



2. Funding and Grant Writing

HOW NOT TO KILL A GRANT APPLICATION

by Vid Mohan-Ram

Facts, Hercule, facts! Nothing matters but the facts. Without them the science of criminal investigation is nothing more than a guessing game.”

Inspector Clouseau’s words ring true as much for *scientific* investigation as they do for legal proceedings—especially because research grants can prove to be as slippery to nail down as the Pink Panther.

Let’s just recap the facts of grant writing thus far: We’ve established how to set the overall tone of your application; we’ve discussed how to design a good title, work out the structure of your abstract, and come up with logical aims and hypotheses; and we’ve learned the importance of careful editing. But before we move on to the next stage of the game—how best to put together methods, results, and your game-winning conclusions and discussions—let’s review the suggestions, advice, and facts about grant writing that have been mentioned in this series:

Part One: Murder Most Foul¹

20/20 Hindsight without Time Travel. Only a quarter to a third of applicants who submit applications to the main federal funding agencies—the National Institutes of Health and the National Science Foundation—get funded. That’s some 17,000 to 23,000 grants and renewals out of the 70,000 or so applications sent to the federal agencies every year!

- » Know the chances of grant-funding success.
- » Be aware that there is a good possibility that you will have to resubmit your proposals.

Young Dogs, New Tricks, Old Mistakes. Be aware of mistakes, errors, and oversights that continue to crop up.

- » Failing to support hypotheses.
- » Failing to explain how data will be analyzed or how results will be interpreted.
- » Failing to cite pertinent research findings.
- » Including jargon.
- » Being overly technical.
- » Making sweeping generalities.

Project Titles: The Sweet Smell of Success. The project title needs to be:

- » The total summary of the proposal.
- » Clever (but not cutesy).
- » Informative.

Part Two: Abstract Killers²

What’s in an Abstract? Your grant application abstract should address the four following points.

- » What do you intend to do?
- » Why is the work important?
- » What has already been done?
- » How are you going to do the work?

Half-Baked Abstracts. To be complete, your abstract should.

- » Summarize the full proposal.
- » Include some indication of the costs of your proposal.
- » Be hypothesis-driven.
- » Never assume your hypotheses are true.

Dog Walker or Cocktail Talker? Be sure to set aside enough time to “walk the dog” (i.e., write the proposal), and remember that “an idea without a plan is simply cocktail talk.”

- » Sit down and write every day.
- » Write a four-page summary of your research.
- » Boil down the summary to create the abstract.
- » Make sure this summary fits with and reflects the entire research project.



Drive home
your message
by repeating
words or con-
cepts in the
title through-
out the appli-
cation.

Om1t J@R/gOn. Everyone involved in evaluating grants—from program officers to reviewers to funding committees—stresses that jargon should be avoided at all costs.

- » Make the specific aims and ultimate goals very clear.
- » Do not assume reviewers know that you know how to overcome and solve problems.
- » Do not write for audiences that are intimately familiar with your field of research.

Keywords Perhaps Not Key. Referral offices—such as those at the NIH—use more than just the title or description to make assignments or pick reviewers.

- » There is no point in trying to direct assignments by judicious word choices.

Rate Your Abstract. Not all reviewers on a panel will be formally assigned to read your entire proposal: Decisions—and the reviews—can be based largely upon this summary. That is why your abstract has to be perfectly constructed and why it is so important to carefully rate your abstract.

- » Does it address the funding agency's criteria?
- » Is it concise?
- » What does it lack?

Part Three: So What?³

Psychological Tailoring. Before dashing off to write a full-length proposal, first step back and ask yourself how you want to sell your research.

- » Decide where and how to pitch your proposal.
- » Ensure your application matches the ideals of the organization.
- » Check out funding agency home pages for submission criteria.
- » Make sure your proposal is honest and realistic.

Uninformed, But Infinitely Intelligent. The research plan should begin with a basic but thorough introduction to the subject.

- » Be explicit and state the obvious.
- » Do not skip over basic information that can help clarify your research project.
- » Be aware of how diverse your audience is.
- » Educate the reviewers.
- » Don't let your reviewer's mind wander or jump.

Biting Off More Than You Can Chew. Some application forms ask for the aims of your research proposal explicitly, others ask for it implicitly.

- » Keep the number of aims to a minimum: two to four aims. Do not be over ambitious.
- » Each aim should consist of only one sentence.

- » The specific aims must be logical and stand alone.
- » Keep aims related but independent of the successful outcomes of the previous aim.

So What?!? We've Heard It All Before. After reading the title, abstract, aims, and hypotheses, the reviewer should have a pretty clear idea of what you hope to achieve and how you plan to go about doing it. In your introduction or "significance" section, you have to now describe *why* you want to accomplish these aims.

- » Do not be subtle—deliver your message fast.
- » Describe the significance of your research at the top of your introduction. Go for the jugular right away.
- » Make a compelling case for your proposed research project.

Part Four: Lost at Sea⁴

"Say It Again, Sam." Reviewers become frustrated at having to read, re-read, and decipher a research plan before understanding a project. To write well:

- » Read aloud what you write.
- » Avoid using "this," "that," and dangling participles.
- » Use bold and italicized text.
- » Use clear headings and subheadings.
- » Leave spaces between paragraphs.
- » Drive home your message by repeating words or concepts in the title throughout the application.

Funnels, Paper, and Brainstorms. How can you organize your thoughts?

- » Buy a sheet of paper, pin it up on a wall, and write headers on it.
- » Brainstorm and write down every idea that comes to mind.
- » Connect the ideas and words by arrows and develop a visual flow.
- » Convert the pathways and arrows into typed sentences.
- » Work in increments: When you write, write in paragraphs.

Review Thermodynamics.

Give your reviewers an application that is easy and enjoyable to read.

- » The more energy and time a reviewer must devote to figuring out your application, the less energy a reviewer has to actually review your application!

Treat your reviewers fairly.

Positive and Negative Feedback. Whatever writing assignment you undertake—editing is crucial to polishing the final work. For grant applications:

- » Circulate your research plan among colleagues.
- » Find out about professional editing services.
- » Approach grant reviewers for editorial advice.
- » Realize that editing is only the halfway mark of grant writing— *not* the end stage.



Don't Sweat the Small Stuff—Just Do It! Applicants can bolster their applications with data from relatively easy but purposeful experiments.

- » If possible, write the proposal one full grant cycle before the intended deadline.
- » Use the extra time to perform the obvious experiments that reviewers will ask to see.
- » Amend the text of your earlier application draft with the new results.
- » Write with confidence, and don't list all methodological details such as buffer concentrations, unless necessary.
- » A reviewer will read your application only once, so you really need that Wow! factor.

This article first appeared on ScienceCareers.org (Next Wave) at: http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/0490/how_not_to_kill_a_grant_application_part_five_the_facts_of_the_case_thus_far

1. Part One: http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/0280/murder_most_foul_how_not_to_kill_a_grant_application
2. Part Two: http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/0280/abstract_killers_how_not_to_kill_a_grant_application_part_two
3. Part Three: http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/0350/so_what_how_not_to_kill_a_grant_application_part_three
4. Part Four: http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/0350/lost_at_sea_how_not_to_kill_a_grant_application_part_four/

FUNDING OUTSIDE THE BOX

by Jim Kling

Your new discovery has implications for breast cancer therapy. Who funds you, the National Cancer Institute (NCI)? Nope: The U.S. Army. You've just developed a swift-growing tree that drinks up metals in the soil as if they were lemonade in July, and it could be the next killer app for cleaning up Superfund sites. Who cut the R&D checks, the Environmental Protection Agency (EPA)? Uh-uh: The U.S. Air Force. A new airborne chemical sensor: EPA? The Department of Energy? Homeland Security? No: It owes its existence to the Small Business Administration (SBA).

Securing funding is difficult, time-consuming, and unpredictable, especially in an election year. Who knows how next year's

president's policies will impact the budgets of the National Institutes of Health (NIH), the National Science Foundation (NSF), and other stalwarts of scientific funding? The outlook right now isn't good. When a well dries up, it's time to drill a new one. It behooves anyone to look for money wherever it can be found.

By all means, go to the obvious sources. If you're a medical researcher, hit up NIH. If you're an engineer, knock on DOE's door or NSF's. But when you've exhausted your primary sources, consider this: Pots of gold are available throughout the federal government and the private sector, often where you'd least expect to find them. For example, the U.S. Army—through its Congressionally Directed Medical Research Programs—trails only NCI as the leading funder of breast cancer research in the U.S. government. Who knew?

Finding Money Plenty

So how do you go about finding these hidden sources? Start with networking. See all those related research articles piling up on your desk? Check the acknowledgment section to see who is funding those projects, says Janet Rasey, director of research funding services at the University of Washington.

Then it's time to get out of the office. Your institution's Office of Sponsored Programs (OSP) is an excellent place to start, says

Put the OSP to work for you.

Jerry Boss, professor of microbiology and immunology at the Emory University School of Medicine in Atlanta, Georgia, and a regular contributor to Next Wave. They may have a list of funding sources other researchers at your institution have used; colleagues whose work resembles yours might clue you in to potential sources you hadn't thought of. OSP should also have a list of private foundations that support scientific research; if your research has even a tenuous connection to a foundation's interests, add the foundation to your list.

OSPs exist to help you secure funding, so use them. Make an appointment and see what services they're able to offer. "It always works out better if you aren't trying to do things all on your own," says Susan Eckert, associate dean for finance in Emory University's Nell Hodgson Woodruff School of Nursing and another Next Wave contributor.

Ask around. Talk to your PI, your old adviser, your collaborators. Pigeonhole researchers at conferences. Don't ask them straight out; chat them up about what they're working on these days—and, oh by the way, where do you get your funding? "I think it's amazing how many different kinds of grants PIs have that we don't know about," says Maryrose Franko, senior program officer at the Howard Hughes Medical Institute, sponsor of GrantsNet.¹

And while you're at it, consider making contact even at the obvious funding agencies, if you haven't already. NIH, for example, is a wildly diverse place, so try to find a friendly guide. NIH program officers are there to help, says Dennis Glanzman, chief of theoretical and computational neuroscience at the National Institute for Mental Health. "Tell us what you're interested in or send a one- to two-page white paper. We can usually find the



right person for you [to talk to]. So many people seem to be afraid of NIH as a black box, so they don't even try" to inquire, he says.

Your Lab Is a Small Business

Of all the odd places you've looked for funding, I bet SBA is one you hadn't thought of. SBA does not directly fund research, but a 1982 SBA mandate has made available hundreds of millions of dollars through participating government agencies (in 2001, total grants exceeded \$78 million). Every government agency with an external R&D budget of at least \$100 million is required to participate in the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs. With 11 participating agencies (not including the National Security Agency and the Central Intelligence Agency, which participate under a different set of rules), this adds up to quite a bit of money.

And before you object that you're not in business, keep in mind a nice little caveat in the SBIR mechanism: You do not need to be in business to apply. Though SBIR grants require you to be employed by a small business at the time the award is made, with STTR grants you can keep your day job, as long as you are *collaborating* with a small business. STTR rules require that 40% of the research work has to be done by the business. If you have an idea with true potential, finding a young technology company that's willing to take some government money shouldn't be that hard.

Here's how it works. A participating agency with a specific need issues an SBIR or STTR solicitation describing it. If you find something you think you can develop, you apply.

Phase I typically nets you fewer than \$100,000 for a short-term proof-of-concept study. If you get invited to apply for phase II, you're eligible for \$450,000 to \$750,000 over a two-year period, at which point you are expected to develop the technology for commercialization. Phase III "is nirvana," says Morgan Allyn, director of strategic initiatives for Springboard Enterprises in Washington, D.C., which helps women entrepreneurs secure equity financing. That's because the true boon of SBIR is that once you've developed the technology, you are the government's exclusive provider for as long as you remain in control of it. That sensor you develop for the Air Force might just be bought by the other armed forces as well.

Several million- and billion-dollar companies owe their starts to SBIR grants, according to Allyn. "It gave them the edge. It put a stamp of approval that they knew how to do R&D, and you get easier access to other federal contracts. And the piece that trumps it all is, the moment you win a phase I SBIR contract you are immediately eligible to be the sole source provider."

The first step Allyn recommends is heading to SBIR World,² which provides a searchable database of SBIR announcements both past and present. Plugging in a variety of keywords related to your work may produce some surprises. Even if you have no intention of applying for an SBIR grant, it might be a useful exercise. All of these agencies have external R&D of at least \$100 million, so there is money to go after even through more traditional avenues.

So go crazy, there and elsewhere. Surf the NSF Web site, NIH's CRISP database, GrantsNet, the DOE Office of Science, and any other potential sponsors you can think of. Finally, visit Next Wave's extensive list³ of federal research-funding agencies. Surf using keywords only tangentially related to your own subject, and see what comes up. It may or may not yield an unexpected windfall, but such explorations are an interesting exercise. Even better: Reading about others' research can always inspire new ideas for your own.

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1. GrantsNet: <http://www.grantsnet.org>
2. SBIR World: <http://sbirworld.com>
3. Next Wave's extensive list of federal research funding agencies: http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/1470/the_federal_trough