NIH & NSF Funding Advisor

The monthly guide to preparing and submitting optimal grant applications

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Attention to detail is critical

Steering Tips for NSF's FastLane, Its Online Grant-Processing Tool

The science behind your proposal is always your top priority, but if you ignore NSF submission instructions, overlook review criteria, or wait until the last minute to file, it's likely that your ideas won't even be considered, says **Bev Sherman,** NSF senior analyst.

"We get so many proposals that we fund only those that obey the rules," she says.

For example, you may think your project is so incredible that it deserves a five-page project summary. But if the program solicitation says to keep it to one page — as is the case for most NSF grants — anything else is chucked into the proverbial dustbin.

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Study Section Insider

2 Strategies for Handling the 'Preliminary Data' Challenge

by Christopher Francklyn, PhD

Today's challenging funding climate makes it more important than ever to acquire enough **preliminary data** to surmount initial reviewer skepticism about the feasibility of your research proposal.

In the past, when numerous re-submissions were permitted, reviewers often consented to giving a *good* application an *excellent* score after being worn down by successive proposals in which the preliminary data were stacked higher and higher. As a rule of thumb, I used to tell junior PIs that they needed to have a third of the grant's experiments completed before having a reasonable chance of funding success.

Now, with the new shorter format and the prohibition against more then one re-submission of the same application, the landscape has changed. Rather than inserting copious figures and tables detailing preliminary data directly into the grant, other strategies are needed.

Essentially, applications must be crafted so that more of the burden of showing feasibility of the research plan — the main reason for including

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"The project summary cannot be any longer than one page. If it doesn't meet that requirement, you're out the door. It will not go any further; it will be returned to sender," says Sherman.

"You must follow both the PAPP (*Proposal and Award Policies and Procedures Guide*) and the solicitation so that you get everything right," she warns applicants.

Sherman covers these and other specifics in a workshop she presents at institutions, called *Use FastLane to Prepare and Submit Your Proposal to the National Science Foundation.*

FastLane is the online grant submission tool used at NSF. (NIH uses a similar system, electronic Research Administration.) It is typically used after a grantee has searched *www.grants.gov* for federal funding opportunities.

Address 2 key criteria separately

Another problem Sherman hears from reviewers is that many applicants fail to identify and clearly address NSF's two main judging criteria — **Broader Impact** and **Intellectual Merit.** All proposals submitted through FastLane must do so or be disqualified.

Each needs to be under its own itemized heading. "If you don't itemize it, we return it," Sherman says.

The **Intellectual Merit** section calls for an explanation of how one's research will advance knowledge and explore transformative concepts, but scientists should keep their explanations as simple as possible.

For instance: If your study is aimed at discovering a new application for solar energy, don't go into great detail about its current uses or well-known challenges to other applications. Instead, perhaps simply say, "We believe these experiments will show that solar energy can be a cheaper, cleaner, and longer-lasting power source for ABCs and XYZs — an application not considered before but one that would have an obvious major benefit to society."

"If you write it too complicated their [the reviewers'] eyes are crossing and they'll say, 'Let's go on to the next one,'" Sherman says.

Barbara Houtz, director of outreach at the Eberly College of Science at Pennsylvania State University, helps PIs there write the **Broader Impact** section of their proposals. (She is a former NIH reviewer but now works with the NSF program.)

She says many PIs either overreach with an overly ambitious **Broader Impact** program or aren't ambitious enough in reaching under-represented groups.

Broader Impact has five main components that a proposal must address: 1) advance discovery and promote learning; 2) broaden participation of under-represented groups; 3) enhance infrastructure for research and education; 4) disseminate research results; and 5) explain societal benefit.

Aim to impact under-represented groups

Houtz starts by helping grant-seekers pick their audience for Points 1 and 2 above — promoting learning and reaching out to under-represented groups, which could be high schools or small colleges with high minority enrollment or in economically deprived areas.

A mistake some PIs make, she says, is creating "broader impact" programs (in their research area) that benefit the most advanced high-school students from the top schools.

"I have a lot of faculty who are not American, so they are completely at a loss as to what the American education system is like. They don't see all the kids the system has failed. I try to push them into the schools that are failing," Houtz says.

Therefore her Outreach Office helps PIs create and present science and math education programs for targeted audiences. This includes coordinating science camps, a variety of science activities at local schools, and the opportunity for groups to tour university laboratories.

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She says newer PIs tend to buy in to the spirit of **Broader Impact** more readily than senior faculty. "They say, 'This is what I'd like to do.' Instead of our trying to convince them, they've already decided there's an obligation."

Avoid rush-hour filing

Houtz's No.1 piece of advice for submitting through FastLane: Do so at least a day in advance.

If the grant deadline is 5 p.m. and you're online trying to submit at 4:45 p.m., there are so many people trying to submit at the same time that you may encounter problems with the system, she says. She's heard of FastLane crashing in the midst of someone submitting a grant close to the deadline.

If you're working close to deadline, FastLane technical support contact information is 1-800-673-6188 or e-mail fastlane@nsf.gov. You may submit a request for technical assistance at https://www.fastlane.nsf.gov/servlet/gov.nsf.fastlane.contact.Action.

Do not complain too much about Internet-related complications, though. Houtz recalls stories of faculty members rushing to drive from Penn State's campus to NSF headquarters in Washington in order to submit grants by a 5 p.m. deadline. Perhaps that's why NSF chose the name FastLane. ■

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preliminary data — is born by components outside the grant. Most notably, these include the PI's reputation and other published work.

For many study sections (and the institutes that monitor their recommendations), the conventional wisdom is that, without at least one or more publications in the research area of the problem, a PI's new R01 application will have an extremely difficult time attracting a score in the fundable range.

Given the decreased space in the application to demonstrate feasibility, it is highly advisable to have published work in the literature describing your expertise in the proposed methodology (or identify expert collaborators with same), i.e. publications that can be cited for the key methods. If reviewers have doubts about your experience, levels of productivity, or even knowledge of the field, they may very well overlook an otherwise well-crafted research plan.

An additional benefit of these publications is that they provide evidence of your motivation to enter a given field and evidence of the momentum of your lab with respect to the problem.

What can new PIs do?

What if you are a new PI without such a publication record? In this highly competitive climate, and for a number of NIH institutes, your optimum path to a successful R01 may well lie in an initial one- or two-year smaller award, such as an R03 or R21. While some department chairmen might balk at this strategy, evidence suggests that having such prior awards — which don't require preliminary data — increases one's chances of success.

Besides the obvious benefit of giving you one to two years of funding to publish and build scientific credibility, there is also this advantage: A prior R03 or R21 does not negate your "new investigator" status, which means that a critical benefit in terms of higher paylines is not surrendered. The same considerations apply to small grants from private foundations, which often are tilted in favor of new investigators.

While the additional time involved in writing and waiting for scoring/funding decisions on grants smaller than an R01 might be considered a drawback in terms of the tenure clock, there is simply no advantage today in submitting an R01 application that does not maximize your chances of success.

As a participant on several review panels, I can say unequivocally that reviewers need to be convinced of your qualifications to carry out a project before they will drill down into the scientific details of your application.

Without the progress shown by a robust publication record, an otherwise scientifically strong and highly creative research plan will be tossed aside with a poor score. So before you try to create the masterpiece of a research plan, ensure that you have addressed the preliminary data conundrum.

Get advice on grant mechanism

Reach out, too, to your senior colleagues and NIH program staff for advice on the most appropriate grant mechanism for your research project — and for the stage at which your program exists.

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Proper targeting can help you avoid the depressing experience of spending one or two months writing and two or three more waiting for a score on an application that will be rapidly rejected, owing to a reviewer's perception that you lack familiarity with the field.

Thinking strategically while you are writing that first application can decrease the number of initial rejections and get you on a path to funding sooner.

Dr. Francklyn is a former study section chair and veteran reviewer for NIH and NSF study sections. He is a professor at the University of Vermont, where his scientific expertise is in protein synthesis and RNA-protein interactions. ■

3 Strategies to Help You Find More Time for Grant Writing

by Christopher Francklyn, PhD

Many principal investigators say that finding enough time to focus on grant writing — thus making their proposals more competitive — is among their biggest challenges.

If you're a new PI, the advice you probably get most often from senior colleagues is, "Start writing early — very early," often followed by "Let me read a draft… a month before the submission date."

That can be difficult when you are simultaneously trying to set up your lab, write new lectures for your classes, interview new students, etc. How can you write a strong grant application while juggling all these pins simultaneously?

Here are three strategies that have worked for me and some of my colleagues:

1. Delegate as much of your lab's routine management activities as possible. During your initial recruitment and hiring efforts, make it a priority to bring aboard a detail-oriented staff member (technician, senior post-doc, etc.) you can count on to stay on top of ordering lab supplies, basic safety training, and drafting routine regulatory compliance forms, etc.

Of course you must have the final look at any key documents that go to University Research Protections offices (e.g., human subjects, animals, recombinant DNA, etc.), but having another individual provide the initial drafts is a huge time-saver.

Investing a relatively small amount of time to train your technician/senior student in these lower-level managerial activities and basics of regulatory compliance can pay you a big dividend — critical "think time" to create your grant proposals.

2. Maximize the significance and timeliness of your application. While **Significance** as a reviewing criterion does have its subjective aspects, expert reviewers will be well-versed in what is considered the "frontier" for your particular field, so your application must reflect that.

With all your time-consuming responsibilities, how can you keep up with the latest trends and discoveries in your field to ensure that your grant idea is significant and timely? Besides attending your field's annual or biannual meeting, use readily available automated monthly searches (e.g., my NCBI http://www.ncbi.nlm.nih.gov/guide/literature/howto/) to have the titles of newly published papers in your field sent to your e-mail inbox.

Then put your lab team to work. As part of your lab's "journal club," have staffers regularly search the literature for important new papers and present them to you and fellow lab members at weekly group meetings. Besides keeping your students at the forefront of your field, this will spur discussion and generate ideas for experimentation.

Reviewing activities, both for manuscripts and grants, also provides a useful vision of "where the field is going" — but new PIs need to be careful not to take too much time away from writing their initial grants and papers to review the work of others. Also, avoid the temptation of using others' materials as a detailed road map for your program; this can easily cross into the danger zone of plagiarism.

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3. Manage the "boilerplate" aspects of your application. These include such components as your **Biosketch, Environment/Resources**, and **Budget/Personnel** justification. While essential to all applications, these pieces typically don't vary much among the different grants you might seek. Thus, it makes sense to keep a "stock" grant-component folder in which these files are always updated, even when you're not currently writing an application.

You can even delegate to your lab manager the task of updating the **Lab Equipment/Departmental Resource** file, and the file that describes the skill sets and experience of each lab member. These serve as direct input for personnel justification files; you just have to assign the individual to a **Specific Aim** in the project.

With modular budgets, preparation of the **Budget** component has been streamlined considerably, and a line-item description of specific supplies is no longer needed. Instead, your three main decisions are:

1. What is my percent effort?
2. How many junior scientists are required?
3. Is there any specialized equipment that can be strongly justified?

Once you determine how many people are required, you can assume a fixed-dollar amount in supply money per investigator ($12-15K/yr). If your department has an administrator in charge of the financial side of grant preparation, it only takes a brief monthly meeting in advance of the submission date to get the ball rolling.

By following these strategies for the "boilerplate" sections, you can devote far more time and attention on writing the **Approach** piece of the research plan — where there is truly no substitute for your personal imprint. ■

5 Common Mistakes to Avoid on Critical Sections of NIH Application

You probably know that the **Significance, Innovation,** and **Approach** sections are at the heart of the NIH grant application. They make up a six- to 12-page narrative in which you explain the expected benefits of your research, demonstrate what you plan to do differently, and show your experimental approach to discovering new science.

Where do PIs most often go wrong in this critical portion of the application?

Dr. Paul Spearman, division chief of pediatric infectious diseases at Emory University, who has served on NIH grant-award committees and reviewed hundreds of applications, offered some suggestions in a recent live webinar, "Making the Pieces Work Together: NIH Grant Sections Significance, Innovation, and Approach," presented by *Principal Investigators Association.* http://principalinvestigators.org/Audio-Conferences/conference-100916/

Here are the five mistakes he says he's seen most often:

1. The PI has chosen the wrong application. "In a five-year RO1, there should be some comprehensive approaches and multiple experiments that tie into a common theme and achieve your overall aim," says Spearman.

He's seen applications for R21 grants (which are usually for simpler approaches and shorter periods of time) that read like something "that's been squashed down from an R01." And he's seen the opposite — R21 grant applications involving one experiment done three times stretched into an R01 application.

Suggestion: Get advice from an NIH program officer (PO) when in doubt whether your approach is comprehensive enough to qualify for R01 grants or focused enough to qualify for an R21.

2. In the Approach section, the Specific Aims are too dependent on each other. The "aims" are the research goals you will attempt to accomplish when you conduct the experiments you describe. **Rule of thumb:** Keep them as independent as possible.

"If the reviewer decides, 'I'm not confident Aim 1 will work, so Aim 2 and Aim 3 are dead,' you have a tough criticism to overcome," says Spearman.

If you have aims that depend on each other, you are better off placing them all under a single subheading. Spearman cites the following as a good example from a successful grant application: *"We realize that Aim 2 is an ambitious aim with multiple components. We have elected to present these experiments within a single overarching aim, rather than create two separate aims, because the biochemical and microscopic techniques are designed to be complementary in reaching the same goal."*

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Result: If the reviewer doesn't think this aim will work, you still have other bites at the apple in other aims. Each aim stands alone, even if they have multiple parts.

3. The PI fails to clearly state what's significant. "You want to go directly to what you are going to achieve that's different," says Spearman.

Cautionary example: *"HIV is a retrovirus that has caused a worldwide epidemic of AIDS. More than 33 million people are affected with HIV globally. As a retrovirus, HIV integrates into the host chromosome. Anti-virals are not without complications; resistance to current drugs occurs frequently."*

As Spearman says, "That's not good enough. This is basic and correct information, but it doesn't say what you plan to do or what's significant about your proposal."

Better: Include a clear statement that follows the above, such as,*"This proposal is designed to discover more about anti-viral drugs and see what can be done to reduce resistance."*

4. The PI assumes the innovation is understood through his description of the experiments. "Don't make the reviewer guess what the innovation is," says Spearman. Keep in mind that the NIH reviewer may not be an expert in your discipline.

Suggestion: Mark the **Innovation** section clearly, and keep it short — one or two paragraphs should be enough. *Some ideas that might be innovative:* Novel equipment, novel uses for the equipment, and new ways to collect or analyze data. Focus on why this approach is better than past approaches. And don't be afraid to use words like "novel" and "innovative," Spearman says.

For example, Spearman says you can start your section: *"Experiments outlined in this application will employ a novel approach to generate broad-based immune responses to HIV. In this study, we'll employ innovative B-Cell stimulation methods ..."*

5. The Approach section's level of detail is either too general or too specific. Spearman admits getting the right level of detail is difficult, and lays out an example of each:

Too general: *"Macaques will be immunized with a cocktail of VLPs together with synthetic GM-CSF. At appropriate time points, assays of immune function will be performed to assess the resulting immune response. We will perform both B and T cell assays. Macaques will be challenged after SIV with three doses of immunogen, and the inhibition of viral replication resulting from vaccination analyzed."*

What's wrong with it: "You need to lay out exactly what assays you're doing and what you're really looking for in terms of immune-response and the exact time points," says Spearman.

Too specific: *"Vaccine will be prepared by mixing a 0.5 ml aliquot of VLP from each of the clade B isolates in Tris-buffered saline (TBS, 01M NaCl, 10 mM Tris-Cl) and sterile filtering the end product. Vaccine will be stored at -80 degrees in the veterinary pharmacy, with bar coding to link to the pharmacy system."*

What's wrong with it: Reviewers don't need to know about your storage plans and the bar-coding link.

Better: Explain the experiments briefly and what you hope to achieve, but don't give a step-by-step explanation of all the specifications.

To order a full transcript of the webinar in CD, MP3, or pdf format, go to http://www.principalinvestigators.org/Audio-Conferences/conference-100916/ ■

3 NIH Grant Winners Share Their Tips on Funding Success

Here is grant-application advice three prominent grantees have for researchers:

1. Clarity is key. "Write it for someone reading it at midnight the night before, and this is the 13th one," says **Dr. Jonathan Karn,** a professor at Cleveland's Case Western Reserve University.

How do you accomplish that? "Make it crystal clear," Karn says. Here are his tips:

- Use explanatory, boldface headlines to highlight key points.
- Avoid trying to impress reviewers with preliminary data that aren't precisely "on point" for your research plan (e.g., if you seek funding for a study specifically on links between HIV and cancer, don't include a lot of data on other aspects of HIV).
- Use figures large enough for reviewers to see easily and that reproduce well in black and white. (Sometimes reviewers receive copies that "look like they came out of a bad Xerox machine from the 80's," Karn says.)
- Remember that imperfect humans will be reading your application. Therefore avoid scientific terms

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not all reviewers will know; for example, perhaps just say "a protein" instead of its full scientific name unless there's a critical reason to give the latter.

2. Don't overstate your aims or resources. Too often researchers give one piece of information and then leap ahead to a successful end product — without explaining step-by-step how five years from now there will be tangible developments, says **Dr. Eric Lagasse,** an associate professor of pathology at the University of Pittsburgh. Therefore:

- Don't forecast results that obviously exceed your data and your capabilities. Explain what you propose to do in increments that, based on your experience and the resources available at your institution, will seem feasible to reviewers.

Example: Don't flatly predict your research will cure a major disease within five years; rather, state that you hope to make step-by-step advances, listing your goals for each of Years 1 to 5. Assuming you meet the incremental goals, state what could be achieved toward better understanding, treatment, and, if warranted, a *potential* cure for the disease by the end of Year 5.

- Tell a good story, ending with a request for funding. As a reviewer, "after reading 20, 30, 50 applications, you quickly learn which ones are really good at that," says Lagasse.

Example: Introduce your idea (make it interesting by saying why human medicine *needs* this research and its potential result), explain your methodology, and finally in simple terms say how your project will advance your field. But be careful not to come across as overly ambitious, making grandiose statements.

3. Get advice from others and publish. Even in today's stricter funding climate, "the basics haven't really changed," says **Dr. James O'Donnell,** assistant dean of research at West Virginia University's School of Medicine. His advice:

- Take advantage of any grant-writing consultants or courses your institution may provide.
- Ask someone who has been a reviewer to read your draft before submission. O'Donnell usually asks someone to read his applications when he is 80 percent finished.
- Publish often. Previously, with more space in the application to elaborate, convincing reviewers that you could complete the research was possible even without an extensive publication history. Today,

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The 3 Grant Winners

Dr. Jonathan Karn is Reinberger Professor of Molecular Biology, department chair and co-director of the Center for AIDS Research at Case Western Reserve University School of Medicine in Cleveland. He was part of a team of researchers recently awarded a $9 million, five-year renewal grant from NIH to study links between HIV and cancer.

Dr. Eric Lagasse is associate professor of pathology and director of the Cancer Stem Cell Center at the McGowan Institute for Regenerative Medicine at the University of Pittsburgh. He was awarded a $2.9 million, five-year Transformative R01 (T-R01) grant as part of the 2009 NIH Director's High-Risk Research Awards. He studies lymph nodes as sites for growing replacement cells for other tissues and organs — for patients suffering end-stage liver disease, for example.

Dr. James O'Donnell is professor, vice chair for research in behavioral medicine and psychiatry, and assistant research dean at West Virginia University's School of Medicine. Collaborating with **Chang-Guo Zhan** at the University of Kentucky, **Wei Wang** at the University of New Mexico, and **Han-Ting Zhang** at WVU, Dr. O'Donnell was awarded $950,000 by the National Institute of Mental Health to investigate whether an enzyme (PDE2) found in brain cells could be regulated by new drugs to control anxiety, depression, and other psychiatric disorders. He has worked on NIH grants, as applicant and reviewer, for more than 20 years.

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your proven qualifications and up-to-date publication records are crucial to funding success, O'Donnell says.

Longtime maxims still valid

All three grantees advise PIs to stick to the following age-old funding advice:

- Young researchers especially should view each grant as an evaluation, not just of their research project, but of their scientific record and credibility. Thus there's no substitute for going to meetings, presenting research, publishing, and influencing colleagues in your field. "You always have to be a scientist first and grant writer second," Karn says.
- Allow enough time to prepare your proposal — never rush it. Karn says he typically allows six to eight months for discussion with collaborators and four to six months for writing. More than 50 people were involved on his last grant application, he says.
- Emphasize what makes you unique. You're more likely to win the grant if the data you present come from your own lab and your lab will test all of the hypotheses, according to O'Donnell. Anyone can write an application based on data that are publicly available, but it's less likely to attract funding, he says. His advice: If you don't have the capability to complete the project on your own, collaborate with someone who does or don't even try for NIH funding. ■