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Tricks of the trade: Developing research funding

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Abstract

Building a research group is an important determinant of career success. Maintaining a cadre of students and assistants depends upon many factors, but perhaps none is so important as funding. Raising money takes time, a fact often bemoaned by professionals across the spectrum, from educators to politicians to missionaries. This paper presents advice from faculty who have been very successful in obtaining funding, including some who have served for a time as NSF program officers. They advise that it's important to serve on review panels to learn how the system works. Find out what each program is interested in, by meeting the decision-makers, presenting a short outline of your research, and listening to what they have to say. Once you've written your proposal, have others give you feedback on how to improve it. Devise a long-range plan that will keep you attentive to opportunities for new initiatives.

Keywords: research funding, program officer, mentoring, mock panels

1. Introduction

Although research funding is an indispensable requirement for advancement in an engineering faculty career, it has evidently received little attention in recent ASEE conference presentations. To address that need, this paper compiles advice from several successful engineering faculty—including two who have served as National Science Foundation program officers—on how to go about seeking research funding. It does not discuss individual programs, though it does offer some suggestions for finding them. Rather, it concentrates on finding out about funding opportunities and building a personal network to enable oneself to compete effectively for them.

The first step in getting funded is to come up with an idea. The next step is to find an agency that is interested in the area. Then the researcher must make a credible case that (s)he can make a contribution in the area. Sometimes this is through a single-investigator proposal, but more and more frequently, it is as a member of a team. In the latter case, networking is crucial.

2. The idea

A good research topic must have many qualities. It must be inventive. An incremental advance is not enough. Don't just read a research paper and think of a better way of accomplishing the same goal. Rather, try to be inventive and find a totally new approach—an out-of-the-box solution that, if successful, can lead to multiple publications and follow-on proposals.

But how to find such an idea? Our respondents were virtually unanimous in advising new faculty to serve on National Science Foundation panels, and to review for other agencies, including the U.S. Department of Education and DARPA. The advantage of this is that you become familiar with a lot of different research ideas and see how reviewers react to them. It is safe to say that you will learn more by reviewing others' proposals than you will be reading reviews of your own proposal. You get to know the characteristics of a good proposal. You see how thoroughly others review related work, and what it means to be innovative. You gain a much clearer idea of what is required in an evaluation plan. And besides, you get paid for your time.

Agencies are always looking for reviewers. The need is particularly acute in large competitions, because no one who submitted to the program is allowed to serve on a panel. Yet qualified reviewers must be found. You can volunteer by contacting a program director, or you can ask senior faculty to recommend you if they can't make it. Provide a very brief draft of your areas of expertise to enable them to assign you to an appropriate panel

Panels are not the only way to gain a broad overview of research. Program committees for conferences and workshops are another. Program committees for influential conferences usually involve many senior researchers, but there is often room for new people. They are similar to funding panels, in that each member is required to read a certain number of submitted papers, and then the whole committee meets—either physically or virtually—to discuss which ones to accept.

A third way to become familiar with current research is to review for journals. This gives you an opportunity to see the most mature new work. After you have submitted your review, you may be asked to review a later revision of the same work. You will usually be able to see other reviewers' comments, and be informed of the editor's decision on whether to accept the work. However, compared to reviewing for conferences or funding agencies, you don't get to see a range of work, and you don't get to discuss it with other experts.

It is also important to find a good mentor [1, 2], a more senior person who will work with you and advise you. You may be able to be a co-PI on a proposal with your mentor. It is becoming more common for universities to set up formal mentoring relationships matching senior faculty with junior faculty [3]. But it's also possible to set up an informal relationship, maybe with someone at another institution.

Students can also be helpful in preparing new ideas. Sometimes unfunded students can be effective, for example, taking an independent-study course [4] to do a literature search and/or exploratory experiments.

3. Agencies

2.1 The National Science Foundation. NSF has 7 directorates, but there will be one, perhaps two, that are relevant to you. Peruse their web sites for programs that are of interest. Sign up for "National Science Foundation Update Weekly Digest Bulletins" at http://www.nsf.gov/mynsf/. Community of Science Pivot (pivot.cos.com) is another service that will alert you to funding opportunities in your area. It is a fee-based service, but your institution likely has a subscription.

The mission of the National Science Foundation is to support "basic scientific research and research fundamental to the engineering process." This doesn't mean that NSF will support *any* kind of research, as long as it is of high quality. Rather, the perspective at NSF is that they are funding things in the *national* good [5]. Since it is not possible to support *all* high-quality research, priorities need to be established. This involves tradeoffs between activities that may not be directly comparable. Is solving an open problem in cybersecurity more important than, say, developing better methods to make buildings earthquake safe? NSF's priorities are reflected in program announcements. Even a proposal that is rated very highly by a panel may not get funded if the program officer does not consider it a high enough priority. Perhaps the program officer has just funded work very similar to this proposal. Two of the respondents said that they had submitted proposals that had received all excellents and still were not funded. The author was once a co-PI on a proposal that received all excellents and very goods and was not funded.

This means that it is important to respond carefully to the solicitation. When in doubt, ask a program officer by phone or e-mail. Only the program officer understands how the program fits together. You need to find out what the officer is interested in, and back out what they're not.

It is valuable to get in contact with a program officer early, before you have invested much in a particular proposal. If you are going to be in Washington (e.g., for a panel or for a conference), try to stay an extra day and visit NSF (as well as other funding agencies). Peruse the NSF web site and make a list of POs you are interested in seeing. Regardless of when you come, many of them will be on travel, so it is wise to just visit whomever is in town, rather than trying to time your visit to see everyone you are interested in.

When you visit, don't treat it as an opportunity to give a research talk. Your goal is not to convince them that you've done good work, but rather to find out what they are interested in. Try to talk for 15% of the time and listen for 85%. Throw out a number of ideas and see what sticks. The officer is he best person to tell you that your idea has already been funded, or that it's of interest, but needs to be modified in some way.

Program officers can also direct you to other programs that might be interested in your work. The author once had a program officer suggest that he check out five different programs. You can then discuss your ideas with officers of those programs, either by phone, or on a later visit.

Talking with PIs is part of a program officer's job. Rotators (faculty on leave with NSF) usually have more time to talk than permanent staff, because they aren't determining policy. If you don't know who's permanent, it shouldn't be hard to do a web search to find out. There is no rule that you need to actually visit them in their office. But, program officers are in charge of multiple programs and panels, as well as traveling to conference and meetings to do presentations and learn what's going on in their field, so their time is very limited. If you can meet them in their office, you will be a higher priority than someone who could phone in at some other time.

2.2 Mission agencies. Mission agencies are those federal agencies whose primary purpose is to advance a particular kind of research relevant to the agency's programs. These include defense agencies (DARPA, Army Research Office, Office of Naval Research, Air Force Office of Scientific Research) , and the Department of Energy, among others. These agencies issue Broad Agency Announcements, which can easily be located on the web. Before submitting to these agencies, it's absolutely necessary to discuss your idea with a program officer. Their needs are very specific, and you can quickly tell whether the program is worth pursuing. You can find out more about the kind of work they are interested in by offering to serve as an external reviewer for proposals submitted to them. The Sponsored Projects Office at the University of California-Berkeley has a useful list of funding opportunities [6] for new faculty from mission agencies as well as NSF.

2.3 Industrial funding. Industrial research tends to be more applied, focusing on specific short-term problems. Personal contact is critical. You can ask to give a talk to get your foot in the door. You probably won't get funded after the first talk, but you may be invited back. And finding out about their problems helps you to mold your ideas to meet those needs.

Former students are a great way to make contact. Connect with your students on LinkedIn, and then do a search for "connections" with that company in their profile. Another way is to look for people from these companies at conferences. When you meet someone, tell them what you are working on, and ask if they know anyone in their company that might be interested in it.

One perennial issue with industrial funding is the continuity. Frequently, projects are for one year, which is not a good length for someone working on a Ph.D. However, if the

money comes in as a gift, which it frequently does, there is no time limit on spending it. If the amount is large enough, it can fund a student until completion.

4. How to get known

Going to conferences, by the way, is a good way to get known in the community. Each year, you should try to go to two or three conferences closely related to your interests. It is good to look at the conference program in advance and list the people that you want to meet, preferably looking up their picture so that you will recognize them at a distance. Attending talks is a good way to get familiar with work that is being done. But even more valuable is the opportunity to meet people "in the hall" to talk about your work and theirs. Or, ask them, "Who is the person that I really need to talk to about my idea?" Many conferences have an opportunity for people to give 5-minute "lightning talks" on "wild and crazy ideas." This is a good way to get up in front of the community even if you haven't had a paper accepted. Others will give you feedback on your ideas, and help you hone them.

Another way to get known and fulfill part of the service requirement of your employment is to volunteer at conferences or local professional meetings. For example, the IEEE has sections all over the country, and they periodically have meetings. Helping to host these meetings puts you in contact with practicing engineers from many different companies.

5. Building your reputation

More and more frequently, collaborative work is where the money is. Fortunately, the same networking strategies that help you find the right program will also help you find collaborators. You may meet them at a meeting or a conference, or you may review something they have written. You shouldn't reveal your identity as a reviewer, but if you see them on a conference program, be sure to seek them out. Do not be afraid to propose a collaborative project with a more senior person. You may be able to take the lead in describing the work, and their advice and their track record may help make it a success. In any case, it's essential to have an idea that all PIs are interested in. Get the idea first, then build the team. If you do it the other way around, you are likely to produce a proposal that looks like it was written by a committee—with no real unity to the work.

One question that comes up frequently is, How many proposals should you submit? The first principle is, Only submit proposals for good work to programs that are interested in that work. If you force more work out the door, you are only wasting your time. In most fields, you should aim to submit about three proposals per year. If you are not successful the first time, discuss the reviews with the program officer. One of our respondents said that he had rewritten a proposal based on that advice, and got funded the second time, even though the reviews were not as good.

Always get your proposal written early enough that you can give it to colleagues to read over. Pay attention to the feedback they give you. A mock panel [7] can be a good exercise to get more extensive feedback and gain insight into the workings of proposal review. A set of researchers read each other's proposals. It can be organized so that they read proposals on the spot, which prevents people from coming unprepared. They write simple reviews of the proposals, then assemble to discuss them. This can help identify weak spots in the rationale or plan for the proposed work. Furthermore, it makes participants aware of each other's work, and helps them identifies opportunities for collaboration. It tends to be hard to organize, because participants need to have their proposals prepared far in advance of funding deadlines. If you take the initiative, setting up a mock panel is a way to enhance the visibility of your research, as well as improve your chances of having it funded.

Finally, set your horizon far beyond your first grant. Think of what you want to be doing ten years from now, and work backwards from that. That will help open your eyes to what you can achieve, and diminish the chances that you will miss out on a useful project or collaboration because your mind was focused too narrowly on your immediate goals.

Note to reviewers: If you, or anyone you know, would like to contribute ideas to improve the final version of this paper, please fill out the survey (anonymously, if you wish) at http://tinyurl.com/res-funding-advice.

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