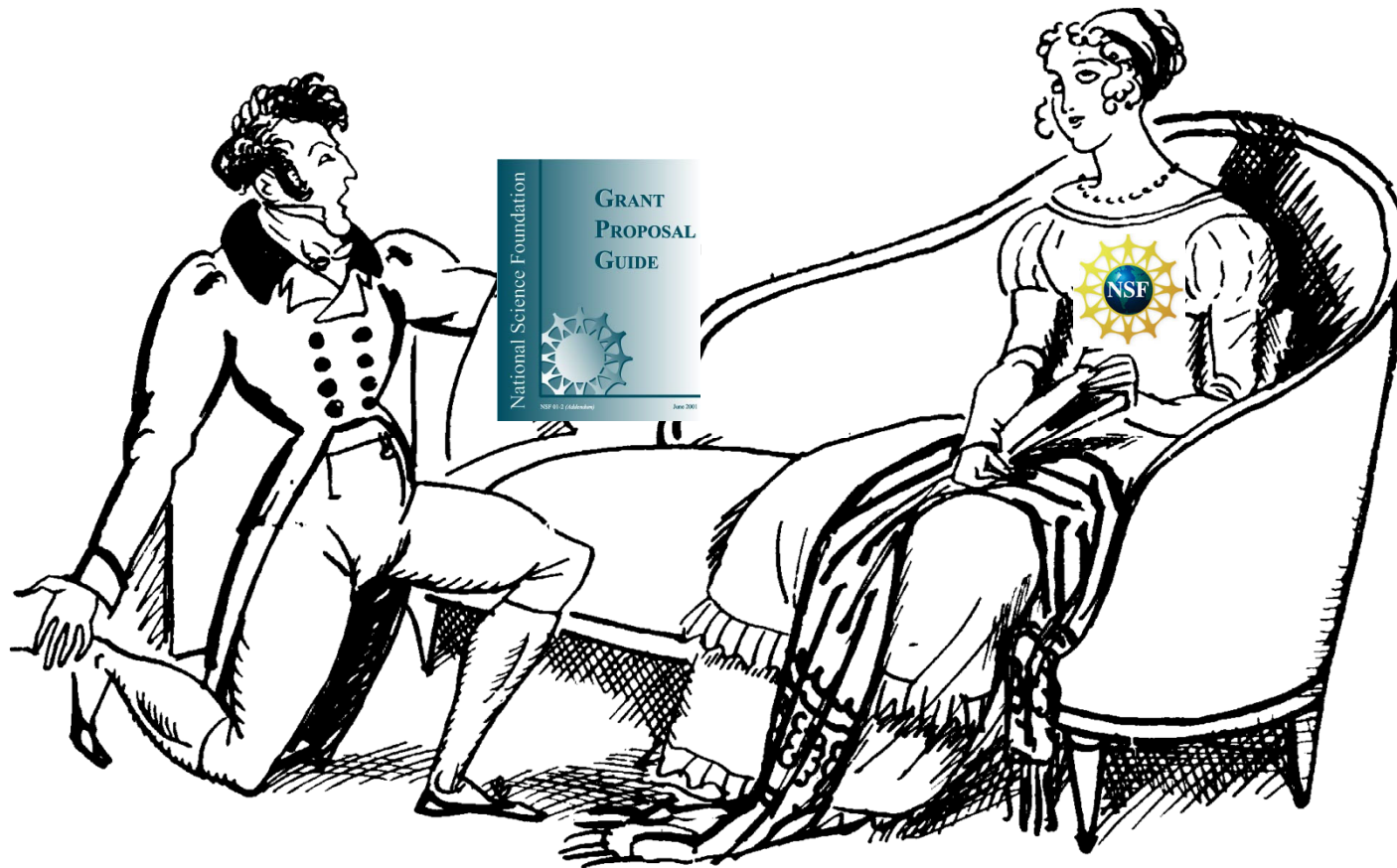


# Writing Effective Grant Proposals

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# Writing Proposals is an Essential Activity of Scientists

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You will likely write proposals for many reasons as a scientist or engineer:

NSF or DOE grad fellowship proposals

NRC postdoc proposals

Grant proposals for your research

Proposals to fund projects in industry or national laboratories



# Identify the Sources of Funding in the Sciences

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One of the most important first steps in acquiring funding, of course, is to know all the potential sources of funding for research in science:

National Science Foundation (NSF)

National Institute of Health (NIH)

Office of Naval Research (ONR)

Department of Energy (DOE)

Department of Education (DOEd)

National Security Agency (NSA)

Air Force Office of Scientific Research (AFOSR)

Army Research Office (ARO)

Defense Advance Research Projects Agency (DARPA)

NASA



# Identify the Sources of Funding in the Sciences

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Increasing number of private funding sources for science:

Moore Foundation

Simons

Gates

Ellison

Brin

Koch

Bezos

....

See NY Times Sunday, March 15, 2014: ["Billionaires With Big Ideas Are Privatizing American Science," William J. Broad](#)

# Investigate the programs

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Your next step is to investigate important details about the various program opportunities:



## 1. What projects are already funded?

There can't be too much overlap of your proposed work with an existing program

## 2. What is the typical range of funding offered by the program?

You should have some idea of the typical funding range offered by the program, because your proposal can be dismissed outright if your budget requests are too extravagant

## 3. What are the stated program goals of the funding agency?

Make sure that your research goals can be, and are, written so as to coincide as closely as possible with the stated goals of the funding agency and the specific program!

# Tips for writing your *first* proposal

Important advice from an expert:

“There is one over-riding principle: You must convince the referees that the project is so far along that it would be a mistake to stop it. Put another way: **Every first proposal should read as a renewal proposal.** If you keep this firmly in mind, writing the proposal is a breeze.”

- *John Wilkins, 1987, Cornell (now at Ohio St)*



## What does this mean?

- Even first proposals need to be written so that the work appears to be on-going and too important to stop
- Results of preliminary experiments and/or calculations should be a prominent feature of proposals, even first proposals
- The research proposed should be compelling and should appear to extend naturally from the exciting results presented

# Tips for writing any proposal

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George Heilmeier's (former DARPA program manager) "catechism" for grant writing (from Celia). An effective proposal should address the following questions:

- What are you trying to do? Articulate your objectives using absolutely no jargon.
- How is it done today, and what are the limits of current practice?
- What's new in your approach and why do you think it will be successful? **What is transformative (the newest buzzword!) about the proposed research?**
- Who cares?
- If you're successful, what difference will it make?
- What are the risks and the payoffs?
- How much will it cost?
- How long will it take?
- What are the midterm and final "exams" to check for success?

# Key components of a good proposal

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Abstract (Project Summary)

Results from Prior Support

Introduction

Review of Previous Research

Proposed Research

Summary

Budget





# Abstract (Project Summary)

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The **Abstract or Project Summary** should provide a synopsis of the motivation, methods, proposed work, and potential impacts of the proposed work. In other words, it should capture the most important and exciting elements of your proposal.

You should include a project summary with your proposal even if it is not required by the funding agency, as it is often the first, last (and sometimes only) thing read by a referee or program director.

# Results from Prior Support

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The **Results from Prior Support** section should describe any recent past research you have conducted that was supported by the agency to which you are applying for funding.



## TIPS:

1. Divide distinct areas of research conducted into separate sections
2. Briefly describe the key results obtained, and try to convey both the significance of the research **and its importance to the agency's goals**
3. Describe how your previous results relate to your proposed work
4. In each section, list the papers published/submitted or other "deliverables" that resulted from prior support by the agency

# Results from Prior Support

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## TIPS:

5. Even if the program does not explicitly request this information, it is a good idea to describe what your past work is, and ***how it impacts the agency's goals***
6. Convince the reviewers that you have delivered on past promises

# Introduction

The **Introduction** provides a broader context for your research, i.e., it provides “the big picture.”

This section (i) shows the funding agency how your research fits in with its funding areas, and (ii) demonstrates that you understand the essential scientific issues associated with your research proposal



## TIPS:

1. This section should be succinct, no more than 2-3 pages, and it should summarize the major, and most exciting, points of the proposal
2. This section should emphasize not only the compelling features of the proposal, but also why the research is important to do and why you are the person ideally suited to performing the work!
3. This section should include substantial background information regarding the current experimental and theoretical issues confronting your field, (i) so the referees can understand the import of your proposal, and (ii) so the referees get the impression that you are an expert in the field

# Review of the Field



The proposal should include a **review of previous research**, either as part of the introduction or as a separate section.

The goals of this section are to:

- (i) persuade the referees that you are knowledgeable about your proposed field
- (ii) convince the referees that you are aware of the key scientific issues and previous publications in the field

The referees for your proposal will likely be in your field of research, so perform an incomplete review of past research at your own peril!

**This section of the proposal should contain:**

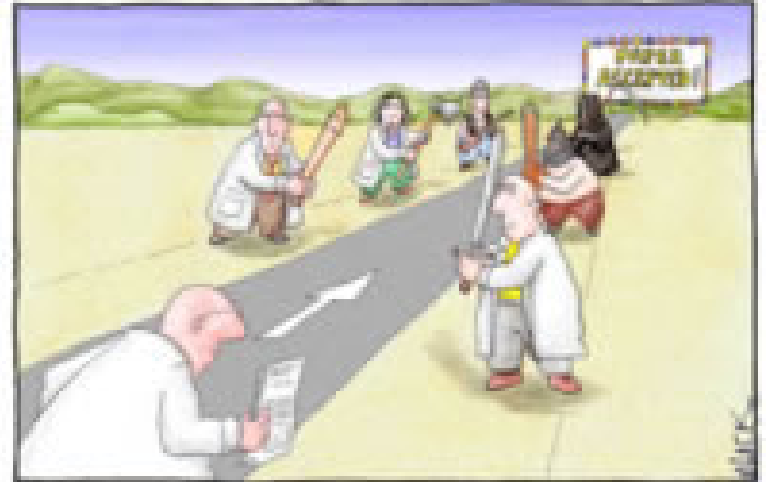
- (i) a general review of your proposed field with lots of references
- (ii) a description of your contributions to the field

**Bottom line** - this section should leave the referees with a clear idea of the important problems you are already in the process of solving!

# Proposed Research

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The **Proposed Research** section describes your specific research plans



Most scientists regarded the new streamlined peer-review process as 'quite an improvement'

## TIPS:

1. Avoid equations and technical jargon in favor of a clear description of the essential science involved in the proposal
2. For each proposed project, explain **what** you are going to do, **why** you are going to do it, **how** you are going to do it, **what will be learned** if you are successful
3. Use figures and diagrams to demonstrate your ideas as clearly as possible.
4. Include data or computations to illustrate your ability to perform the experiments or calculations proposed
5. This section should include a clear description, even a timetable, of the steps you will take to accomplish your goals

## The Proposed Research Section Should Answer These Questions:

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1. What research do you propose to do?
2. Why is this research important?
3. Why are you ideally suited to conducting this research (e.g., because of your access to personnel, experiences, and/or unique facilities)?
4. How do you plan to accomplish this research?
5. How will you know if the research is successful?
6. What is the timeline for the research?
7. What will be the benefits to the scientific community if the research is successful?

# Additional Tips

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**Project yourself:** If at all possible, convey something unique about yourself and your research in the proposal. To referees and program directors, you should appear to be the ideal person to carry out the research you're proposing

**Don't propose to do too much:** Don't propose more than you can reasonably accomplish in the allotted time. Doing so provides an easy target for referees

**Outline your procedure clearly:** Clearly outline the steps by which you plan to achieve your proposed goals, perhaps even providing a timeline. Vague strategies invite negative remarks from referees

**Make sure each procedural step is reasonable:** Make sure your plan has achievable steps, that you convey your understanding of potential technical difficulties, and that propose alternative strategies in case initial plans fail



## Additional Tips (cont.)

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**Explicitly respond to the criteria:** Before submitting, review the criteria listed in the RFP. Make sure you've hit all of the program's major points

**Obtain local advice:** Ask your adviser or senior colleague to read and critique your proposal. This will help minimize minor (and major) flaws that may diminish the effectiveness of your proposal

**Proofread and check for grammar:** ***Everything counts!*** A sloppy, poorly written proposal undermines the quality of the ideas presented, and a well-written and well-formatted proposal conveys the sense that the PI is competent and knowledgeable