NIH & NSF Funding Advisor

The monthly guide to preparing and submitting optimal grant applications

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Less than one in three major research instrumentation (MRI) grant applications receive NSF funding. One expert offers six steps to improving your odds for this type of agency support, including examining NSF goals, understanding your eligibility and examining institutional need, among others.

Creativity Can Help You Win A 2-Year NSF Grant Extension

Is your NSF-funded research on a roll? On the cutting edge of science? If so, you could be eligible for two extra years of funding under NSF's Special Creativity Extension.

Although these grant extensions are rare and competitive, they are within reach for those who learn the system and follow some guidelines. **Karin Ruhlandt-Senge,** Distinguished Professor and Chair of the Department of Chemistry at Syracuse University, received an extension in 2008 for her work on the chemistry of highly reactive metals, their applications and the means of tuning the reactivity to these applications.

"By understanding how to tune the reactivity, we are able to use the compounds in novel applications. This is important because some of the metals are bio-compatible, opening areas in the medical field that are very exciting," says Ruhlandt-Senge.

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Study Section Insider

Using the Biosketch to Establish Your Credibility With Reviewers

by Christopher Francklyn, PhD

Are you and your research team the *right* group to tackle the problem or central question presented in your grant application?

That's one of the key issues reviewers will consider. And the answer has to be "Yes" for you to have a strong chance at funding in today's competitive environment.

There are a couple of good ways to convince reviewers yours is the right team. One is to make your case through an authoritatively written research plan. The other is to focus on the Biosketch — the relatively short but vital part of the NIH application where you present your professional and technical credentials.

If you have never served on an NIH study section, you may not appreciate the influence Biosketches have on the review process. Because the panel may review 30 to 40 applications in just one or two days, most members won't have time to read yours thoroughly before assigning a score. They likely will base their opinions on the comments of the primary, secondary and discussant reviewers. And some will use the time when the primary and secondary

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"I believe I was one of five in the country in my area of research — inorganic chemistry" to receive the extension, she says. "The program officer [PO] told me that NSF liked the quality and steady flow of work ... and that the extension was NSF's recognition of quality in a fairly unique area of research."

How it works

There's only one main challenge. You can't apply directly for these extensions, at least not officially. The impetus is generated by NSF, especially through the PO's efforts regarding your existing grant.

NSF awards Special Creativity Extensions to investigators it considers highly creative and who hold three-year continuing NSF grants, like Ruhlandt-Senge. During the extension, the agency does not limit research to the PI's original proposal; she may move into other areas. Ruhlandt-Senge says her $290,000 creativity extension afforded her freedom she never had with standard grants.

"The most amazing thing about this grant is that the PO told me I was free to do whatever research I wanted," says Ruhlandt-Senge. It allowed her to go in directions quite different from what she did before. "I was able to explore new applications such as bone therapy and novel hydrogen-storage materials. It also enabled me to pursue an industry collaboration," she adds.

Whether your project receives a creativity extension rests largely in the hands of your PO. It is through his or her recommendation to the NSF division director that your research will land on the short list.

"The PO is supposed to be looking at the annual reports; that's how we maintain oversight of the awards. Once the reports are approved, we examine them and identify a PI who warrants a Special Creativity Extension," says **Sam Scheiner,** NSF Program Director in the Division of Environmental Biology.

Keys for getting NSF's attention

Ruhlandt-Senge says developing a good relationship with your PO and communicating the progress of your work are essential elements in gaining the attention for an extension. She offers the following suggestions:

1. Keep your PO in the loop. "How this happens depends on you. Some PIs talk to their POs more than others, in regard to grant submissions, questions, etc." In addition, POs may attend proposal review panels where PIs serve as panel members or make contact during mutually-attended meetings.

2. Use your annual reports to communicate with your PO. "Use your annual reports to provide a good summary of your accomplishments," Ruhlandt-Senge suggests. You can emphasize your work's relevance in specific applications, which allows you to explain the importance of what you are doing. The annual reports also offer tidbits of your work to NSF, which it can use to promote its funding efforts to Congress.

3. Publicize your work in high-quality journals. Scheiner agrees that publication in high-profile journals is important. He also stresses the importance of having a project with broad impact.

"We look for the most competitive projects that address fundamental questions, that go beyond the particular system under study," adds Scheiner. For example, one such project might address a general mechanism of how mutation effects evolution that is clearly going to be studied in this particular system. At the same time, the agency will want to ensure that the mechanism holds for a wide range of species, he notes.

"We awarded an extension last year to a team that had already done some very interesting work and had come to me with an idea for expanding it," Scheiner says. The team produced software and distributed it as freeware so that others could use it in their research. "The team was highly productive with results that had a wide impact."

He stresses the competitiveness of the extensions. "We really have a high bar that says why this person

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should get an extension over everyone else." Statistics from 2007 to 2010 show only 98 extensions were granted.

Keys while pursuing research

Despite the competition, Ruhlandt-Senge says you'll stand a better chance if you do the following while conducting research:

- Maintain a high productivity level for an extended period in a relevant area of work. What you should consider "high" and "extended" will depend on the standards set in your specific field.
- Show a constant stream of quality work. If you have a two-year break between projects, this will not look particularly good to the PO. "Consistency in your approach and productivity are key. Do this by showing a constant flow of quality papers."
- Carve out a special area of expertise associated with your name. "When I started this project 15 years ago or so, very little was known. Now, looking back at what we've done — along with others — there is now a body of knowledge connected with the names of a few people who developed this area."

Simple process after recommendation

What happens once you know you've been recommended for an extension? "You submit a supplemental funding request online via FastLane," says Scheiner. "You need to write a short narrative of what you're planning and submit a budget," he adds.

"As compared to a proposal submission, it was incredibly quick and easy, more or less a formality," says Ruhlandt-Senge. "I wrote a very brief summary; I believe it was two pages."

NSF notifies those it recommends for extensions usually well in advance of the original grant's expiration. Ruhlandt-Senge was informed nine months ahead.

She offers one final piece of advice: "Maintain a good track record in mentoring students and doing a good job when it comes to the professoriate. This is an important NSF mandate — to educate the next generations." ■

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reviewers present their critiques to browse your Specific Aims to get a picture of your science and to read the Biosketch pages for your qualifications.

Importance of a strong Biosketch

Panelists who see a Biosketch from a PI with poor productivity or limited qualifications rarely shy away from bringing these facts to the full panel's attention. This can push what might be an otherwise strong proposal into "unfunded" territory.

Therefore, you must ensure the proposal's Biosketch(es) are comprehensive, with one for each PI on the team. (No sketches are necessary for postdoctoral fellows, graduate students and staff). If you are the project's only PI, the job's easier because you have to focus only on yourself. If it's a team effort, things become more complicated.

Recently, NIH changed the Biosketch format to include a narrative section and reduce the number of listed publications. These are important changes you should try to exploit. Other than your name and educational credentials, the new format includes four sections:

- Personal statement
- Appointments and honors
- Selected peer-reviewed publications
- Other support.

New format an equalizer

The most important change is the **Personal Statement.** Here, you have the opportunity to remind reviewers of your training and expertise, your key scientific accomplishments, and your background's other technical aspects that qualify you to lead the research.

In the old format, reviewers had to rely on "reading between the lines" or personal knowledge of your reputation to appreciate your technical capability. Often this meant that reviewers gave senior PIs — just because they were better known — more deference, particularly on technical issues.

With the new personal statement, reviewers treat early-stage investigators (ESIs) and established ones more equally. To make the most of it, think like the reviewer, and ask what parts of your application constitute the greatest technical risk. Use this section to address those points, either by underlining your qualifications or alerting reviewers to the strengths of one or more collaborators.

Appointment and Honors section

The next part of the Biosketch, **Appointment and Honors,** usually has a modest impact on the review, serving mainly (along with Other Support) to delineate early-stage from established investigators. Use it to note

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any and all distinctions (including past fellowships, junior faculty distinctions and any awards from private foundations) that shore up your professional standing.

This is the best spot to include any professional courses or workshops you've taken or attended that speak to your technical proficiency and any professional society memberships. More experienced PIs typically include editorial board and study-section service and plenary lectures. Unless this section includes information that bears directly on your qualifications to handle the specific project, reviewers will tend to go through it quickly.

3 Factors in selecting publications

Arguably, the place reviewers tend to look most carefully to assess your expertise is the **Publication List.** In the old format, applicants would tend to include as many publications as space permitted. In the new one, NIH encourages them to include no more than 15. (You can mention the total number if it's impressive.)

Your first five publications should be those most relevant to the current work and the next 10 should be related to the work in some way. You should consider three things when preparing your list: impact, technical relevance and timeliness.

For impact, list those papers published in the most prestigious journals as well as your highest cited papers; both help you to make the case for your standing in the field. (If these are major discoveries, you might have already pointed them out in your Personal Statement.)

To show technical relevance, your designated papers should demonstrate your expertise in your proposal's major technical approaches. Although you will cite these in the application's body, use the Biosketch to reinforce your technical skills.

As for timeliness, reviewers want to see evidence of substantial recent productivity. This shows you have momentum in the field. If reviewers sense you have issues getting your work published, this can significantly dampen their enthusiasm for funding.

Where Other Support is most useful

Other Support, the last part of your Biosketch, probably won't significantly influence your reviewers' perceptions about your ability, particularly if you are new or an ESI who hasn't yet developed a solid funding history. In my experience, panelists generally don't use this as a review criterion other than to help distinguish between new and established PIs.

But Other Support *can* have an impact if you have an existing grant that is scientifically close to your current proposal's subject area. Technically, such perceived overlaps are not supposed to influence scores, but reviewers typically will bring the issue to the floor so that the Scientific Review Officer (SRO) of the agency can include an administrative note to alert institute Program Officers (POs). Although the determination of overlap is technically not the study section's purview, POs must examine this carefully before recommending any awards.

Value of multiple PIs on project

Because of the increasingly multidisciplinary nature of modern biomedical science, many applications submitted these days — including those by new investigators and ESIs — feature multiple PIs. Having more than one on your application provides an opportunity to demonstrate a broader expertise base than would be possible for a single PI.

In addition, if you are a new investigator or ESI, including a well-established PI can smooth any gaps in your technical background and add credibility through the implied mentoring interaction. When submitting applications with multiple PIs, be sure to describe clearly your past interactions and the plans for collaborating on the new project.

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In summary, the new Biosketch format represents a fresh opportunity to showcase your qualifications and suitability to carry out the proposed project. In any application you must convince your reviewers of the work's essential nature and that yours is the ideal lab to perform it.

The Biosketch's relatively short length means that reviewers can read it and rapidly formulate an opinion about your qualifications. This is the place to make a strong and convincing first impression that will stimulate their enthusiasm for you and your science.

Dr. Francklyn is a veteran reviewer for NSF and NIH and served as an NIH study section chair. He is a professor at the University of Vermont, where his scientific expertise is in protein synthesis and RNA-protein interactions. He is also assistant editor of the Journal of Biological Chemistry, and is a member of the Editorial Advisory Board of NIH & NSF Funding Advisor *monthly newsletter.* ■

6 Strategies to Help You Land A Career-Enhancing K Award

If you're a new or early-stage investigator, you might consider seeking a K grant instead of jumping into the tough competition for your first R01 research grant. It likely will be a steppingstone to help you establish your career and more easily win NIH funding for future projects.

NIH intends for the K grant to give you some "protected time" — usually three to five years — for career development, training and mentored research. (Protected time means relief from teaching/administrative duties.)

Funding levels vary

K awards require a commitment of up to 75 percent of your time. And funding levels for salary, research and training vary from one NIH institute or center (IC) to another.

The most commonly awarded NIH K grants for new and early-stage investigators include the following:

- K01 — Mentored Research Scientist Career Development Award for basic laboratory research
- K08 — Mentored Clinical Scientist Research Career Development Award for basic laboratory research with a clinical component
- K23 — Mentored Patient-Oriented Research Career Development Award for research involving patients.

The agency awards another type of K grant to mid-career and senior investigators, giving them protected time to pursue outstanding research projects or mentor junior investigators.

Here are six application strategies that have helped others win K grants:

1. Propose relevant research

For example, **Roxanna Bendixen,** PhD, a research assistant professor in the Department of Physical Therapy at the University of Florida, won a five-year, $570,000 K01 last year for *Comprehensive Assessment of the Impact of Illness and Disability in Children* from the National Institute of Child Health and Human Development.

She believes one reason she succeeded on her first submission was because her planned research could someday impact public health. She is studying boys with Duchenne Muscular Dystrophy (DMD) — with special focus on how the disease affects their quality of life. She will later examine the effectiveness of new therapies.

The lesson: Don't necessarily focus on basic aspects of diseases, other health issues or treatments that other investigators have already widely examined. Instead, try to break new ground by drilling down on certain aspects that have received less previous attention, as Bendixen did.

Another option is to consult with the Program Officer (PO) before applying to make sure your proposal relates to a particular IC's mission and that you understand any specific criteria.

2. Have a realistic plan

Your project must not only serve the IC's mission, but also must be "doable" in the reviewers' eyes. What makes it so? First, it should fit within or harmonize with:

- The context of your previous research
- Your knowledge and expertise
- Your current position
- Your institution's ability and willingness to support you.

An overly ambitious plan can work against you. "Whatever research you're thinking of proposing — scale it back," advises **Thomas Mitchell,** MPH, academic coordinator for the University of California-San Francisco's Department of Epidemiology and Biostatistics.

Example: Perhaps you want to develop a behavioral intervention to encourage sedentary adults to exercise more to reduce their risk for cardiovascular disease and

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diabetes. "Instead of a full-scale trial comparing your intervention group to a control group, make one of your specific aims simply a pilot study on the feasibility of your intervention," Mitchell says.

This strategy's advantage: It gives you hands-on intervention research experience *and* preliminary data — boosting your chances of winning a future R01 grant to fund the full-scale trial.

3. Provide clear specific aims

NIH now gives you only 12 pages (as opposed to 25 previously) for your entire K grant application, so you must keep your specific aims (and other sections) clear and concise.

Example: Bendixen wasn't general or vague about the aims for her DMD study. Instead of broadly stating that she would focus on the boys' quality of life and later on certain treatments, she was very specific. Here's how she stated her study's aims:

- Evaluate physical/physiological abilities/strengths and activity engagement in boys with DMD as compared to healthy boys;
- Evaluate disease progression;
- Explore environmental/parental perceptions/ behaviors that facilitate/inhibit activity;
- Quantify physical/physiological changes over time.

Spell out your specific aims just as clearly. Say you want to study a form of cancer. Don't speak in generalities, saying only that you plan to conduct lab experiments and examine tissue specimens. Instead briefly describe the *type* of experiments and *how you'll perform them*, exactly *what you'll be observing* in the specimens, and perhaps *how you'll obtain and isolate them*.

4. Present a solid career-development plan

Your K grant application must outline the steps you'll take to develop your research career. First state what your long-term career objectives are, and then tell reviewers what you'll do to achieve them.

For example, Bendixen's **career goals**, all very specific, were as follows:

- Expanding her skills in statistical analysis and quantitative assessment;
- Learning more about project design, data-collection methods, and review and study analysis;
- Gaining more exposure to pediatric clinical research; and
- Improving her grant-writing and publications proficiency.

What exact steps would she take in working toward those goals? She listed four:

- Coursework
- Mentored lab time
- Attending specifically named seminars/conferences
- Manuscript preparation and grant-writing courses.

Reviewers especially liked her plan to take on two separate three-month lab-training stints at the National Institute of Neurological Disorders and Strokes and at the Research Center for Genetic Medicine.

Your career goals and training plan will differ, of course, but the take-home advice is to state your goals specifically. Don't merely say you want to gain more lab experience or learn more about your field; state what *kind* of lab experience you want or what *aspects* of your field most interest you. Then, if you will take any particular courses, attend certain seminars or have key mentors in mind, *identify them.*

5. Cultivate strong mentors

Even before you begin your application, line up mentors (usually within your institution) who you are certain will regularly and meaningfully support you when you are working under the K grant.

Bendixen enlisted leading researchers at UF as her primary and secondary mentors. Listing them and their credentials on her application demonstrated that they and UF were behind her project. Institutional support, especially when you are asking for "protected time" away from teaching, administrative and service duties, is important to reviewers.

6. Show you're in training for an R01

Reviewers also want to see a specific training plan — a detailed, year-by-year plan of activities — that includes time to prepare your application for an R01 award, your eventual goal.

Elizabeth Bertone-Johnson, ScD, associate professor of Biostatistics and Epidemiology at the University of Massachusetts, won a five-year, $868,857 K01 grant for her study of the relationship of vitamin D, calcium and parathyroid hormone (PTH) to premenstrual syndrome (PMS) and premenstrual dysphoric disorder (PMDD).

Now in her fifth K01 year, she is writing an R01 application to submit this year. How did she win her K01?

Reviewers were particularly impressed with her five-year training plan, which allocated her time by percentage. It sets a good example of how you might outline your own training plan:

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- Coursework – Years 1-3: 20%; Years 4-5: 0%.
- Short courses/workshops – Years 1-3, 5%; Year 4: 2.5%, Year 5: 0%
- Seminars and colloquia – 5 years: 2.5%
- Meetings – 5 years: 2.5%
- Supervised reading – Years 1-2: 10%; Years 3-5: 5%
- Clinical observation – Year 1: 5%; thereafter: 0%
- Research project – Year 1: 35%; Year 2: 40%; Year 3, 45%; Year 4: 50%; Year 5: 60%
- Teaching – Years 1-5: 20%
- Service – Years 1-5: 5%
- Preparing R01 application – Years 1-3: 0%; Year 4: 10%; Year 5: 5%

A solid training plan is as critical as a good research plan, according to Bertone-Johnson and others who have won K awards. ■

NSF's MRI Grant Program: Making Your Proposal Stand Out

You have about a 30 percent chance of landing an NSF major research instrumentation (MRI) grant.

That's according to **Karen Markin,** PhD, Director of Research Development at University of Rhode Island, a former reviewer for NSF and the Department of Education and a published expert on grant writing.

How can you improve the odds that your MRI proposal will rise to the top? Markin, who presented a recent Webinar for Principal Investigators Association, recommends these steps:

1. Your equipment must fit NSF goals

Here's what NSF's MRI program tries to do:

- Support acquisition and development of high-end scientific instrumentation for research and student training — instruments that are too costly for support through other NSF programs.
- Improve research and research training.
- Collaborate with other organizations — including the private sector.

Examples: A single-crystal CCD X-ray diffractometer, high-resolution optogenic microscope, development of a dynamic atom probe and instruments for sequencing DNA.

"A good way to start is to see what's already been funded," says Markin. "Even if you've read the call for proposals, there could be a slight difference between how you interpret what the agency is looking for and how they have interpreted it in practice."

You can find more examples here: http://www.nsf.gov/od/oia/programs/mri/2010.jsp.

Remember: The collaborative element is key. The University of Notre Dame, for example, received an MRI grant at its civil engineering and geological science facility. The application sought access to NSF-funded equipment for18 researchers at six universities in Indiana and Michigan.

"Collaboration was the primary impetus for pulling the grant together," says **Dr. Antonio Simonetti,** research associate professor in Notre Dame's Department of Civil Engineering. "My colleague, Clive Neal (of the same department), and I wished to make this a regional research center — and pretty much knew this was the only way our grant was going to be successful."

2. Know what's eligible and the limits

Keep in mind the limits of the grant: $100,000 to $4 million. There can be exceptions to the $100,000 floor if:

- It's for mathematical sciences or social, behavioral and economic sciences.

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- Yours is a "Non-PhD-granting institution," which does *not* mean that you have no PhDs in the sciences. Rather, it means that you've awarded five or fewer in the past two years.

On the other hand, the following are not eligible for MRI funding:

- Standard lab equipment. "No matter how desperately you may need it," says Markin. The MRI program is not designed to help you balance your budget.
- Support technology, such as computer networks or telecommunications equipment.
- Equipment for standard science courses. **Note:** You can use MRI-granted equipment in standard science courses, but that cannot be the primary use, which must be research.
- Construction, renovation or maintenance of facilities (e.g., electrical or plumbing).

Note: Don't forget about the institutional submission limit: Each university can submit only three proposals for acquisition and one for development. Ask your sponsored projects office how your institution manages limited competitions and follow the procedure. If your institution submits too many, all may be returned without review.

3. Look beyond your department

NSF wants the best bang for its buck, which means that it wants *many users* for the instrumentation.

"If the agency pays a lot of money for this instrument, it wants to know that a lot of people are going to use it," says Markin. "The notion of shared use shows up again and again in the program announcements. You have to make sure this isn't someone's pet project and that you're not trying to force through something that *appears* will have a lot of users. Of course, if coincidentally it's a pet project, I don't see how that will be a problem."

Therefore, in your narrative:

- Show a need at your university.
- Show that investigators from many disciplines, and not just your own, can use the instrument (and document their projects).
- Canvass fellow faculty members and those at nearby institutions.
- Recruit students, both graduate and undergrad. "You can talk about the equipment as a recruiting tool."

"Go outside your department and go outside your college to ask what people are doing. They might be able to use it," says Markin.

Example: "We had a PI who requested a DNA sequencer," says Markin. "He contacted faculty in different departments and colleges and found about 15 people who gave short descriptions of their work and how the sequencer would take it to the next level." The result: He got funded.

You can also partner with private non-profits, such as museums and science centers. Commercial entities can be involved as sub-awardees in a consortium.

4. Discuss the impact on infrastructure

Once you've determined your proposed equipment fits NSF goals and you've lined up allies, your next step is to write your proposal's narrative. Explain how the instrument will strongly boost your institution's ability to conduct leading-edge research and how it might benefit education and research training.

Questions to consider:

- Will the university develop new courses?
- Will there be outreach to secondary schools?

"NSF is looking for a lot of use here," says Markin.

5. Examine the Broader Impacts

Try collaborating with diversity-related programs at your institution.

"Discussing the social benefits of this equipment is essential," says Markin. She recommends looking for internship programs for minorities and women — or perhaps your institution has a partnership with a university that serves under-represented groups.

Example: "Say the instrument will help us gauge the severity of hurricanes so that disaster-preparedness teams can plan an informed response," says Markin. "Show how the instrument will advance science in a way that will have clear societal benefits."

Use subheads for both the Intellectual Merit and Broader Impacts sections, or you can get knocked out of the competition, she adds.

6. Provide support documentation

Lastly, include supplementary documents that describe your plan for managing the equipment.

Some management questions/issues reviewers will expect you to answer:

- **Where will the equipment be housed?** "NSF wants to know that if you get this equipment, you have a place to put it — and that you can get it up and running right away," says Markin.
- **Who will operate it and maintain it — and how?** Your institution must provide a one- or two-page letter explaining this. "NSF wants to know who is accountable for equipment maintenance. If no one is, it won't be maintained," says Markin.

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- **How much will it cost** for a technician to operate the equipment?
- **How will instrument time be allocated?**

"NSF needs to know you've thought about all these issues," says Markin. Here are other required supplementary documents you'll need as well:

- **Cost sharing.** It is exactly 30 percent. Include a letter documenting your cost-sharing. (**Note:** Non-PhD-granting institutions are exempt from cost sharing.)
- **Data-management plan.** You must have one or show you don't have a need for one. From NSF: "Investigators are expected to share with other researchers, at no more than incremental cost and within a reasonable time, the primary data, samples, physical collections and other supporting materials created or gathered in the course of work under NSF grants. Grantees are expected to encourage and facilitate such sharing."
- **Post-doc mentoring plan,** if applicable.
- **Letter** stating your institution's status as PhD-granting or not.

Markin's last word on making your proposal stand out: "Share your excitement about your research. Talk about all the things you'll be able to do. Show the transformative impact of activities across and within disciplines."

This article is based in part on a Webinar presented by Dr. Markin for the Principal Investigators Association. For details on how to order a full transcript of this Webinar in CD, MP3 or PDF format, visit http://principalinvestigators.org/Audio-Conferences/audio-conference-101208/. ■

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- What Having Human Subjects Does to Your Application
- How to Ensure Your Proposal Isn't Too "Ambitious"
- Aims, Goals, Objectives: What's the Difference?