposals, and finding concise statements to justify his/her decision.

You will benefit also from logical design of your project

HOW ARE REVIEWERS SELECTED?

Personal knowledge of the field

your list of references! Also, those who have cited your references

suggestions you make (an often overlooked opportunity to influence the selection of reviewers)

conference attendees at recent topical conferences on related topics

Do you know, and are you known to, the program officer? If not, correct that. (e.g., volunteer to review!)

MORE GENERAL ADVICE:

- You want to convince the reviewers that:
 - you are qualified to conduct the project;
 - you have a good idea and topic; and
 - you have developed a good approach.
- **Avoid mistakes; reviewers jump on them and this makes their job too easy.**
- Be specific and focused; avoid vagueness, ambiguity, and generality.
- Focus on results, and state clearly what results can be expected (summary and conclusions)
- Anticipate criticisms and address them.

COMMON WEAKNESSES

- Trivial, uninteresting, or unstated goals (“doing research”)
 - Failure to demonstrate awareness of the research context
 - Weak research plan
 - Ambiguity regarding specific planned accomplishments; inconsistent statements of goals
- Unreasonable scope; tasks that are not achievable under the grant
 - Small budgets for ambitious projects
 - “Trust me” sketches of research areas,
 - Arguments that the research area (rather than the specific project) is important

COMMON CRITICISMS FROM REVIEWERS

- Not specific enough (what will they really do?)
- Not interesting enough (lacks originality or insight; duplicates other work; incremental)
- Contains errors - almost always leading to downgrading the rating: reflects on competence
- Too ambitious (scope not matched to effort)
- Not likely to lead to definitive results (poor experimental approach)
- Past performance and follow-through were weak

Review your project description to see if these might be legitimate criticisms

PHRASES TO AVOID

Vague phrases that call for revision in writing and thinking:

If you find these vague phrases in your writing, see if you can substitute a more specific phrase and concept

vague	specific
"to understand better"	"to determine if..."
"to learn about..."	"to test if..."
"to study ..."	"to measure ..."
"to investigate ..."	"to rule out ..."
"to find evidence ..."	"to show"

THE PROJECT SUMMARY

THIS IS VERY IMPORTANT!

Characteristics:

- NOT an abstract
- Concise summary of what will be accomplished
- State objectives and methods, not context, justification, past work
- Address the review criteria explicitly

Components

- Goal and objectives
- Project approach (few sentences)
- Expected contribution you will make
- Expected impacts

This is the first part everyone reads, the basis for public summaries and award descriptions, etc. Worth special effort.

THE BUDGET

Use administrators and NCAR expertise, and consult experienced PIs. Many rules apply here, and you won't know them all.

- Include a reasonable amount of **your own time**, if permitted
- **Don't underestimate**; your first goal is to convince reviewers you can do this
- Use the **budget justification pages** to explain your needs
- Follow rules regarding travel, equipment, consultants, subawards – these will be examined carefully
- It is to your advantage, and often required, to include a **visible educational component**

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A Recommendation Regarding Budgets:

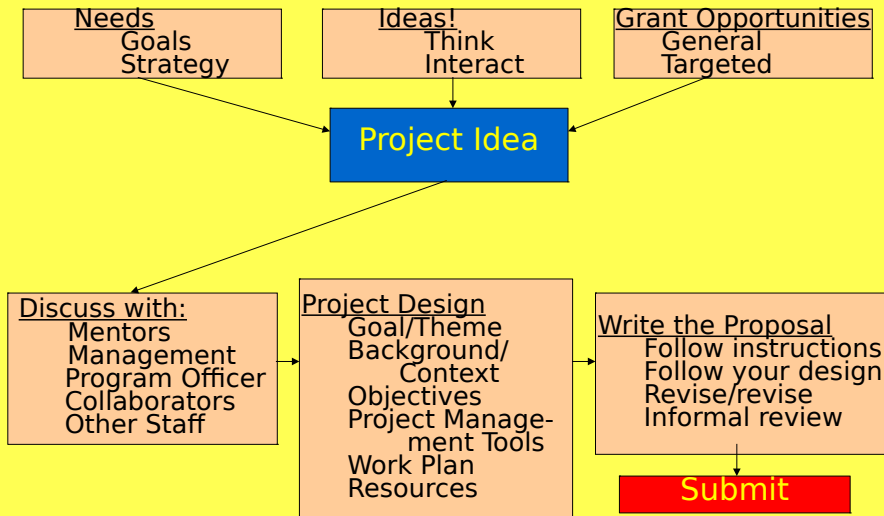
- It is better to be realistic or even high rather than low
- Reviewers often rate low because the budget is unrealistic
- It is the program officer's task to negotiate
- Good reviews are essential in that negotiation

A CHECKLIST

Be Sure Your Proposal Contains These

- 1 A clear statement of the goal of the project
- 2 Evidence that there really is a problem needing resolution
- 3 Your objectives, highlighted and easy to find.
- 4 Your milestones, highlighted and easy to find.
- 5 Your methodology, coupled to your objectives.
- 6 Critical steps that will provide evidence of your progress.
- 7 Discussion of your approach to problems that may arise in the project
- 8 Summary of expected results and their significance
- 9 Address the review criteria.

The Process:



Some Sources

CAREER proposal-writing workshops, Jian Cao and Janet Twomey, NSF, January 2005

Hints from Mark Schoeberl on the Atmospheric Section of the AGU web site

CAREER proposal advice from Ana Muriel, Univ. of Mass. at Amherst
“Emerging Research Trends at NSF” by Dr. Ulsoy, Director, Division of Civil and Mechanical Systems

“Best Practices” by Anu Singh, NSF CAREER Proposal Workshop, Columbia University, May 2005, esp. presentations by Anu Singh, NSF, Gracious Ngaile, NC State, and Jim Smay, Oklahoma State (CAREER grant recipients)

Fastlane, esp. Maya Anderson presentation:

<http://www.nsf.gov/attachments/104160/public/2grinnell.ppt> – good tutorial

The Proposal Writing Seminar of the Learning Lab, Foundation Center

The NASA Guidebook for Proposers

The NSF “Guide for Proposal Writing” – NSF document nsf04016

More Sources

The NSF Grant Proposal Guide – nsf04-23

Pepperdine University Grant Writing Workshop, Feb 26 2005 (NSF Biosciences)

Proposal Writing Workshop, Gene Stein, SDSU Foundation, Sponsored Research Development NSF Regional Grants Conference, April 4-5 2005, University of California, Oakland California

Research Program Development Workshop, Scottsdale AZ, January 2005 – this one is especially good! See

<http://www.nsf.gov/eng/dmii/documents/RPD%20Workshop%202005.ppt>

NSF CISE Guide to Writing Proposals:

<http://www.nsf.gov/cise/cns/cwardle/rules.jsp>

Writing a Federal Grant Proposal – Federal Grants Wire