

Murder Most Foul: How Not to Kill a Grant Application

By [Vid Mohan-Ram](#)

January 07, 2000

As the sultry murder-mystery editor Miss Fromsett told private eye Philip Marlowe in the '40s classic *The Lady in the Lake*, "People who write usually don't know the facts, and people who know the facts usually can't write." Her characterization of mystery writers could easily apply to scientists preparing grant applications: They know the facts, but they have trouble writing and selling their ideas. In the movie, Marlowe's attempt at crime writing was a success because he blended real-life facts with intrigue and style--the perfect ingredients for bestsellers, but also the essential elements of competitive grant applications.

Grappling with grant applications at your desk is as central to scientific success as is wrestling with experimental conundrums at the bench. In the fight for research dollars, grant writing can make or break a research career no matter how good or innovative a scientist's ideas are. From inexperienced graduate students and struggling postdocs to exultant new faculty members and worldly-wise senior investigators, competing for grants occurs at all stages of academic research careers. But many candidates falter, making needless mistakes that tarnish potentially award-winning applications: Research plans are overambitious, incoherent, or too diffuse, for example. Learn to address these problems, and your grant applications stand a good chance of receiving a favorable review.

20/20 hindsight without time travel

Postdocs and junior faculty members face tough challenges while trying to secure financial support: Between the National Institutes of Health (NIH) and the National Science Foundation, the two federal agencies regularly receive nearly 70,000 grant applications and proposals every year! The problem, however, is that the percentage of applicants who get grants typically swings between 25% and 33%. So how do young scientists compete on equal footing with established scientists without the grant-writing experiences and benefits that come with age, career stage, and hindsight?

Young dogs, new tricks, old mistakes

The first step is to be aware of certain mistakes, errors, and oversights that occur time and again in many research applications. Reviewers and administrators at the National

Institute of Allergy and Infectious Diseases (NIAID) put together a table highlighting mistakes that routinely crop up during review. Applicants, they say, fail to support hypotheses or discuss how potential obstacles will be dealt with, for example. "Provide good alternative approaches and contingency plans in the event your original approaches do not work," officials suggest. They reveal that some applicants do not explain how data will be analyzed or how results will be interpreted. Other research plans are weak in describing why the studies are being done in the first place. "Describe how the proposed research addresses a gap or problem area," the troubleshooting guide informs.

A well-rounded understanding of the scientific literature is crucial in validating new ideas, but some grant writers shy away from including pertinent research findings from other groups in their applications. "Reviewers do not like to see their own relevant publications ignored!" exclaims the NIAID guide. "Impress reviewers with your up-to-date knowledge of your field; ... reference work from your lab and from your competitors."

"Be clear, be organized, be detailed," informs Cheryl New, president of Polaris, a grant consulting firm. "Avoid jargon--say what you mean in clear, simple language." New, along with her husband, James Quick, conducts grant-seeking workshops around the country. "Give enough detail that a reader can see clearly how you intend to go about your research," she recommends. "Sweeping generalities," New points out, are "the kiss of death" when grant-seeking.

Project titles: The sweet smell of success

"A lot of people think the title is not terribly important--that is a serious mistake," reveals Liane Reif-Lehrer, a former NIH study section member who presents proposal-writing workshops at universities and other organizations across the country. The title is the reviewers' first impression of a grant application. "Do your homework and research what the agencies are funding," she suggests. Some institutes at NIH are well-funded and others less so, relates Reif-Lehrer, who submitted her first application on retina research in the mid-'60s. Her mentor suggested that her original title, "Control Mechanisms in Animal Cells," would have caused her application to be assigned to the National Institute of General Medical Sciences, where competition for dwindling funds was high.

The mentor pointed out that the National Eye Institute (NEI), which had just come into being, had more money to fund projects. By modifying the title to show that her studies involved eyes, her application was routed through NEI and was funded. Referral officers sometimes rely on the title when assigning applications to study sections, she says. Titles that define the project clearly and accurately help referral officers steer applications to the most appropriate review panel.

"Project titles should be clever but not cutesy," say New and Quick in their book, *GrantSeeker's Toolkit: A Comprehensive Guide to Finding Funding*. "A project title with a clever twist or sound or acronym is easily remembered by a reader," they disclose.

Klaus Nüsslein, a new assistant professor at the University of Massachusetts, Amherst, agrees that the title should "stimulate thoughts and sound sexy."

"The title is the total summary of the proposal and should open a drawer in the reader's mind," Nüsslein says, into which you drop your hypotheses and ideas. "I repeat as many of the words that are in my title in the questions that follow in the text," he explains. "This way, the hypotheses sound familiar" and the reader is always referred back to the title, he says. Nüsslein is wary of proposals he's read that phrase titles as questions. Although this style can pique a reader's interest, sometimes "the proposal never answers the question!"

"Get on the phone, talk to the program officer, and find out what program areas the agency is most excited about," recommends Reif-Lehrer. "Then determine whether there is any realistic way to tailor your project and title into a good match with those topics." She adds that "Grantsmanship"--above and beyond doing good science--"has a lot to do with understanding the psychology of the reviewers."

"Very nice title," purred the svelte Miss Fromsett as she toyed with Marlowe's semifictional underworld crime story *If I Should Die Before I Live*. The title sealed the deal and won him a \$500 publishing contract. In the academic world, a grant application's title is the first step toward securing those much-needed research dollars. Written well, your grant proposal may itself become a timeless classic!

To be continued ...

In the [next installment](#) of "How Not to Kill a Grant Application," we shift our gaze downward to the abstract--what makes a good one and hints and tips on making it better!

Abstract Killers: How Not to Kill a Grant Application, Part Two

By [Vid Mohan-Ram](#)

January 28, 2000

"We must confess that your proposal seems less like science and more like science fiction," declares an executive in *Contact*, the movie about scientists who detect alien transmissions in outer space. Grant reviewers may confess the same of application abstracts that are filled with wonderful ideas but lack practical, nuts-and-bolts details. A good abstract is like a postcard-sized reprint of a famous work of art: It captures and illustrates the entire research picture without leaving the reader puzzled or confused.

In their efforts to spruce up and dress the body of the research plan, many grant applicants--postdocs and faculty alike--often fail to include essential pieces of the abstract, such as research data and methods. Because the abstract is the first glimpse a reader gets of an application's worth, such oversights can raise unnecessary questions, and may even create the impression that the research plan itself may be incomplete. The key to designing a winning grant application is to start off with a well-rounded, concise summary of your whole application: To accomplish that in a few hundred words, however, takes skill.

What's in an Abstract?

Ellen Barrett, a professor of physiology and biophysics at the University of Miami School of Medicine suggests four key components of a well-rounded abstract: The abstract should introduce the reader to the problems you are addressing, the overall hypotheses you are testing, the main techniques you will be using, and your overall experimental plan. Barrett's advice echoes the Public Health Service grant application instructions, which state that a grant applicant should address the following questions:

1. What do you intend to do?
2. Why is the work important?
3. What has already been done?
4. How are you going to do the work?

The abstract should provide succinct answers to all such questions.

"Most good research is hypothesis-driven," writes Barrett in an [online grant-writing guide](#) she put together for researchers at her university. In an abstract, those hypotheses should

describe "your overview of the mechanisms underlying the process you are studying, not just your prediction" about how experiments will turn out, she says. Barrett warns against writing abstracts with the assumption that your hypotheses are true--a costly error that "has doomed many applications," she says.

Half-Baked Abstracts

With many abstracts, "the problem is that applicants don't summarize the full proposal," says consultant Bob Lucas, a former university research administrator, who is now director of the Institute for Scholarly Productivity based in California. What many applicants do is simply cut- and-paste the first two paragraphs of the introduction into the space set aside for the abstract, he discloses. And while those two paragraphs may be beautifully constructed, they don't typically explain the whole project. Applicants wind up "saying what they are going to do, but not how they're going to do it," reveals Lucas. Physicist Scott Bergeson, for example, was 0 for 3 before attending one of Lucas's workshops. "I made the typical mistakes," explains Bergeson, an assistant professor at Brigham Young University in Salt Lake City. "I had great ideas but my proposals were really vague, too general," he says. As a new member of faculty, Bergeson tried hard but failed to secure three major grants that totaled more than \$1 million. But then last March, he went to one of Lucas's workshops, began applying the professor's writing practices, and instantly turned his game around.

Dog Walker or Cocktail Talker?

Lucas suggests beginning with a four-page description--a "concept paper summary"--of what you want to accomplish. By adding more specific detail to this document, you end up with a draft of your research plan. Conversely, by "boiling it down," you wind up creating a concise research abstract that fits with and reflects the entire research plan. This practice keeps you focused and "helps remind you what the point of your research application is," Lucas says. It helps you become disciplined, too: Word limits on abstracts forces you to delete, rephrase, and chop up information that is not essential to the abstract, says Lucas. "You might be making an interesting point," he states, "but it might not be relevant," so out it goes. Bergeson used such writing techniques for a grant application due the following May, just 6 weeks after the workshop. It worked--his application was funded.

Lucas lets his eager scholars in on a couple of insightful anecdotes: Writing, he says, isn't an ordeal if you realize it's like "Walking the Dog." You don't think about taking the dog out for a stroll, you just do it. With writing, simply set aside time to "walk the dog": Sit down and write every day and soon writing will be as natural as handling radioactivity. "An idea with a plan is a grant application," Lucas continues. "An idea without a plan is simply cocktail talk."

Om1t J@R/g0n

"Make the specific aims and the ultimate goal very clear" to reinforce ideas for reviewers, says Suzanne Fisher, director of the Division of Receipt and Referral at the National Institutes of Health's (NIH's) [Center for Scientific Review](#). Bergeson agrees with her: "You cannot assume the reviewer knows that you know how to overcome and solve problems" unless you write down those solutions and alternative approaches, he says.

Fisher directs the team of referral officials and administrators who process and review applications at the federal funding agency. By virtue of having to handle tens of thousands of submissions every year, she is sensitive to mistakes that scientists continue to make--especially when it comes to writing in plain English. "Descriptions," she says (the abstract is now called the description at NIH) "should avoid excessive use of jargon and abbreviations," because "unless you are an insider, you have no idea what the application is about." Science gobbledygook--" *We will study the MLC2 Ser-18-Ala Nyquist B-process at pCas 7.5-5.5 +/-MLCK*"--will not enamor reviewers, even if they do understand what you're talking about.

Keywords Perhaps Not Key

Fisher tries to dispel the commonly held belief that shrewd keywords win over the hearts and minds of reviewers and officials: "The referral office uses more than just the title or description to make assignments," she enlightens, "so there is no point in trying to direct assignments by judicious word choices." Starting off your abstract with the word "Aging" for example does not mean you should expect your application to be automatically routed through to the National Institute on Aging, she clarifies. Fisher makes another point that "if an award is made," the description "will be public information" deposited in the federal [CRISP](#) (Computer Retrieval of Information on Scientific Projects) awards database. "So it should be clear, concise, accurate, and not contain proprietary information."

Rate Your Abstract

Perhaps the most important reason to write a succinct and complete abstract is because not all reviewers on a panel will be formally assigned to read your proposal: Generally, the primary and secondary reviewers report their analysis and give it a rating or predetermined classification. *The remaining reviewers must also rate your application*, and unless they have previously scrutinized it, they may pass judgement only on what they read in the abstract.

It's understandable that to make sense of alien messages, some pretty advanced deciphering technology might be required. Research abstracts on the other hand shouldn't need that level of decoding. "All I'm asking is for you to just have the tiniest bit of vision," replies *Contact* star Jodie Foster to the skeptical executive. "Just sit back for one minute and look at the big picture," she pleads. If you can bring those--vision and the big picture--together in your abstract, your next grant application could be out of this world!

*For many young scientists, the research plan itself can appear to be an alien landscape!
Next week we begin a series of head-first plunges into the [nitty-gritty of your actual research plan](#): How to structure it, what reviewers are looking for and what irritates them the most. Stay tuned...*

Science Magazine

Career Advice

So What?: How Not to Kill a Grant Application, Part Three

By [Vid Mohan-Ram](#)

February 11, 2000

When Miles Davis recorded his landmark album *Kind of Blue* in 1959, he redefined the musical world with five of the most revered pieces in jazz history. Although one of those tracks-- *So What*--may be music to your ears when Davis plays it, it may mean death to your grant proposal when a reviewer says it. And if your proposal doesn't clearly state its own purpose and significance, chances are your grant reviewer will start to ask themselves, "so what?" after reading your proposed research.

Don't make reviewers search for reasons to fund your work--learn to address the importance of your intended research and avoid invoking the "so what?" response from your peers. Set the tone of your research plan, address your proposal to your readers, explain the significance of your proposed research, and keep your workload realistic. Pay close attention to all of these areas and your chances of winning funding will increase.

Psychological Tailoring

The first step to success in the proposal process is to decide where and how to pitch your proposal. Nothing frustrates administrators and officials more than receiving applications that have nothing to do with the ideals of the organization. And organizations that appear quite similar may have very different missions. The National Science Foundation, for example, rejects proposals that include the etiology of disease or any kind of diagnosis or treatment. Animal models of diseases and studies of drugs for treatment are also inappropriate, officials say, but applications of this sort are *still* submitted to the NSF. The National Institutes of Health (NIH), on the other hand, welcomes medically related applications as well as basic science projects.

So do your homework: Find out the mission of each potential funding agency: Call up the program officer or grants office and ask about their interests. Almost all funding agencies have Internet sites, so check out their home pages for more information. It is perfectly legitimate to tailor your research proposal to fit within the goals of the funding agency, but be honest and realistic. If your research isn't a good fit for a particular program, don't force it in the hope that it will zip through the grant process undetected. It won't. It'll only come zipping straight back.

Uninformed, But Infinitely Intelligent

Grant reviewers all agree that the body of the research plan should begin with a basic but thorough introduction to the subject. "I really appreciate a good introduction," reveals NIH reviewer Sally Camper, who complains that many applicants automatically expect reviewers to be familiar with their field of research and so they skip over basic information that can help clarify their research project. This can be a fatal mistake.

"People don't realize how diverse the audience is," explains Camper, referring to the variety of peers who assess applications. As a reviewer for NIH's Mammalian Genetics study section, Camper, who is an associate professor of genetics at the University of Michigan, Ann Arbor, is assigned applications covering a wide variety of topics in genetics. While her own research involves investigating the molecular problems of deafness, she also reviews applications on many topics that include simple and complex genetics, covering a range of biologic systems such as neurologic and mitochondrial diseases. "[The applications received] are really all over the map," she says.

In light of that diversity, reviewers need to be educated by the proposal writer. Kasturi Haldar, an NIH reviewer who sits on the Tropical Medicine and Parasitology study section, says that without basic information to help reviewers fully understand a proposal, reviewers can "get lost in a sea of detail." Having reviewed grant applications for 4 years, she advises younger applicants to "assume your audience is uninformed, but infinitely intelligent."

Ideally, you want to "guide the reviewer through the entire proposal. Feed them everything they need to know slowly," suggests assistant professor Klaus Nusslein, a microbiologist at the University of Massachusetts. Nusslein says it's very important for readers to understand the substance of your research plan from the beginning. "Your research plan is like a very high-level sales plan," he declares. "Don't let your reviewer's mind wander or jump. Give them absolutely everything. Be explicit." And don't shy away from stating the obvious, he encourages.

A typical reviewer has very little time to do their job--both Camper and Haldar receive anywhere from 6 to 12 applications to evaluate three times a year. Unclear and vague narratives only add to their workload.

Biting Off More Than You Can Chew

Every proposal should clearly state the aims of the research project. Some application forms ask for this information explicitly, but they all ask for it implicitly. In their [*Short Guide to the Preparation of NIH Grant Applications*](#), National Cancer Institute (NCI) officials suggest the specific aims section of their applications start with a "brief narrative describing the long-term goals of the project and the hypothesis guiding the research." A numbered list of aims should then follow. "For clarity," the guide says, "each aim should consist of only one sentence." Reviewers will not have read the background and

significance parts of an application at this point, warns Camper, so the specific aims "must stand alone."

I Aim to Hypothesize My Theories

Be sure you understand the differences between aims, hypotheses, and theories. A hypothesis is not an aim.

Aim 1--To determine if protein X interacts with protein Y.

Your aims are your intentions, the "directing of effort toward a goal."

Hypothesis 1--Protein X binds to protein Y, increasing the concentration of Z which affects enzyme activity.

Hypotheses are assumptions made in order to test specific ideas--which may or not be true.

Theory 1-- Enzyme activity is dependent upon the concentration of Z, only when proteins X and Y are present.

Theories imply a greater range of evidence that have some basis in existing facts, i.e. in this example, a theory could be that protein X and Y are needed for Z to function.

When defining their aims, researchers often weaken their proposals by trying to do too much. An overambitious proposal can make reviewers question your ability to achieve your goals and also wonder whether the project has been thoroughly thought through. So be realistic about what you can accomplish in the duration of the grant and within the budget requested. NCI officials say that "most successful applications have two to four specific aims."

Gary Gillis, a postdoctoral fellow at Harvard's Concord Field Station, wanted to know how the musculoskeletal system accommodates function. With this general question framing his overall research, he wrote his background and introduction. Gillis then fine-tuned the ideas he wanted to test and came up with four clear, logical hypotheses and aims. The NIH funded Gillis's project, proving NCI's claim that less is more.

Reviewers also emphasize the importance of keeping the aims related but independent of the successful outcomes of the previous aim. Otherwise, if reviewers suspect that you won't achieve your first aim, your entire proposal may come crashing down.

So What?!? We've Heard It All Before

After reading the aims and hypotheses, the reviewer should have a pretty clear idea of what you hope to do. Now they want to know why you want to accomplish these aims. This is where many applicants fall flat. They fail to make a compelling case for their

proposed research project, leaving reviewers with no answer to the big question: So what?

Research Plan Tips and Hints

1. Work out the overall tone of your research plan. Everything must relate to one fundamental question.
2. Realize your audience is diverse. Reviewers may be experts in your field but not in your topic.
3. Include basic, obvious information throughout. Keep it concise and avoid convoluted arguments. Guide your reader through every sentence and idea.
4. Define your aims. Develop your hypotheses to fit with your aims. Design experiments to test your hypotheses. Never assume your hypotheses are "correct."
5. Demonstrate that your aims are realistic. Explain how you can accomplish all of them with the money you will receive. And in the time allowed.
6. Emphasize why you want to investigate these aims and why the outcome of your research is important. What is the significance of your work in the larger context of science knowledge? By how much will our knowledge be expanded because of your work?
7. Make sure the underlying science and experiments behind your plan are sound, feasible and complete.

Haldar has some simple advice about how to show the significance of your proposed research: "[Go] for the jugular right away!" she says. Applicants often tack the significance of their research onto the end of the background part of an application as an afterthought, Haldar explains. But holding back is a dangerous tactic, she says, "Everyone is short on time. Do not be subtle. Deliver your message fast."

Like an inspired improvisation over a jazz standard, good grant-writing should stimulate reviewers who've heard it all before. A new variation of a well-known theme is always welcome--as long as you stick to the fundamentals. In his liner notes to the original 1959 LP release of *Kind of Blue*, Bill Evans wrote that Miles Davis's musical frameworks were "exquisite in their simplicity," allowing musicians the freedom to interpret the melodies in their own style.

Researchers should follow suit: Develop your own straightforward style and write your proposals with clarity, vigor, and enthusiasm. Then, perhaps like Davis, your compositions will be simple, exquisite, and award-winning!

Part four of this series: [making the grant reviewers happy](#).

Lost at Sea: How Not to Kill a Grant Application, Part Four

By [Vid Mohan-Ram](#)

February 25, 2000

When Britain's 18th century Board of Longitude offered £20,000 to anyone who could accurately tell the time at sea, plans and proposals flooded in from all over the world--from Royal Astronomers to novice watchmakers. A major problem, however, was that many contenders never considered the actual conditions of the contest, and so not one proposal aroused the board's interest for over 15 years! Unfortunately, today's review boards **still** face lackluster proposals from researchers who continue to make the same mistakes that doomed their seafaring predecessors: The science is mediocre, sentences ramble, there are no headings, figures are unclear, sections are disorganized, and the writing is uninspired.

"People really underestimate the value of good English," remarks Tim Nilsen, a molecular biologist who reviews applications for the National Institutes of Health's (NIH's) Cell Development and Function study section. Nilsen observes that applicants are still "very casual in the way they write"--possibly because they "write grant applications as if they're talking to labmates who already know and understand their projects." Reviewers, however, become frustrated at having to read, reread, and decipher a research plan before understanding a project.

"Say it again, Sam."

So how can applicants be sure they submit a well-written application that doesn't leave the reviewer miserable? One way is to "read aloud to themselves what they write," suggests Nilsen. This way, long-winded text and unclear explanations will quickly become evident. Sentences that begin with "This" or "That" or end in dangling participles are "horrible," says Nilsen: "Many grant applications are underprocessed. The aesthetic qualities of an application are seldom looked at or addressed." To save space for example, "sometimes people don't leave spaces between paragraphs," leaving reviewers with a "blur of words" to digest, says Nilsen.

Bold or italicized text should "help guide the reader's eye through the application to pick up important points," says Klaus Nuesslein, an assistant professor at the University of Massachusetts, Amherst. He also recommends "repeating the words or concepts in the title throughout the application." This way you keep reiterating your overall questions and goals, driving home your message and aims.

Funnels, Paper, and Brainstorms

Nuesslein had some other conceptual and practical grant-writing tips tucked up the sleeve of his lab coat: "Picture two funnels placed on their sides and joined together tip to tip," he begins. At one end, you start off with a well-rounded abstract and introduction. Then as you enter the joined stems, discuss the "heart of the proposal--the actual specific problems you hope to solve and why it is important--in very clear, concise language," says Nuesslein. Enter the second funnel and "open back up again with conclusions, address the 'So, what?' questions, and finally finish with a strong summary and a powerful take-home message."

But how do you write so that your text flows smoothly in through one funnel and out through the other? "Go out and buy a huge sheet of paper, pin it up on a wall, and write headers on it. Brainstorm and write down every idea that comes to mind, in any order," he suggests. "Connect the ideas and words by arrows and develop a visual flow." Once your network is complete, "convert the pathways into typed sentences, following the logic of the arrows." Nuesslein suggests you work in increments: "When you write, write in *paragraphs*."

Review thermodynamics

"I've discovered over many years of reviewing applications that there is another Law of Thermodynamics," joked Elliot Postow to attendees at the American Association for the Advancement of Science's annual meeting held in Washington, D.C., this week. Speaking at the Trolling for Dollars grant seminar, the director of NIH's Division of Clinical and Population-Based Studies explained that "the more energy and time a reviewer has to devote to figuring out your application, the less energy a reviewer has to actually **review** your application!"

Positive and Negative Feedback

Editing is a critical component of writing, but many grant writers are too close to their work to do it properly. Some scientists let professional editors sharpen their text. Others send out drafts to peers or senior colleagues. Circulating your research plan should be seen as the halfway mark of the grant-writing marathon, **not** the final leg. Gary Gillis, a postdoctoral scientist at Harvard's Concord Field Station, for example, wrote a postdoc fellowship application while finishing up his graduate studies. He then let his entire Ph.D. thesis committee assess it, which resulted in two rewrites. Gillis then sent the draft to senior investigators within his field, incorporated more specific details, and rewrote yet *another* draft for final comments.

Don't Sweat the Small Stuff--Just Do It!

Nilsen urges applicants to bolster such drafts with data from relatively easy but purposeful experiments. While conceding that perhaps not many researchers will actually attempt this, Nilsen recommends that "people write the proposal *one full grant cycle*

before the intended deadline." Not only do obvious experiments strengthen an application's preliminary data, but they help "make the writing much more crisp." Those experiments may include simple immunoprecipitations, a quick round of DNA amplifications, or simple restriction digests. By completing a proposal months ahead of time, you can do the experiments and amend your text with the actual results. But don't include "excessive amounts of experimental detail," advises Nilsen. "Write with confidence. Unless you're describing a brand-new technique, I don't want to see buffer concentrations. I don't want to see your oligonucleotides either. Tell a story. How is your work going to advance the field?" As a member of the Trolling for Dollars audience put it: "Typically, a reviewer will read your application only **once**, so you really need that 'Wow!' factor."

John Harrison, the self-made British clockmaker who persevered through a lifetime of trials and tribulations, eventually created a "watch" that could keep accurate time at sea. Harrison's years of determination, superb technical expertise, and meticulous documentation culminated in an invention that forever changed navigation at sea. Likewise, you will need the perseverance, the science, and the "write stuff" to realize your goals. You never know--unlike the majority of proposals received by the Board of Longitude, if prepared well, your next application may arouse everyone's interest. You may even sail away with the coveted prize itself!

Part five of the series: [summing up the facts in the case.](#)

Science Magazine

Career Advice

How Not to Kill a Grant Application, Part Five: The Facts of the Case Thus Far

By [Vid Mohan-Ram](#)

May 26, 2000

"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 Foul](#)

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 Killers](#)

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.

Om1t J@R/g0n

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?](#)

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 Sea](#)

"Say It Again, Sam"

Reviewers become frustrated at having to read, reread, 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

Treat your reviewers fairly and give them an application that is easy and enjoyable to read.

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

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 stages.

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.

That's it for now. We'll get to grips with the remainder of a grant application in upcoming issues of the Career Development Center--including postings of funded proposals. In the meantime, apply as many as possible of the techniques addressed by the contributors to this series, and what a "WOW!" you'll get! The Pink Panther could soon be in your clutches.

Science Magazine

Career Advice

How Not to Kill a Grant Application, Part 6: Developing Your Research Plan

By [Vid Mohan-Ram](#)

August 11, 2000

So, after whetting the reviewers' appetites with a well-rounded [introduction](#) and some logical (and testable!) hypotheses, it's time to let them sink their teeth into your research plan.

Details, Details ...

In practice, applicants do often detail the experiments they plan to conduct, but many fail to realize until it is too late that experimental details are not enough! Reviewers want to understand the *rationale* behind your proposed studies before they pass judgment. "Much more important than experimental detail is a clear discussion of the design, including the underlying logic, of the proposed experiments," reveals a National Institutes of Health (NIH) program official.

For example, it is not enough to state that you're going to add a "special buffer" to an enzyme and measure its activity. Reviewers want to know whether you expect the activity to be enhanced or diminished and why. They want to know what is special about the "special buffer." How will you interpret the data? How will you use that information? Remember that for each statement you make, reviewers will be ready with a dozen questions. Stay a couple of steps ahead of the game by offering the answers before reviewers even think to ask the questions--and before they begin to poke holes in your methods.

Tips to Make Your Research Plan a Winner:

- Address all questions readers may have about your experiments.
- Identify potential weaknesses in your protocols and research design.
- Offer alternative methods, in case your primary method fails.
- Show you are capable of adapting future experiments depending upon the results generated.
- Be focused, but put your immediate experiments into the context of the "big picture."

If Plan A Fails, Here Is Plan B...and Plan C and Plan D ...

Openly recognizing any inherent holes or pitfalls in your research design can "show maturity," says John Schwab, program director in the Division of Pharmacology, Physiology, and Biological Chemistry at the National Institute of General Medical Sciences (NIGMS). "It is entirely appropriate to acknowledge weaknesses in your project and to present alternative plans," says Schwab, formerly a professor of medicinal chemistry at Purdue University, who joined the NIH in 1996. Schwab is well versed in grantwriting: In addition to his official duties, he regularly conducts grant workshops, and he has just finished co-authoring a book chapter on grantwriting. "It is to applicants' credit," he says, to highlight potential hiccups in their research protocols--as long as adequate methods to overcome those problems are included. It is a common and costly mistake to leave this kind of information out of your research plan.

"Your research plan must be adequately focused, and yet at the same time, you must also provide a long-range view of your research goals," explains Schwab. Discuss, for example, the experimental protocols you will use to investigate a problem, but also mention how your studies fit with other research being conducted in the field. In short, put your project in context.

Also be aware that reviewers are very keen to read about any relevant preliminary data you may have generated--especially if you're proposing to use new or controversial methods. "A new principal investigator will not have an extensive track record, so there is no basis on which to give him or her the benefit of the doubt," say NIGMS officials. Highlighting your previous findings and discussing how you will interpret your data, therefore, "provides an indication of [your] critical thinking and grasp of logic" and are crucial to grantwriting (and funding!) success.

More Tips ...

- Discuss how you will interpret your data.
- Do not overwhelm readers with facts.
- Prioritize your experiments.
- Refer to supportive and conflicting (if any) scientific literature relevant to your work.
- Make sure your text is visually easy to read.
- Check your use of English spelling and grammar.
- Broaden your horizons: Read anything you can get your hands on.
- Keep reading Next Wave!

Same Old, Same Old ...

Don't forget that just as the logic and structure of your proposed experiments are under scrutiny, so, too, is your command of written English. New applicants "get low scores for reasons that were clearly avoidable," reveals Schwab. He identifies spelling mistakes,

grammatically incorrect sentences, and convoluted paragraphs as a few of the blunders that continue to crop up in research plans. And no matter how objective reviewers are, if the research plan is poorly organized or poorly written it's bound to color their opinion: If you're slipshod with your grantwriting, reviewers will question your abilities in the lab and at the bench. There's no other way to say it: Check, double-check, and proofread your entire application before sending it off.

In fact, it is foolish *not* to circulate your research plan before expediting it off to the funding agency. Your colleagues can offer valuable insights and highlight areas in your plan that still need work. But many young faculty members think that distributing their application would be an "imposition," says Schwab. Some actually fear--or even shun--feedback from their peers, whereas others are "not ready to sacrifice their pride," he says. Like any kind of public writing, grantwriting requires the author to take criticism on the chin. Working in a university or a research institution presents many opportunities to share your application with other scientists. Do so, and reap the benefits: You will become more established within your research community and earn the respect of those from whom you are seeking assistance.

Use References Wisely

To be a successful grantwriter, you need to know what to say and what not to say. This is particularly important when referring to literature that describes the methods and techniques in your research plan. As long as you refer to the original papers, you do not need to needlessly explain specific details of commonly used methods, say NIH officials. And as a general rule--whether it is in your research plan, or elsewhere in your application--refer to scientific studies that support your work, but also include pertinent references that do *not* support your work or that even hold opposing views. Be sure, however, to summarize succinctly the references you cite, because reviewers will not have time to track down each one of them.

Useful Links...

- [Instructions for PHS 398 Grant Applications](#)
- [NSF Grant Proposal Guide](#)
- [How To Write an NIH Grant](#)

Make sure the organization of your key experiments follows the same order as your specific aims and hypotheses. Prioritize experiments that address different aims and put them in chronological context. Learning how to construct an [outline](#) of your research plan is extremely beneficial. Consider, also, including a time line; it will show the reviewers that you're thinking ahead and plan to work logically toward your goals.

Read, Write, and Be Merry!

The harder the reviewers have to work to plow through laborious text or to scramble to the library to check your references, the less inclined they will be to cut you a break. "Make your application a joy to read," advises Schwab. The grants process has "become so competitive that if you fail to win the reviewers' enthusiasm, you hurt your chances considerably," he discloses.

Improve your writing skills by simply reading beyond the scientific literature. Expose yourself to writing styles other than those in journals and papers. Read about subjects other than your immediate research. Read short stories, magazine features, biographies, or the latest best seller. As you develop your own style and better understand what reviewers are looking for, you will become more and more skilled in weaving the reader through your proposals and in expressing your ambitions. *You* know your research is stimulating, exciting, and groundbreaking; the only thing you need to do now is to convince those holding the purse strings.