Applying for Grants: Why and How?

John Etnyre

Applying for grants is an important part of an academic research mathematician's career. There are myriad reasons why, from the obvious—directly supporting your research and pleasing your employer (or future employer) if you get the grant—to the less obvious—refocusing yourself on where your research fits into the greater mathematical world and why you are doing it, even if you do not get the grant.

Before moving on to the actual application process, let's flesh out a bit more "why you should apply." Grants will typically support some or all of the following: your travel to conferences and workshops; your ability to bring collaborators to you; a summer salary that allows you to focus on research; the undergraduate and graduate students working with you; computer and other supplies; and, in some cases, the postdocs working with you. All of these things are of course highly beneficial to your research program. In addition, university administrators are interested in faculty obtaining grant support, so demonstrating that you can do this can be advantageous to a job search or to building a case for promotion. This alone is ample reason to apply for grants. But even if you do not get a grant when you first try, the application process can be very favorable to your research. Specifically, research problems can frequently be highly specialized, and while working on them it can be easy to lose sight of why one is working on the problem. Without some reflection on what you are working on, it can be easy to head down a rabbit hole that no one really cares about. Writing a grant makes you step back and think about the big picture. Why are the problems I am working on interesting to the mathematical, or broader, community? What should I be trying to work on over the next few years? While trying to answer these questions, you can frequently come up with whole new interesting lines of research, in addition to having a better and deeper appreciation for problems on which you are already working.

There are numerous organizations that fund various types of research mathematics. Consider applying for several grants; even small grants, like grants to support travel, can have a big impact on your career, and they can be a stepping stone to larger grants. [The AMS website has a convenient list of many of these opportunities at `https://www.ams.org/opportunities`, and the *Notices* prints a Mathematical Opportunities section in every issue, where Early Career Opportunities feature prominently.] The most common funding for most mathematicians comes from either the National Science Foundation (NSF) or, more recently, the Simons Foundation. The Simons Foundation offers various types of grants, details of which can be found at `https://www.simonsfoundation.org/funding-opportunities`. The NSF also has various opportunities from research and CAREER grants, to workforce and FRG grants; see `https://www.nsf.gov/div/index.jsp?div=DMS`.

The rest of this article will primarily focus on NSF research grants, though much of the discussion will apply to other grants as well, especially other NSF grants.

First and foremost, every grant will have a grant solicitation that describes all the particular issues about the grant, such as who may apply, what funding may be requested, criteria for reviewing the grant, and other essential information. Read and carefully follow the grant solicitation when preparing your grant proposal. Secondly, for whatever grant you are applying for, ask colleagues if they can share examples of successful grants of that type. Reading as many such examples as possible is a great way to get a sense of the structure of a successful grant proposal.

As with all writing, one needs to keep the audience in mind. Typically, your NSF grant proposal will be evaluated with forty or more other grants in a similar area by a panel of ten or more experts. The panel will put them into some rough order, and then the NSF program directors will take these orderings and evaluations and combine them with other panels' evaluations for nearby areas of mathematics to determine which grants will be funded. Your grant will typically be read by three people on the panel, then their evaluations will be read to the rest of the panel, who will then discuss, give your proposal a collective evaluation, and rank it with the other proposals. It is important to keep in mind that of the three people who carefully read your proposal, most, and maybe all, are probably not experts in your specific research area. They will be in some nearby research field, and probably know something about your field, but that is all you can assume. In particular, they will probably not know the intricacies of some of the important questions of your field or why they are important. You need to explain that to them. That is, the target audience for your proposal is someone broadly working in an area similar to your own, but not necessarily an expert in the area. As such, your proposal needs to appeal to this audience, so carefully explain your terms, why your problems are interesting, and how your work fits into the broad field as a whole.

Also, keep in mind that each panelist is reading a large number of proposals, so make it easy for them to read yours and see the merits without any difficulty. It is good to make sure some non-technical indication of the main goals of your proposal and its impact on the field are included in the first page or two of the proposal. This should help keep all of your reviewers carefully reading and give them ideas to use while arguing for a better ranking for your proposal.

John Etnyre is a professor of mathematics at the Georgia Institute of Technology. His email address is `etnyre@math.gatech.edu`

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If your grant is not funded—typically less than one third are, so you are in good company—then you will receive feedback on your proposal. Carefully take this feedback into account and resubmit your grant the next year. Your proposal will hopefully be stronger for this and there will be a new panel evaluating the proposal, both of which can affect how your proposal is ranked.

NSF grant proposals must discuss "intellectual merit" and "broader impacts." Most people are fairly clear on the intellectual merit of their proposal; this is usually the research that will be done if the grant is funded. Broader impacts are not as well understood by many. The NSF has a good discussion of broader impacts at `https://www.nsf.gov/pubs/2007/nsf07046/nsf07046.jsp`.

In mathematics, broader impacts usually involve your impact on other people. For example, your educational efforts beyond your standard teaching duties—such as preparing notes to introduce young mathematicians to your area of study and mentoring undergraduates, graduate students, or people at any level; your efforts to build STEM infrastructure—such as organizing seminars and conferences, developing new curricula, and partnering with researchers in industry; and your outreach activities—such as participating in math circles, giving public lectures, broadening participation in math of people from underrepresented groups, and writing general audience articles. While younger mathematicians might not have done all that much on the broader impacts front, don't worry. The panelist reading your proposal knows that it takes some time to develop a good track record; but it is not hard to start doing several things to improve the mathematical community around you, and doing so will give you some good broader impact; so, get out there and get started now!

Preparing a grant proposal can be a very rewarding endeavor, helping you to broaden and deepen your research program. And, of course, being awarded a grant can be a real boon to your research program. Therefore, now is the time to start looking into your grant options and start thinking about writing a grant proposal.

John Etnyre

Credits

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