"A Guide to Writing Proposals for Federal Funding"

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February, 2000

Index of Subtopics

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1. INTRODUCTION

The following sections provide a guide to the art and science of writing competitive proposals for federal funding. While this guide may provide valuable information for proposal writing in general, it was prepared with research proposals in mind, not educational proposals.

Federal agencies such as the National Science Foundation (NSF) and the National Institutes of Health (NIH) have traditionally provided support for research funding in the form of grants, where money is transferred to the grantee institution and there is no substantial involvement between the agency and the grantee. In contrast the Defense Advanced Projects Research Agency (DARPA) traditionally uses contracts to provide research support and with this type of funding mechanism, there is a great deal of DARPA involvement during the project performance period. This guide discusses issues relevant primarily to grant procedures, although contract procedures are addressed briefly.

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2. INSTITUTIONAL ENVIRONMENT

When writing proposals, you need to take into account your institutional environment. If you're in a major doctoral institution with a one course per semester responsibility, you must be successful in obtaining research funding. If you're in a liberal arts college or comprehensive university that do not offer doctoral degrees, where you may be teaching three courses per semester, you will have very little extra time to do research. It does not mean that it's impossible, but you may have to do different sorts of research, or less quantity, or collaborate with people at other institutions. A teaching-oriented institution may also encourage you to look for funding to support innovative curriculum development, rather than research. If you are teaching at an Institution with a large proportion of minority students, there may be special programs that you can take advantage of.

3. SUBMISSION STRATEGY

3.1 COMMUNICATING WITH YOUR PROGRAM MANAGER

First you must choose to which funding agency or organization you will submit your proposal. Once you have identified the agency that funds your type of research, you should find the program manager within the agency whose program best matches your research focus and scope. Carefully read through the program announcement or description and talk with the program manager to make sure that there is a good fit. If the program manager likes your work, but it does not fit exactly in her funding area, she will often be able to make suggestions that will steer you in a slightly different direction more in line with what she is able to fund. She can also suggest other programs and organizations for you to contact that may be helpful in your research endeavors.

Sometimes a proposal will overlap more than one program or organization. In this case, you may need to discuss your project with several program managers to determine to which program you should submit your proposal.

You can see why getting to know the program manager who funds your type of research is an important activity. Many program managers go to conferences to evaluate the research being presented and to meet the researchers. So if you are attending a conference and see your program manager there, use this opportunity to introduce yourself. In the best case the program manager will have read your work, but don't count on this, and have ready an explanation of what you do. She may sit down with you right there and then and talk. If she is too busy at the conference don't be worried, take it in stride. Ask for her business card and contact her after she gets back to Washington. If you do not have an opportunity to see your program manager face to face, then contact her by telephone or by Email.

Remember, when you have the opportunity to explain your research to a program manager, you must get across very concisely and very coherently the problem you are solving, why it is important, and how you plan to attack the problem. You may not have much time to do this, so decide what you're going to say and practice it beforehand.

3.2 TYPE OF PROPOSAL

3.2.1 One proposal or many?

There are good reasons for submitting several proposals and probably trying more than one funding organization. The first is that not all funding sources fund everything you will need. Industry tends to give equipment, and the federal government likes to support faculty and students (it also supports equipment acquisition of course). The second is that there are many more good proposals submitted than there is money available, so not all of your proposals will be funded.

A good model is to write a core technical text on which you can base several proposals, each of which is sent to a different source. For example, you send one proposal to the National Science Foundation asking for Research Assistant salaries and your summer salary, and one to Sun Microsystems asking for workstations, notifying each about the other proposal. It's the same research project, but you're asking for different types of support. As another example, in the core text you might have different subprojects, each doing a separate part of the work, perhaps each with a different focus. You could submit some of the subprojects to the NSF and then different ones to the Office of Naval Research (ONR). But remember, always notify each agency about the other proposals.

It saves you time to submit several proposals as described above, rather than to craft several new proposals from scratch. (Frankly, in the beginning of your career, you might not have enough research ideas to craft several separate proposals). From the funding agency's viewpoint, they want to get good researchers into their programs, and they want to fund viable research. So they are usually happy to share funding with another agency.

3.2.2 Single or multiple investigators?

Should you be the sole principal investigator (PI) on a proposal or collaborate with others on a group proposal? Some organizations have sources of funding strictly for one PI, e.g., the NSF CAREER awards for junior faculty. Other organizations have sources of funding channeled in the direction of collaborative, multidisciplinary projects which will have several investigators, be more complex, will ask for more money, and will extend over a number of years. So the answer is yes, you should participate in writing both individual and group proposals, emphasizing the approach that makes most sense for you, taking into account how far along you are in academia and how broad your research interests are.

3.3 INSTITUTIONAL COMMITMENT

To succeed in your research endeavors, your need your institution to be committed to your research project. This commitment may take the form of adequate laboratory space for your research, basic equipment to get you started, released time from teaching, etc. Funding agencies often require some level of cost sharing, either in cash or in kind. You need to discuss this with your department chair or your dean, so make sure you keep them up to date with what you are doing. Your proposal will require a senior institutional representative to sign that the University agrees to the amount and form of cost-sharing, as well as other financial agreements in the proposal.

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4. PROPOSAL PREPARATION

4.1 WHEN TO START WRITING

Start the proposal-writing process early. If the proposals are due in October or November, start gathering your thoughts in June. It takes a long time to focus fuzzy, new ideas into a concrete, credible proposal. It is also a good idea at this time to discuss your ideas with senior colleagues. Even experienced proposal writers typically take two to three months to write a proposal. It's not merely a matter of writing things down; you're trying to find a problem, come up with a good solution and explain it well. It will take you several iterations to get it right. You're new at this so you want to leave yourself enough time to craft a good proposal.

Allow sufficient time for your administration to read through your proposal and sign off on the Institution's commitment. Your administration cannot sign off in twenty four hours. Allow yourself at least a week for the administration to check budgets and determine sources of cost sharing etc.

4.2 WHAT TO ASK FOR

In writing your proposal, you need to determine what you want to ask for in support. Do you want summer salary for yourself? Do you want to buy equipment? Do you need a powerful workstation? Do you need a robotic arm? How much do you need to travel to a major academic conference? Do you want to support undergraduates, graduates or postdocs?

Let us say you need equipment, most people do nowadays. Does your university have a base of equipment already? When it hired you did it give you a workstation for your desk? Or do you have one that three faculty share? If you don't have the equipment infrastructure you need for your research, that's the first thing you should ask for in your proposal.

4.2 DEFINING THE RESEARCH PROJECT

One of the first sections in a proposal is a discussion of the problem you plan to solve. You should make it very clear that it is a problem worth solving. This is important even if you're working in a field where no one doubts that the problem is important.

In thinking about a research project, you've got to find a problem, an idea, something that's exciting to you. If the problem is new to you, survey the literature. Find out what other people are doing, what has already been done. You have to show your credibility, that you know what else has been done. Contact some of the major investigators that you find perhaps through that literature search. Perhaps you'll bump into them at a conference. Ask some friends if they know them.

Discuss your ideas with other people, with your colleagues and ask for their feedback. This is a good brainstorming way of getting your ideas going. And very important, don't wait until you get funded, get started on that project. If you need equipment then get started on some of the theory behind the project. Do that literature research. It looks a lot better on your proposal if you can show that you've done some preliminary work even if it's just some of the very basics.

Before you start writing, read through some successful proposals in your area. Contact the program manager of the funding organization and ask how to obtain copies of successful proposals. For example, if you do experimental work, read a proposal in experimental work, so you can see what kinds of things they talk about, how much space they devote to the various sections, how they hone their arguments and so forth.

And lastly, many program managers like to see your vision of where you're going with this research. So if you have that future view, include it in your proposal.

4.3 YOUR UNIQUE CONTRIBUTION.

Why are you the best person to do this research? One way of demonstrating this is to talk about how you are qualified to carry out this work. You should discuss your track record, show some of your previous work that leads up to it, which may, of course, mean your thesis. Basically you need to show that you have the skills, the background and experience to do it.

Are you extending somebody else's work? Are you doing a problem with different techniques or are you designing new techniques? Say why your contribution is unique. What are other people doing in the area, either directly in your area or related to it? This demonstrates that you've done your literature research, that you're familiar with what's going on.

Is your project technically feasible? A proposal that neither the reviewers nor the program managers think is technically feasible will not succeed. So show that your proposed work is feasible with the resources you are asking for and the resources you indicate that you have at your university?

4.4 THE RESEARCH PLAN

Describe at a fairly high level, how you plan to address the problem. Be concise but give sufficient detail for the reviewer to understand exactly what you are proposing to do. Provide enough information to indicate that what you are proposing to do will actually work. If you do experimental work, put in some preliminary data. If you do theory, sketch out partial proofs. If you develop algorithms, include some algorithmic design.

4.5 BUDGET

Present a carefully justified and realistic budget. Nothing irritates reviewers more than unrealistically high budgets. For equipment get the best discounted prices you can and use these discounted prices in your budget. If there is something unusual in your budget or perhaps something very expensive don't try to hide it. Come up front and say why this item is necessary for you to do your research. It may be expensive but if it's a one-of-a-kind there will be no discount.

Do not exceed the program budgetary guidelines. Talk to your program manager about what can be included in your budget and what is excessive. It varies from program to program. Some programs, like theoretical computer science programs, have very tight constraints. Other programs that are more experimental in nature have much looser requirements and will provide more categories of support such as graduate students, multiple computers etc.

4.6 REVIEWER NAMES.

While NIH has standing study sections to review proposals, NSF uses different groups of reviewers in each competition. Thus at NSF, it is standard procedure with a research proposal to list names of people that you think are qualified to evaluate your proposal. When making suggestions, don't leave out a whole school of thought, but if you would rather the program manager avoid someone, say so. There may be some people who you do not feel comfortable with as reviewers because you have some personality conflicts with them, or you think they are biased against you or your work. It's up to the program manager to take note of this or otherwise. But they will usually honor your request and choose names from those that you have suggested as reviewers, as well as some different names.

The reviews are usually not blind, the reviewers know who you are. They receive your full proposal containing everything that you submitted. In contrast, you usually receive anonymous reviews with the names of the reviewers removed. At NIH a roster of the study section members is sent to the investigator along with the reviews. At NSF, such rosters are not revealed to the investigators.

4.7 PROPOSAL DOCUMENTS

Each federal agency has its own set of rules and regulations concerning the format of a proposal together with special forms that must be submitted with each proposal. Required forms usually include cover sheets identifying the program, the investigators and their institutions, budget sheets, current and prior awards forms, institutional disclosure forms etc. Your institution should have a sponsored research office which probably has these forms and can help you fill them out. They are an important resource and should also be able to point you in the direction of appropriate programs for your research interests.

You are usually asked to supply biographical sketches of all investigators on the proposal. Read your program announcement carefully because it will very often specify a maximum number of pages for each vitae. Also check the agency guidelines before including appendices. NSF, for example, does not allow appendices to be included with a proposal.

There are usually very tight guidelines on proposal lengths. Agencies are trying to reduce paperwork to reduce the burden on reviewers. NSF and NIH impose page limits on various parts of your project description and will return your proposal if it exceeds these limits.

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5. PROPOSAL PRESENTATION HINTS

All the reviewers and program managers are scientists or engineers. They are used to reading scientific literature, so write in the scientific style.

Present your ideas clearly and succinctly and write to the reviewers. It is important for a reviewer to understand what you're doing right at the beginning. Most programs require you to provide a project summary or abstract outlining the problem, your research plan and expected outcomes. This is the reviewers' introduction to your project, so you should put considerable thought and effort into writing it well.

A good proposal is readable, well-written, well organized, and grammatically correct. Organize your proposal to permit skimming. Many reviewers will read the abstract to see what you're doing, then they'll look at your paragraph headings and probably look in detail at particular sections that catch their eye. Use paragraph headings either underlined or bold so people can see what you're doing.

It's also important to get feedback on your proposal before you send it to the funding organization. Show the proposal to someone on your faculty, someone who has written successful proposals. Or ask someone who has served as a reviewer for a funding agency to assess your proposal and give you comments on improving it. Allow sufficient time for making changes to your proposal as a result of these collegial reviews.

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6. PROPOSAL REVIEW PROCESS

What happens after you submit your proposal? Assuming that it meets the page and formatting requirements of the agency, at NSF it will be sent to the program you indicated for review, at NIH it will be sent to the appropriate study section for review.

There are two sorts of reviews, mail review or panel review. Mail review used to be used a great deal by NSF for research proposals, but now panel review is more commonly used. Mail review means that copies of your proposal will be sent out to several people in your research area. Each reviewer will provide a written review of the proposal together with a rating. At NIH, it is usual for proposals to be reviewed only at Study Section meetings.

Reviewers are drawn from colleges and universities, industry, foundations, professional societies and government laboratories and agencies, as appropriate for the proposals being reviewed. Reviewers are chosen based on their scientific and educational expertise.

Panel review is often used to speed up the review process and goes hand in hand with a program with a deadline. A deadline is a specified date by which you must submit your proposal. All the proposals are then collected together and a panel of outside experts is brought together to review all the proposals at once. It sometimes happens that panel members are unable to adequately review a proposal because its research area is outside their own areas of expertise. In this case, the program manager will send the proposal to additional reviewers for a mail review.

So when the reviews are done, whether by mail or panel, they will be examined by the program manager and some action will be taken. Most of the time the program managers agree with the reviewers' recommendations but sometimes they will disagree. There are usually far more highly rated proposals than there is money to fund. So the program managers have to decide which of these can be recommended for funding.

For programs awarding grants (NSF and NIH), you will receive copies of the reviewers' comments with the reviewers' names removed. Reviewers are charged with safeguarding the confidentiality of proposals and are asked not to copy, quote, or otherwise use material from any proposal. At DARPA, where the mode of funding is through contracts, you will not see the reviews but may receive a briefing summary.

You should expect it to take several months from when you mail in your proposal to when you hear whether you've received an award or not. It's perfectly all right if you haven't heard anything for a while to inquire as to the status of your proposal.

It is very interesting and informative to understand the review process, and it will really help you write better proposals. So talk to your program manager and volunteer to be a reviewer.

7. EVALUATION CRITERIA

It is important to learn the evaluation criteria of the organization to which you are sending your proposal. For example, in 1997 NSF moved from using four criteria to using the following two criteria:

Criterion 1: What is the intellectual merit of the proposed activity?

How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of prior work.) To what extent does the proposed activity suggest and explore creative and original concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

Criterion 2: What are the broader impacts of the proposed activity?

How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?

In addition to these base criteria, individual NSF programs may have additional criteria which are described in the program announcements. Be sure to read the current announcement carefully.

Other agencies also have specific review criteria. These can be obtained from the program officer or from the agency web site.

8. SUCCESSES AND FAILURES

The four possible actions following your submitting a proposal to a federal agency are: an award, withdrawal of the proposal, return of the proposal, or a declination. Let's look at each of these.

8.1 Award – this is what we are all hoping for, that you are successful and receive an award.

8.2 Withdrawal of the proposal – your proposal can be withdrawn by your institution any time before the final decision has been made. This would happen if you left the university for example.

8.3 Return of the proposal without review – a funding agency will return a proposal that is inappropriate for the program, or that exceeds the specified page limits, or that arrives after the program deadline. For example, a proposal concerning development of building architecture that had been sent to a computer architecture research program, would be returned to the submitting institution.

8.4 Declined or non-fundable – this means that your proposal will not be funded. If this happens, do not be discouraged. Everyone has proposals rejected. There is not enough money for this not to happen. So the first thing you should do is damage control on your spirits.

Second, treat the declination as a learning experience and look carefully at the reviewers' comments. If you don't understand what they've written then contact your program manager and ask her to explain the reviews to you. Always take the reviews very seriously. If the reviewers complain about something or misunderstand something you have written, then re-write that part of your proposal. Unless the feedback indicates otherwise, revise your proposal taking into consideration the reviewers' comments and re-submit in the next competition.

9. FEDERAL FUNDING SOURCES

Different funding agencies have different rules, different budgets, and different priorities. Individual programs within agencies may have different rules, different budgets, and different priorities, so read the program announcements carefully.

Federal programs, rules and procedures change over time, so check with the agency to which you will be submitting your proposal, for their current information. This information can usually be found on the agencies' web sites.

10. ACKNOWLEDGEMENTS

This guide is based primarily on the Computing Research Association's Committee on the Status of Women in Computing Research (CRA-W) proposal writing workshop the author conducted at the Grace Hopper Celebration of Women in Computing in 1994. However a number of ideas from two CRA-W panels held at the Federated Computing Research Conferences FCRC '93 and FCRC '99 have also been incorporated. The transcripts of all these presentations are available at the CRA-W Web site: http://www.cra.org/Activities/craw/.

My thanks to the panelists: Dr. James Cassatt, National Institutes of Health; Professor Marina Chen, Boston University; Dr. Frederica Darema, National Science Foundation; Professor Susan Eggers, University of Washington; and Dr. Helen Gigley, Naval Research Laboratory. I would also like to thank Dr. Dianne Martin, George Washington University and NSF; and Drs. Judy Finkelstein and James Cassatt, NIH who read through the guide and made helpful suggestions.

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11. FREQUENTLY ASKED QUESTIONS

11.1 Can you submit the same proposal to different programs in the same agency or to different agencies?

In general the answer is –no-. NSF does not allow you to submit the same proposal to more than one program in the Foundation, and any related proposals submitted to other agencies must be disclosed in your proposal. However certain Directorates in NSF may impose stricter rules, e.g., the Biological Sciences Directorate does not accept proposals that have already been submitted to NIH.

NIH does not stop you from submitting your proposal to another agency, but it does want to know about it. It is illegal to accept federal money for the same project from two sources.

11.2 What happens if you have an award at one university and you accept a position at another university? Can you take the award with you to the new university?

It depends on the type of award. Some of them you can take with you as long as both universities agree to the transfer, and your new university agrees to assume any cost-sharing and financial obligations that were part of the award requirements. Except for fellowships, the award is made to the university and most times the university will let you take the award with you. If your current university does not agree, and the funding agency determines that it does not make scientific sense for the project to continue without you, then the award will be taken back from your current university when you leave.

11.3 What are the percentages or proportion of proposals that are funded? How big are the awards and how long do they last?

The average success rate at NSF is between 28% and30%, the success rate being the ratio of the number of proposals that are funded divided by the total number of proposals received. NSF's average annual award is just over $100,000 with most projects being funded for 2-3 years. At NIH, the success rates vary depending on the particular Institute. In the National Institute of General Medical Sciences (NIGMS) the success ratio is 35% to 38%, the average award size is around $250,000 (total costs) and most projects are funded for 4 years. DARPA's success rate varies from 10% to 20%, with awards ranging from $220,000 to over $1 million, with durations of 3-5 years.

11.4 What should I do if my proposal is turned down?

Keep trying. It's a very competitive process. If the average success rate is thirty percent that means that seventy percent of proposals that are received are turned down. It doesn't mean that those seventy percent are poor proposals. A large number of them have probably been evaluated as fundable. There is just not enough money to fund all good proposals.

Each agency also has a number of priorities such as national initiatives, geographic diversity, balancing awards to new faculty versus experienced faculty, funding small institutions as well as large institutions. So even though there may be a set of proposals that have received excellent technical reviews, when deciding upon whom to fund, other priorities must also be taken into account.

So if your proposal is turned down, look at the reviews and try again. Don't be too discouraged if you are not successful the first time.

11.5 Are budgets ever negotiated?

Yes, many times the budget is negotiated, more often down than up. For example, a program manager might only have enough money left to fund graduate students but not equipment. So you should accept the reduced budget and look elsewhere for equipment support. You may decide to go back to your university and explain the situation to them. Sometimes they can come up with additional funds. The university negotiation is up to you; the program manager will not get involved with that.

Question: Would they make that reduced funding contingent on your getting such funds from elsewhere?

It's up to the program manager, but probably not.

11.6 How do you know what to put down for salary?

There's a strict algorithm for that. If you're on a 9-month academic appointment, each month of support is one-ninth of your gross salary. If you're on a twelve-month appointment, you use one-twelfth.

11.7 What if you are graduating and don't yet have a job, so don't know what your salary will be?

For most programs, it is the institution you work for that submits the proposal on your behalf, and an award is made to the institution, not to you. So when you are hired by the institution you'll know from the letter they send you what your salary is going to be, and that's what you fill in. You can't submit a proposal until you have the university appointment.

11.8 Is cost sharing always required in NSF proposals?

NSF's policy on cost sharing changed in 1999. Cost sharing is not required in NSF proposals unless explicitly stated in the program announcement. Programs supporting equipment acquisition usually require a significant level of cost sharing. However, additional cost sharing by the institution is no longer allowed to be taken into account in the review process.

11.9 How can I find out about issues relating to indirect costs?

The best source is your institutional sponsored research office (sometimes called the grants and contracts office). In addition, each funding agency publishes a document that provides all the details related to budgets, including indirect costs. Look for these documents on the Web.

11.10 What are the most frequent causes of a proposal receiving a poor review even if the research ideas are good?

A very common reason is poor presentation of your ideas, so that it is unclear to the reviewers what research you are proposing to do or how you are proposing to do it. The guidelines presented here have been designed to help you write well-organized proposals that present your ideas clearly and succinctly.

Another common reason is failure to address all of the components of the program. For example, if you submit a pure research proposal to the NSF CAREER program and omit an educational component, then the reviewers will downgrade your proposal since the program requires you to address the integration of research and education.

The most common reason for faring poorly in an equipment request is failing to justify the need for the equipment