

Putting together your NSF proposal:

Excerpt from:
“Advice on Writing
Proposals to the National Science Foundation”
<http://www.cs.cmu.edu/~sfinger/advice/advice.html>

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1. Project Summary

1 page. This is not an abstract. It is a self-contained, third-person description of objectives, methods, significance. If you are funded, this goes into NSF's Summary of Awards publication as well as being published on the NSF Web site. It will be read by your colleagues, the general public, and Congress. Be sure to include and label a section on Intellectual Merit and a section on Broader Impact. (Also, you will be required to address “transformational” aspects of your research in proposals going forward—P. Miller 11/12/07)

2. Project Description

The project description has a 15 page limit. Proposals over this limit are thrown out. The formatting requirements are given in the *Grant Proposal Guide*, which you can get from the [NSF Web site](#)

. The NSF home page usually has a link to the latest version.

2.1 Objectives and Expected Significance

What are the main scientific challenges? Emphasize what the new ideas are. Briefly describe the project's major goals and their impact on the state of the art.

Clearly state the question you will address:

- Why is it important? What makes something important varies with the field. For some fields, the intellectual challenge should be emphasized, for others the practical applications should be emphasized.
- Why is it an interesting/difficult/challenging question? It must be neither trivial nor impossible.

2.2 Background and Technical Need

- What long-term technical goals will this work serve?

- What are the main barriers to progress? What has led to success so far and what limitations remain? What is the missing knowledge?
- What aspects of the current state-of-the-art lead to this proposal? Why are these the right issues to be addressing now?
- What lessons from past and current research motivate your work. What value will your research provide? What is it that your results will make possible?
- What is the relation to the present state of knowledge, to current work here & elsewhere? Cite those whose work you're building on (and whom you would like to have review your proposal). Don't insult anyone. For example, don't say their work is "inadequate;" rather, identify the issues they didn't address.

Surprisingly, this section can kill a proposal. You need to be able to put your work in context. Often, a proposal will appear naive because the relevant literature is not cited. If it looks like you are planning to reinvent the wheel (and have no idea that wheels already exist), then no matter how good the research proposal itself is, your proposal won't get funded. If you trash everyone else in your research field, saying their work is no good, you also will not get funded. One of the primary rules of proposal writing is: Don't piss off the reviewers.

You can build your credentials in this section by summarizing other people's work clearly and concisely and by stating how your work uses their ideas and how it differs from theirs.

2.3 Research Description

Broad technical description of research plan: activities, methods, data, and theory.

This should be equivalent to a PhD thesis proposal for the big leagues. Write to convince the best person in your field that your idea deserves funding. Simultaneously, you must convince someone who is very smart but has no background in your sub-area. The goal of your proposal is to persuade the reviewers that your ideas are so important that they will take money out of the taxpayers' pockets and hand it to you.

This the part that counts. WHAT will you do? Why is your strategy an appropriate one to pursue? What is the key idea that makes it possible for to answer this question? HOW will you achieve your goals? Concisely and coherently, this section should complete the arguments developed earlier and present your initial pass on how to solve the problems posed. Avoid repetitions and digressions.

In general, NSF is more interested in ideas than in deliverables. The question is: What will we know when you're done that we don't know now? The question is not: What will we have that we don't have now? That is, rather than saying that you will develop a system that will do X, Y and Z, instead say why it is important to be able to do X, Y and Z; why X, Y and Z can't be done now; how you are going to go about making Z, Y and Z possible; and, by the way, you will demonstrate X, Y and Z in a system.

Right now, NSF is more open to application-oriented research. They need to show Congress that the money spent on research benefits the US economy. Some years ago, the word "applied" was a bad word at NSF. Now it's a good word. The pendulum between focussing on basic or applied research has about a 20 year periodicity. You always need to check to find out where it is at the moment. Check with the program director and knowledgeable colleagues.

2.4 Education and Human Resources

What are your potential contributions to developing human resources in science & engineering at postdoc, graduate, and undergrad levels?

In the last few years, NSF has started to take educational goals much more seriously. This section used to be boilerplate; it can't be any more. You need to think about what impact your research will have on education. Be specific but don't overstate.

2.5 Plan of work

Present a plan for how you will go about addressing/attacking/solving the questions you have raised.

Discuss expected results and your plan for evaluating the results. How will you measure progress?

Include a discussion of milestones and expected dates of completion. (Six months is the about the smallest time chunk you should include in an NSF proposal.) You are not committed to following this plan - but you must present a FEASIBLE plan to convince the reviewers that you know how to go about getting research results.

For new PIs, this is often the hardest section to write. You don't have to write the plan that you will follow no matter what. Think of it instead as presenting a possible path from where you are now to where you want to be at the end of the research. Give as much detail as you can. (You will always have at least one reviewer who is a stickler for details.)

3. Results from Prior NSF Support

If any of the PIs have received NSF support in the past 5 years, you must include a summary of the results of previous work. The pages in this section count toward the total 15 pages. You can use this section to discuss your prior research and how it helps to support your current proposal. One of the purposes of this section is to help the reviewers evaluate your track record.

- Award #, amount, period
- Title
- Summary of results

- List of publications acknowledging NSF
- For renewals: relation to proposed work

4. References

Pertinent literature referenced within the project description.

Program directors often look in the bibliography for potential reviewers, and reviewers often look in the bibliography to see if their work is cited. If your bibliography has a lot of peripheral references, your proposal may be sent to reviewers whose work is not directly related to yours and who may not understand your proposal. On the other hand, if you do not cite the relevant literature, your proposal may be sent to reviewers who are not cited and who will criticize you for not knowing the literature. Most of the references in the bibliography will be cited in the Related Work section. The references do not count in the 15 page proposal limit.

5. Biographical Sketches

Educational background and career, academic essentials only. List the highlights that a reviewer of the proposal needs to know about you.

List up to five relevant publications, patents, copyrights, or software systems, plus up to five other significant publications.

Graduate students advised and postdocs sponsored in the past five years and total numbers advised & sponsored.

List long-term associates with whom you have collaborated in the past two years plus your graduate and postdoc advisors. This is for conflict-of-interest: NSF will not send your proposal to your close colleagues, your thesis advisor, nor to anyone at your current institution. You may list such people explicitly, if you wish.

Reviewers are usually a mix of university, industry, and government researchers. Almost always, the majority are academics.

6. Budget

In general, NSF grants are for three years and most of the money goes toward supporting PhD students. A typical budget for a single PI grant is about \$100K/year which will pay for a graduate student (tuition and stipend), about 10% of the professor's time to supervise the student, a little bit of travel, copying, and overhead. However, the grant size varies from division to division. Ask someone in your area what is typical.

Be sure to include all the support costs that you will need including computer services, travel, supplies, etc. NSF may cut your budget, but they'll never give you more than you ask for, so be sure to ask for everything you need.

Describe, justify, and estimate cost of equipment items \$1000 or more. If your equipment needs change between the time you submit the proposal and the time it is granted, you can still buy what you need -- But be sure to talk to the university grants office **BEFORE** you buy the new equipment. There are special rules about equipment money because it is usually exempt from overhead charges.

The business manager in your department or grants office will usually help you fill out the budget form once you have identified the direct costs.

7. Current and Pending Support

List all current and pending support on the given forms. Your budget office can probably help with these.

If you have submitted the same proposal to more than one agency, be sure that you declare it on the cover page and in the current and pending support section. If you don't and the same reviewer is picked by both agencies, you won't get funded and your reputation will be damaged. Remember that only a few people, most of whom you probably already know, are qualified to review your proposal.

8. Facilities and Special Considerations

This section should focus on the facilities available to you that you need to do your research. If you will rely on any specialized equipment, describe it. The question in the reviewer's mind is: Do you have the necessary resources to carry out the research? In addition, if you are asking for equipment in your proposal, you will want to make clear what equipment you don't have.

OPTIONAL: Special considerations if some work will occur off-campus