

**Writing Successful NSF Doctoral Dissertation Improvement Grants:
Perspectives on Proposals and the Review Process from Two Former Panelists**

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Introduction

The National Science Foundation (NSF)'s Division of Environmental Biology (DEB) and Integrative Organismal Biology (IOB) offer PhD candidates a great opportunity to apply for research money while starting a relationship with NSF. Through its Doctoral Dissertation Improvement Grant (DDIG) program, NSF awards up to \$12K to students meeting eligibility requirements. However, these requirements – or any other related logistical matters – are not going to be discussed in this document. We are going to assume that you, the reader, has dutifully researched the logistical components of a successful DDIG (requirements, deadlines, formatting guidelines, various components, etc., available from NSF's webpages, www.nsf.gov) and now seek advice on a different level. What separates funded DDIG proposals from the others? How can your DDIG be one of the 20-35% of successful proposals? We have thought about these questions after having served as DDIG panelists – that group of scientists who actually review proposals, rate and debate them, and ultimately recommend the best for funding. After having serving on separate DDIG panels for DEB (Spencer for Ecology, Leonie for Evolution) in Winter 2006, we compared our experiences and noted many common aspects of those proposals that made it to the “fund board” and those that did not. Here is our advice (see several similar points also raised by Skelly 2003):

1. Know your reviewers and your panel

A. *Write assuming that your reviewers are tired and not experts in your subdiscipline....* It is important to appreciate that three panelists will read your proposal and many (15-25) others, sometimes at the last minute (even on the airplane!), and often on subjects with which we are familiar but not experts. This situation sets a very high premium on clear, concise writing aimed at a broad ecological or evolutionary audience. Proposals aimed narrowly at a targeted subdiscipline often failed, and nuance often got proposals nowhere.

B. *... But be prepared for an expert to review your proposal.* Occasionally, a panelist's dissertation or current research overlaps with a student's proposal. In these instances, students who include shallow or murky methodology ran into trouble. So, this means that proposals must be written for a general audience but must also be technically sound.

C. *Understand expectations of your panel:* Not all NSF programs fund DDIGs. Occasionally, we read proposals arising from other disciplines (e.g., paleontology, genomics) which were more tangentially related to the ecological or evolutionary focus of our panels. If you find yourself in this situation, ensure that you know how your panelists think and tackle questions. Proposals arising from other disciplines failed if they did not pitch research ideas and plans in a way to which reviewers could relate. For instance, ecologists typically expect replication of treatments, statement of hypotheses which can be tested, etc. We both saw genomic-oriented proposals which seemed technically sound and exciting fail in the panels because the proposal did not satisfy these expectations.

2. What are the traits of our favorite proposals? Successful DDIGs:

A. *... asked conceptually cutting-edge, often risky questions.* The best proposals usually pushed conceptual boundaries and challenged the status quo. This aspect of DDIGs made them very fun to

review. NSF invests relatively few dollars per DDIG (\$10K compared to, say, \$300K) and therefore is willing to fund exciting proposals which might not work. On the other hand, we saw proposals fail which seemed solid and technically sound but did not excite panelists.

B ... *clearly demonstrated the ability to *improve* the grant.* Panelists look to see that the dissertation is well in progress, since it is a dissertation improvement grant, not a dissertation grant. In most cases, this means that some compelling data are needed to win over panelists.

C ... *broadly pitched the conceptually-motivated introduction on the first page.* The reviewer must know what the proposal is about – and want to know more about it – by the end of the first page. Set that hook early; waiting until page three or four is too late.

D. ...*tested clearly stated hypotheses which naturally stemmed from the Introduction.*

E. ... *smoothly integrated background material to place those hypotheses into context.* This background material helps to show promise of dissertation.

F. ... *very clearly explained methods which obviously related to the hypotheses and strongly argued that the proposed research will answer the questions raised.* While panelists are willing to fund risky proposals, they do want to know that the proposed work is logical and feasible.

G. ... *contained broader impacts beyond graduate training.* The Broader Impacts section offers the student applicant an opportunity to highlight aspects of the research which can appeal to audiences beyond those who will read the student's papers. You must make an effort to establish the broader implications of your research, whether they are in education and training (especially of underrepresented groups), broader scientific outreach and/or dissemination, establishing scientific partnerships, or societal benefits. Think about ways in which your research can extend to management, education of students of all ages at schools, museums, etc. If you can include such an aspect, do write about it in this section.

H. ... *exhibited at least some degree of independence from the advisor's work and grants.* DDIG panelists are not interested in funding the advisor – they want to fund exciting work of promising students. It may be good to strive for some degree of independence from your advisor's program anyway; it is particularly important for successful DDIGs. This aspects of your DDIG is highlighted in a "Context for Improvement" section. Newly introduced in 2006, it requires that you present a case for how NSF DDIG funding will substantially improve your dissertation while also addressing how your project is distinct and independent from your advisor's research. We read this section carefully.

3. Some common shortcomings of proposals:

While we read many proposals which truly excited us, we also noticed a common set of problems or mistakes in many others, most of which are completely avoidable. Many of these problems mirror the attributes of our favorite proposals in Section 2. These include:

A. *Work that was sound but not terribly exciting.* Solid but boring = no funding. Often the problem here is the failure to place research into a broader intellectual and scientific context, or to overemphasize description rather than hypothesis-driven science.

B. *Lack of pilot data.* Preliminary data establishes both that your methodology is sound and appropriate, and that you have the necessary skills to complete the research. The panel must be confident that the research can be done, even if the specific outcome is not yet known. We noticed that proposals with little

or no prior data were rarely funded. If you do not have compelling data yet, consider submitting your proposal in a year.

C. *Overemphasis on Methods, and/or question and inquiry that are not conceptually-rigorous.* Spencer noticed that this problem seemed especially acute with proposals involving newly emerging molecular methods. Yes, these methods are exciting and can open intellectual doors which were formerly closed. However, if your proposal relies heavily on these methods, heed this warning: for ecology and evolution proposals, methods are just means to an end. The end must be feasible, logical research that asks and answers conceptually compelling questions. Spencer saw that poorly framed questions addressed with cutting edge molecular technology were typically denied funding. On the other hand: if your proposal will rely heavily on molecular methods, make sure that you have demonstrated that you can do the work, have developed the necessary primers, have access to PCR machines, etc., in the proposal. Reviewers like conceptually risky proposals but might balk if you seem underprepared to take on an ambitious molecular-technology based program.

D. *Poor scholarship, especially large gaps in knowledge of the literature directly related to the project.* One obvious red flag for this problem is the ‘first time ever’ claim. This claim reads something like, “to our knowledge, this is the first study to examine adaptation in the wild”. Do not make a ‘first time ever’ claim unless you are certain that your study and/or approach is truly unique. Better yet, why not instead emphasize the burning need to answer the question you have raised in your proposal? Panelists are often much more inspired by (and motivated to fund) proposals emphasizing the importance to solve critical problems than those making claims to novelty alone. Many boring questions have not been asked yet...

E. *Poor integration of Introduction, Hypotheses, Background Material, and Methods.* As we said, panelists review up to 25 proposals. They cannot be expected to integrate sections or see the wisdom of certain approaches or questions on their own. The various sections of the proposal must all work together towards a common goal.

F. *Poorly written prose, sloppy presentation.* Do we really need to say it? Always do a spell-check before submitting. Also, remember that premium on clear and concise writing....

G. *Minimal or non-existent broader impacts.* This section will generally not kill a scientifically impressive proposal but can sink a proposal on the borderline between Fund and Do Not Fund.

H. *Poorly justified or non-existent ‘context for improvement’.* As with broader impacts, a poor job in this section can kill a borderline proposal. Both of us noticed that when panelists were wavering on a “fund” decision, program officers frequently questioned both this criterion and the broader impacts of the proposal to broker a final decision.

4. Some more advice:

A. *Do not start writing the proposal at the last minute.* It shows and it does not impress.

B. *Find examples of successful proposals and use them as a model for your own.* This might work especially well if the proposal is similar in style and content to your own. Ask a senior student in your lab group for a copy of her successful DDIG proposal.

C. *Multiple modes of inference are good if integrated.* Panelists seemed to love work that combined multiple avenues of inference, especially modeling with data collection. We suggest that you highlight this aspect if it applies to your work. However, do not emphasize components that are not well integrated

with the rest of your proposal. An unrelated collection of projects creates the impression that there is no central theme to your research, and that can sink your proposal.

D. Make sure that your advisor reads it. It seemed obvious that many students did not get good feedback from their advisors and/or labmates.

E. Make sure that others read it, especially those who do not study similar problems. If you study plants, give it to a plankton person. If you study disease, give it to someone who works on nutrient cycling. They can note places where the proposal is not clear and does not make sense to the generally informed reader in your overall discipline.

F. Produce high-quality figures. One well thought-out diagram or graph can simultaneously show preliminary data, demonstrate your research skills, and save a substantial amount of text. It can also really help panelists if your proposal involves complex interactions (species, populations, or genes). In this case, look to simplify names of players and include a diagram. You do not want reviewers to get lost with who-is-who.

G. Use the space you have been given. You have eight single-spaced pages for your proposal (excluding the Summary and Context for Improvement sections). Use every bit of it to state your case.

H. Submit a polished document. Go over the proposal one last time before submitting, to correct spelling and or grammatical errors. Even better -- get someone else to read and check the last version of the proposal. This step is particularly important if English is your second language.

I. Note on resubmissions. If your DDIG is not funded the first time around, you should submit it during the following year if possible. (This means that you should prepare to submit a DDIG as soon as you can in your graduate career). The second time around, indicate that the proposal is a resubmission in the text and explain how the proposal incorporated feedback from the previous review. We explicitly looked for that and criticized proposals which ignored previous comments. We knew which proposals were resubmitted, and we accessed prior reviews.

J. Know what NSF wants to know from panelists: As panelists, we are asked to address the following generic questions. Make sure that a reviewer could rate your proposal positively when answering these questions.

What is the intellectual merit of the proposed activity?

How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of the prior work.) To what extent does the proposed activity suggest and explore creative and original concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

What are the broader impacts of the proposed activity?

How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?

Literature Cited

Skelly, D. K. 2003. How to write a successful Doctoral Dissertation Improvement Grant proposal. *Bulletin of the Ecological Society of America* 84:137-138.