

Finding Funding

Susan Morey

You just got a new position. Congratulations! Now you're ready to get down to work to make your new position a long and prosperous one. While there are many aspects of settling into a new position that might be challenging, obtaining funding can be among the most daunting. So where do you start?

Getting Started

One of the first steps you should take is to talk to your department chair and colleagues to find out about the culture surrounding external funding. Is it required in order to obtain tenure? Is all funding valued equally ("the color of money is green"), or are certain national funding sources (e.g., NSF) seen as more desirable? Are certain types of funding viewed differently than others? For example, would obtaining funding for students be highly prized, or viewed as a minor point if it does not also fund your research? If funding is required or strongly recommended for tenure, the parameters and expectations are hopefully written in a tenure and promotion document or policy statement, but it is still a good idea to talk to senior faculty members to find out how they view the issue. Please keep your local situation in mind when taking advice about funding, including the advice presented here!

The next step is to find out what resources are available to help you find funding. Is there a staff member within your department, college, or university who assists on the pre-award side, either through helping find funding sources or through providing information for the budget or institutional infrastructure portions of the proposal? Is there a centralized office on campus for grant activity? Are there workshops offered that would help you obtain funding? Does your institution subscribe to one of the services that helps identify sources of funding? Is there someone on campus who assists with proposal budgets or proofreading? Will you be attending any meetings that have sessions on funding or opportunities to meet with representatives from funding agencies? Take advantage of these opportunities and resources. Go to that panel discussion or visit with the appropriate support staff. Asking for advice from colleagues who have served on grant review panels can also be useful.

The third step is to make a plan that fits your situation and allows you to balance the time needed for research and for proposal writing. You should talk to your chair at this point and keep him or her informed as you progress. The

chair will need to approve the proposal and possibly find ways to support it, so they need to be aware of your plans.

You are probably aware that research funding in mathematics, particularly from the largest national funding agencies, is highly competitive. If you already have a track record of success obtaining funding from these agencies and you utilized the funding productively, then you have a great start. If you are in a heavily research-oriented position with a modest teaching load, you might be able to pursue multiple national research funding sources while continuing your high-quality publication record. If your position has a heavy teaching and service load, you might find that working on a collaborative program or outreach grant best fits your objectives. While a six (or even seven) figure grant is a wonderful way to support your research endeavors for several years, a more modest four figure grant applied judiciously can be exactly what is needed to get a project started or to create new opportunities within your department. Grants of this type vary widely, both in source and intent. They do not all generate the same degree of indirect cost funding as traditional research grants, so be sure to check the details of the grant and make sure your institution will support the proposal before spending large amounts of time writing it.

Expanded Funding Opportunities

Once you have a plan, you will need to find the right funding sources to make your plan a success. There is funding available in mathematics beyond the large national research grants. Many institutions of all types have some form of internally funded grant opportunities. Apply for these internal grants and use the resources they provide as fully as possible. Perhaps you can get summer funding to allow you to reduce your summer teaching and focus on research. You might find a source on campus that funds work with undergraduates. Maybe your university has some travel funding for which you can apply. There could be a small grant that allows you to bring a collaborator to campus. Leverage these opportunities to the fullest. While travel is difficult at the moment, apply with the future in mind. There are also a variety of equipment grants if your research needs more than what your university provides. Ideally, these smaller grants allow you to improve your research portfolio, gain experience with the grant writing process, and provide seed projects from which larger external grants can grow.

Although COVID-19 has curtailed travel this year, opportunities for external travel funding still exist with an eye toward the future or to offsetting registration fees for the present. Interested in going to a large conference relevant to your area? Check to see if the conference offers a travel grant for early-career mathematicians. Plan ahead as the deadlines are often set to allow time for the applications to be reviewed prior to the registration deadline. The AMS-Simons travel grants, the AWM travel grants and mentoring travel grants, and the SIAM early-career travel awards are all

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excellent opportunities for early-career mathematicians to explore. Many other national societies have opportunities for travel funding for faculty or to aid faculty in sponsoring student travel, including SACNAS, NCTM, NAM, MAA, and others.

The national mathematical societies provide an array of funding opportunities in addition to travel. The tab for “Grants & Opportunities” under “The Profession” on the AMS website lists a variety of funding possibilities, and it has a convenient filter option to focus on those geared toward early-career faculty members. Are you interested in outreach activities and in a department that prioritizes them? Do you have a great idea of how to enhance your student’s education but no idea how to pay for it? Consider applying for one of the MAA programs listed on the MAA website under the “Outreach Initiatives” tab of “Program and Communities.” A grant of this type can really give that great idea you have a boost in the right direction while building your grant writing and administration experience. Explore the websites of the societies mentioned in the past two paragraphs to find additional opportunities.

There are several national organizations that provide grant opportunities in mathematics including NSF, NSA, and DOD. Many other countries have analogous funding agencies. The types of grants, qualifications, and eligible fields of mathematics vary by agency. In addition to standard research grants, national agencies support REUs, conference grants, programmatic grants, and grants to support students. If appropriate to your area of expertise, consider collaborating with others outside of mathematics. An applied mathematician working with an engineer, physicist, or chemist as appropriate for their work can be very successful with grants housed in agency divisions other than mathematics.

Words of Caution

When considering the type of grant for which to apply, make sure your department supports the initiative, is willing and able to supply necessary resources such as space and staff support, and you are aware of the amount and type of work involved in making the grant a success. For example, if you are going to run an REU, be prepared to potentially spend time solving unexpected practical problems that might pop up with housing, transportation, library access, and more. Talk to someone who has received the type of grant before if possible to avoid unexpected surprises. When branching out to a different type of grant, be sure you or one of your collaborators has each type of expertise required. If the grant involves educational research, program development, or has a strong educational component (such as a CAREER grant), plan ahead and build a team if necessary. For example, you might need to find an educational expert to serve as an external evaluator for your educational component and that person’s services will need to be reflected in your budget.

There are private entities, such as companies or foundations, that fund various types of mathematical endeavors. A company might provide funding overseen by a faculty member that pays graduate students to work on applied or statistical problems of interest to the company, for example. Some companies and foundations have programs that provide outreach grants or donations for specific types of activities. Before considering this type of funding, you should first do some research regarding your institution. There may well be a development office or administrator who oversees private funding, and a different set of guidelines and procedures that you will need to follow. As an example of why working through such an office or official is important, consider the reaction you are likely to get if you secure \$10,000 from a foundation that has a “one award per institution” policy when unbeknownst to you someone in another department was in the process of submitting a \$1,000,000 proposal with a high likelihood of success. In addition to assisting with important documents, such as a Memorandum of Understanding, and other regulations that differ from grants, these offices often have staff who can help you find appropriate private funding sources for your work or proposed project.

Time to Write

OK, you have a great idea and you found a funding source. Now you need to write a competitive proposal. Start early to allow time for revision and allow for any extra time the grant office at your institution might require or to get necessary approvals for submission.

Know your audience and tell a compelling story. When applying for a research grant from a federal agency you will want to provide a sufficiently detailed and technical description of your research plan that will convince an expert in your field that you are working on a good problem and have the expertise to solve it. You should include an introduction that describes how your work fits into the broader area and illustrates its importance. If you are writing an internal proposal, find out who will be reviewing it. In many cases, the review group will consist of faculty members from a variety of disciplines and might not have a mathematician of any subfield on it. You need to think very carefully about how to talk about your work for a general audience of people with PhDs in fields other than math, and you are likely to have only 2–5 pages to make your case. You will still need to describe your work and how it is important, but you will need to do so with a minimum of technical language. You can certainly state the problem using technical language, but in many cases you will not have room to define every term starting from scratch, so you will need to include an explanation and context for the problem instead. The reader should get a broad sense of what you are doing, be convinced that it is important work, and know how the outcome might benefit your institution. This outcome might be a refereed journal article, an external grant proposal,

development of a new course, implementation of teaching innovations, or a seed project that increases the likelihood of future external funding, for example.

Once you have a draft, you should first go back to the guidelines and check very carefully that all have been followed. Do not give the reviewer a trivial reason to reject the proposal. Make sure you have addressed all items requested in the call for proposals or program description and that you have the nitty gritty details (margins, font sizes) correct. For programs that evaluate proposals using a rubric, following the guidelines carefully and in order will make it easier for the evaluator to find each section, which is likely to lead to a better outcome. Now enlist an experienced colleague or your department chair for feedback. For a technical grant, someone in your area who has received a similar type of funding is ideal. For a more general (internal) grant, someone not in your field might be better able to advise you on whether or not you have explained your work well for a general audience. Seek feedback and then listen to it. Revise as needed to improve the proposal and to reach the correct audience. If you have reviewers' comments from an earlier version of your proposal, read those carefully and modify your proposal to address any concerns raised. If you are unsure how to interpret the comments, a trusted experienced colleague can help. You can also contact the program officer or review committee chair (for internal grants) to ask about feedback received, to ask for additional feedback on earlier proposals, or to clear up any confusion regarding guidelines.

By the time the proposal is ready to be submitted, you will have spent a great deal of time and energy on it. Ideally the experience of thinking about your proposed work and how to present it along with how it fits into the bigger picture will have been a benefit to you whether or not the grant is funded. Use the process to learn, connect with new mentors, and get feedback on your ideas. If the grant is not funded, you will still have benefited from the experience. This is particularly important since it typically requires several rounds of application, denial, revision and improvement, and reapplication to become successful in obtaining funding. If your proposal is funded, congratulations! The hard work of making the most of the opportunity is just beginning.

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Credits

Photo of Susan Morey is courtesy of Susan Morey.

Communicating Mathematics in a Research Proposal

Emily Clader

Good proposal writing is, in many ways, just good mathematical writing, which is just good writing, period. Neither of these equivalences is entirely true, however, and examining their nuances is a helpful way to probe the question of what exactly makes a strong research proposal in mathematics.

To be clear, when I say “research proposal,” I have in mind the Project Description in an application for a National Science Foundation grant, but also the part of any grant application—whether through the NSF, the Simons Foundation, your home institution, or some other funding body—in which you, the applicant, explain the work for which you are requesting funding and why it deserves to be supported. How can you comprehensibly and convincingly explain the significance of your research within the constraints of a proposal?

Good Proposal Writing is Good Mathematical Writing

Let's start by considering, in the specific context of a research proposal, some of the aspects that good mathematical writing generally exhibits.

- **It invites interest from the entire intended audience.** “Know your audience,” they say. In the case of a grant proposal, that audience is your reviewers, who are likely to be members of your broad research community—algebraic geometry, for example, or number theory—but unaware of the technical details of your more focused field. On the other hand, they could very well be the world's leading expert in your microtopic. For the sake of the nonexperts, it's helpful to highlight some of your subfield's flashier or more well-publicized results, and to situate your own work within that story. The experts will catch you if you tell any outright lies, but they're likely to be impressed rather than bored if you can gloss over the details enough to give an engaging and accessible account of the mathematics they already know.
- **It leads with motivation and chooses details with intention.** No first sentence should ever be “Let X be a projective variety.” This is true of papers, and it's doubly true of research proposals. Before being presented with mathematical details, a reader's interest should

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