Being Flexible and Wearing Many Hats

In our department there are a large number of part-time adjunct lecturers supporting our ability to offer the courses that our students need. Because of this, our full-time faculty members take on many additional roles to keep things running smoothly and to make improvements to better serve our students and community. Some of this work looks like what you may traditionally think of as "service," but not all. For example, a wide variety of courses have to be taught (within and outside of faculty members' areas of expertise), new courses must be developed to meet student demand, decisions need to be made about the curriculum, students must be selected for awards, departmental events need to be organized, the website must be kept up to date, job openings must be filled, and so on and so forth. Outside the department other work needs to be done as well, for instance in college-wide committees or in the faculty union if the institution has one.

It is important to protect research time, but it is also important to be willing to be flexible, wear several different hats, and contribute to the common effort of the department. We have found that much of this work is enjoyable and interesting: it can be a way to pursue intellectual interests outside of your research, collaborate with colleagues on a shared project, and contribute positively to the departmental atmosphere.

It will benefit your application if you can demonstrate that you would be willing and able to contribute to the department and the college in these various ways. Of course, as a grad student or postdoc, your primary focus should be on developing your research and teaching. However, you may want to take on some small, manageable responsibilities that show your ability to contribute to the community when the opportunity arises. For example, you could co-organize departmental activities such as colloquia and graduate student seminars, coordinate TAs and common final exam grading, or advise undergraduate students in a mathematical modeling competition. You can also seek opportunities outside of your department by, for example, serving as a judge at undergraduate research poster sessions or on panels for prospective graduate students.

Some Final Thoughts

We were both on the job market before the COVID-19 pandemic, and our experiences involved a lot of in-person opportunities and networking. We understand that the pandemic has made seeking out these sorts of opportunities much more challenging. We recommend reading other articles in addition to ours to get tips on how to navigate the job market in a more virtual world (see, for example, [GH1]).

Good luck in your job search!

References

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Heidi Goodson   Diana Hubbard

Credits

Photo of Heidi Goodson is courtesy of Heidi Goodson.
Photo of Diana Hubbard is courtesy of Nicholas Vlamis.

This Is What Success Feels Like: What I Learned from Applying for the NSF Postdoc Twice

Kim Klinger-Logan

Early one morning in January 2020 I was lying in bed trying to summon the will to exit my warm sheets and go downstairs. I usually check my email and the news to muster the energy to handle the chaos that results from juggling two dogs, a 9 month old, and oatmeal. There it was. *The* email. *The* NSF. But I had to be misreading something. "Congratulations" … since when do they congratulate you for applying … ? in January … ? I needed a rational, fully conscious and caffeinated person to read these words. I leapt from bed, calling my partner's name, and as I was rushing down to the stairs, my foot slipped out from under me and I slid down the entire flight. My partner was sure that I was holding the baby and it took a good 10 minutes before he could comprehend that nothing was wrong and

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we were just in some alternate universe where a new mom can also be an NSF Postdoctoral Fellow.

One year before, in January 2019, I was welcoming undergraduates to the beginning of a workshop that I had helped found and organize aimed at recruiting women and minority math majors. I was 6 months pregnant and there were no stairs to slide down in excitement. Instead, I was crying on the floor of the women's restroom of the math department after finding out that I did not get the NSF Mathematical Sciences Postdoctoral Research Fellowship (MSPRF) and, in fact, would probably not get any job as my husband was about to accept a job at a remote school in Kansas and I had no other offers. That day I wondered how I was supposed to show these young people that they could become mathematicians when I could not even tell myself that I was a successful mathematician.

When I think about the contrast between these two days, I am reminded of what of my advisor Paul Garrett used to tell me, "This is what success feels like." He never said this in regards to the "Congratulations" email you get while lying in bed. He was always talking about the other email. Success is trying and not quite succeeding but maybe learning something in between. So here is what I learned in 2019, and what I did differently a year later.

What is the NSF MSPRF and Why Should You Apply?

The NSF MSPRF is a postdoctoral fellowship taken at your research sponsor's institution for 2 years with no teaching or for 3 years, teaching one course per semester for the last two years (with part of your salary paid by the sponsoring department). Compared to many US postdocs the salary is a bit higher and the award has significantly more travel funding and less teaching.

There are many reasons why you should apply to the NSF MSPRF. First, there are 30–33 fellowships given each year and so it is seen as fairly prestigious. While you may personally not care about prestige, it will likely have a positive impact on your career.

Given how competitive it is you may wonder if applying is just not worth the effort. However, the effort is in fact what makes it worth it. Drafting the 5-page Project Description will force you to begin considering the direction of your research post-PhD. This document is less about what you have done and more about what you will do next. Writing the proposal will help you plan where you want your research to go and how you want to define it. It will likely form the basis of the research statement you write as a component of your job applications.

Finally, it is likely you will need to apply for grants as part of your job later on. Many NSF grant applications have similar evaluative criteria (which I will mention in more detail later on). While the requirements for other applications may not be exactly the same, framing a good proposal is a learned skill. Even if the projects you propose

do not get funded and never come to fruition, you will get valuable practice at grant writing in a relatively low-risk yet high-reward setting.

The Application

If your first application is submitted while you are a graduate student you can apply at least one more time. It is also not rare to be awarded the fellowship on your second try.

Before I dive in, I should outline the main components to this NSF application (Note that these may change so please check the requirements each year.):

(a) Project Description—This is the meat of your application. It is to be a maximum of 5 pages (not including the references). The key emphasis should be on the "Intellectual Merit" and the "Broader Impacts" of your proposal which I will describe below.

(b) Project Summary—This is a one page summary of what is in (a). It has three main sections: "Proposal Summary," "Intellectual Merit," and "Broader Impacts."

(c) Biographical Sketch—This is essentially a CV in a very specific format.

(d) Letter of Sponsor Support—Unlike many other NSF grants, you will choose a "sponsoring scientist" to serve as your mentor who is required to write a letter that you submit with your application. This is not a letter of recommendation but should address how the sponsor plans to support you and your research during your fellowship.

(e) Letters of Recommendation—It is always good if you can have at least one of these coming from outside your home institution (though this is certainly not necessary).

(f) There is also a separate list of references and data management plan—these are not time consuming to complete but it is good to be aware of.

Your proposal needs to address two main criteria. These are the only dimensions on which it will be judged. The NSF describes these two components as follows and states that there are no weights assigned to the review criteria [K4].

Intellectual Merit: The Intellectual Merit criterion "encompasses the potential of the project to advance knowledge" [K3].

Broader Impacts: The Broader Impacts criterion encompasses the potential to "benefit society and contribute to the achievement of specific, decided societal outcomes" [K3].

Many people have written about what qualifies as Broader Impacts. Peter March's letter on Broader Impacts Review Criterion highlights some Broader Impacts often seen in successful proposals [K3]. There can be a fine line between a Broader Impact and "doing one's job" and I encourage you to see Max Lieblich's *Notices* article "What is Broader Impact?" [K2]. While this is aimed at faculty, he draws some helpful distinctions about what are and are not Broader Impacts.

When reading your materials, the reviewers are asked to evaluate them with respect to the 5 Merit Review Criteria (which can be found in full detail in [K1]). They address the potential of your proposal to advance knowledge and benefit society, the originality of your ideas, and the likelihood of you successfully completing what you propose.

What I Did the First Time Around

In this section I discuss the things I was glad I did the first time that I applied for the NSF MSPRF.

1. I started early.

The application is due the third Wednesday in October and I began writing my Project Description in early June. This is not strictly necessary; however, drafting and editing a good statement takes much longer than you likely think it is going to.

I recommend getting as many people to read your materials as possible. If you start this process early enough, you will have time to implement the suggestions of one person before sending it on to the next. The first people I had look at my application were other graduate students in my cohort. We made a schedule and rotated reviewing each other's proposals each week of the summer and most of the fall semester. It went something like "Week 1: draft NSF Project Description, Week 2: edit NSF Project Description, Week 3: draft NSF Project Summary, … " Having each document planned out with ambitious deadlines that someone else was holding me accountable for was immensely helpful.

If you are the only one in your cohort who is planning to apply to the NSF Postdoc, you can still do a version of this with friends at other institutions. Alternatively, you might set parallel schedules with friends who have other goals, e.g., who are applying for other jobs or other fellowships. No matter how disciplined you are, having an accountability buddy and external support is priceless. However, this tip is just meant to be helpful, and it is certainly not necessary to have peers to review your application or work on theirs with you. You should apply regardless of what your cohort is doing.

Once you have a draft of your materials, send them to your advisor and/or project sponsor. Ask around and find out if you know anyone who has been on an NSF review panel. I did not do this in my first round but I did on the second time around and I believe it made the difference between me not getting the award and me getting the award. This person may have a good eye for details that you should tweak in order to appeal to a panel.

2. I chose a sponsor whose work relates closely to the project I was proposing.

I was fortunate enough to have a clear idea of who I wanted my sponsor to be early on and asked him to be my sponsor during the summer before I first applied. My dissertation was a direct response to an area that he helped develop so it was natural that I would work with him. My sponsor was also an excellent and well-regarded mathematician with a

variety of other research that I found interesting. While very busy, he was a person I found that I could work with and would have time and energy to devote to writing a good letter of support.

You want to choose a sponsor who you can talk to and will have time to work with you, but it is also helpful to have someone who is whose work is known in your field. It should be clear that your sponsor is capable of at least discussing your project with you. I was told early on that it is good to have your sponsor's work align well with yours and most of the projects I have seen funded support this theory. You may want your sponsor to be someone you or your advisor has published with, or perhaps your project cites your potential sponsor's work. When you write up your proposal, call attention to the relationship between your sponsor's work and the work you are proposing, and make the case that your sponsor will be equipped to support you.

When I asked my sponsor if he would serve in this role, I had never met him before and had no reason to believe he knew who I was. I did not have my full proposal written but I did give him a rough idea of what I was planning on working on and sent him my CV and other relevant information. I sent him a draft of my proposal not long after he agreed to be my sponsor and he did provide me with some helpful thoughts on the proposal but the work I proposed was my own.

3. I read other people's applications.

If you do not personally know anyone who has received this award, talk to your advisor and/or Director of Graduate Studies to see if any recent alumni have received it. You also likely have a faculty member or postdoc in your department who at least applied for this fellowship. (In fact, I wish I would have read more "unsuccessful" applications as well.) You can even view all of the previously funded projects and their PI's on the NSF's website; however, it is best if you have a personal connection with someone before asking to view their materials. Remember, these are someone's research ideas so sharing materials requires an element of trust. That said, many people are happy to send portions of their own materials if you ask nicely. For instance, a person that I had only spoken to once or twice at conferences generously shared her materials with me. However, do not share any of these materials with anyone else unless you were given explicit permission to do so.

While I did read a few accepted applications on my first round, I wish I had examined the proposals more critically and at varying points of my writing process. In particular, I should have revisited the applications I had access to after I thought my draft was "done." It is good to take a break from writing for a few weeks (if possible) to think about how your application will be perceived in a pile with the other applications you have—after all, that's essentially where it will be when it's reviewed. It is more likely you will be able to do this if you start early.

It's likely that (provided you have any proposals to read) the ones you have will be outside your area. In retrospect, I wish I had asked myself questions like: How did they format their document? How much time is spent on background material? How many projects and conjectures are proposed? How much of an outline are they providing for how they plan to attack each project? How does the proposal denote proposed versus completed work? What is the intellectual merit? How is project sponsor discussed?

Pay special attention to the verbiage used in successful applications and think about how your proposal will compare to the others if they were in the same group. For instance, characterizing your future work as "extending" or "generalizing" other work (whether yours or someone else's) without support or explicit details can make it seem like you really don't have anything novel to contribute.

4. I engaged in Broader Impacts.

Intuitively one ought to propose things you *will do* while you are on the fellowship that will have Broader Impacts. However, since you will likely be pursuing your fellowship at an institution you've never been to before, it is tough to say anything meaningful about either (a) what's possible in this new environment or (b) what impact such things might have.

However, like most things, the best indication of future success is past success. In graduate school, I was fortunate to be given support from my advisor and graduate program to develop programming to create community among graduate and undergraduate students with the goal of broadening participation for women and minorities. Getting involved in these projects early helped give me a clear perspective on what I enjoyed and what I saw my contributions to be. As a graduate student there are often lots of ways for you to get involved in whatever you are passionate about—AMS, AWM, and SIAM Student Chapters; REUs; Directed Reading Programs; Math Circles, Camps, and Festivals; adjunct teaching; etc.

This work should not distract you from your research, but it is important to be honest with yourself on both sides. Ask yourself: Are you doing so much that you do not have time or energy for research? If so, find a way to prioritize your research—that is the thing that will allow you to stick around to continue to make Broader Impacts. However, the tougher question may be: Are you really working on research and being productive with all of the time you do have? Contributing to your community will be part of your future job if you choose to stay in academia. First, service is a required and important component of many tenure application materials. Second, Broader Impacts are an important component of all NSF grant applications, and in many departments, you will be expected to apply for these grants regularly whether you want to or not. You might as well find out what you enjoy now while the stakes are relatively low. There is a "sweet spot" I try to achieve. If I do not have enough to do I get a bit directionless. On the other hand, if I say "yes" to every act of service asked of me I can run myself ragged and have no energy for research.

My Broader Impacts did not change significantly between my first application and my second. However, I did pare them down. In concrete terms, the Broader Impacts section in my first application occupied about half a page; and, in the second, it occupied a small paragraph that was closer to a quarter of a page. I included fewer items which were in my more distant past. This was tough, but to be honest, I did not engage in these activities for the NSF.

Women and minorities in general are asked to do far more service than others and they are often penalized for working on these projects rather than on research. We all have 5 pages for our Project Description and the more you say about your Broader Impacts the less you are saying about the Intellectual Merit. While program guidelines state that neither of these aspects is of greater weight, they are, in practice, not evaluated by similar standards of rigor. As I later became aware, while it is important that you have Broader Impacts, there is less of a hierarchical ranking about which are better or how many you need or what amount of time they should occupy. I am not providing a normative statement here but only a descriptive one.

What I Learned the Second Time Around

My sponsoring scientist and institution did not change between the first and second round and my relationship with my potential sponsor did not change much in the year between my first and second application.

In the year between my applications I had time to think about what I had proposed from a more detached perspective. As I mentioned previously, being able to come back to your application after taking time off is truly beneficial. What you saw a year ago as "as good as you could possibly do" is now kind of crappy. This is a measure of growth. The year between my applications was a year spent developing my ideas more deeply and adding new ideas to my application.

The major difference between my first and second application was the number of projects that I proposed. In the first round, I really only proposed one project. It had many steps and potential publications along the way but most of them were not very explicit. In my second round, I basically added a whole other aspect of my proposal that likely could have been its own application. Instead of having only one explicit conjecture, this proposal had five. In the second proposal the sectioning made very clear that there could be seven different publications from the proposal. While it is good to have some unifying theme or picture, the entire proposal does not have to work toward answering *one* question.

Between my two applications, I also sat down with someone who had served on NSF panels before. This person gave me details about the review process which helped me fine tune aspects of my application.

While having time for my ideas to develop was invaluable, it would have been worthless without also having my "failed" application. I had already done all the leg work that causes so much unacknowledged anxiety: contacting my sponsor and letter writers, formatting my biographical sketch, and, especially, writing a first draft.

Receiving a rejection when you put so much time and effort into something is difficult. However, the effort is exactly what makes the process worth it. I did not see it at the time, but all the work I put into the proposal was me being a successful mathematician. Putting all of my best ideas out there, pushing myself to learn more, trying to find answers to the questions that drive my research, and communicating that vision to my peers—that is what success feels like.

References
[K1] Max Lieblich, *What is broader impact?*, Notices Amer. Math. Soc. **68** (2021), no. 7, 1137–1139.
[K2] Peter March, *Broader impacts review criterion*, `https://www.nsf.gov/pubs/2007/nsf07046/nsf07046.jsp`.
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Kim Klinger-Logan

Pathways to a Career Outside of the Academic Silo

Elizabeth Munch

Whether we want to believe it or not, the world is changing. In particular with the rise of data science and high performance computing, there is no longer[1] a single career path to be followed by a person with a Mathematics PhD.

I earned my PhD from a traditional math department in a traditional university. I held a tenure-track position in a traditional math department, and still have a 30% appointment in one. I was expected to do only traditional math research. It was quickly made clear to me in my first years of a tenure-track job that I would need to conform to the template of what those institutions thought of as a "real mathematician," or I would fail. For me, satisfaction in my career came after my move to a new, interdisciplinary department, with all its freedoms and challenges. For some of you, the tenure-track position in a math department is your personal definition of success. I truly believe there is much good work to be done from that vantage point, and I wish you the best of luck. However, this advice is not for you. I'm writing to offer advice to those looking to make their mark outside of any single academic silo by looking for a career path in an interdisciplinary department, program, or institute.

No advice is unbiased. My advice comes, admittedly, with a heavy dose of survivor bias. Additionally, my axes of privilege, including being white, cis-gender, heterosexual, and having a big-name university attached to my PhD, have yielded a great deal of something-that-looks-like-luck over the course of my career. Finally, I only have experience in the American academic system; what I say may be wildly incorrect outside of the United States. Given these limitations, I invite you to sit with my advice, and if it doesn't fit for you, I encourage you to simply dismiss it.

Perhaps you are nearing the end of your PhD program in a math department and are working to envision where you can see yourself and your career in the next five years. Perhaps you are excited about the possibility of research in an interdisciplinary setting, but are trying to figure out how to get there or what that would look like. This advice is for you.

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[1]*Nor was there ever.*