Make Your NSF Proposal Better From the Beginning – Intellectual Merit and Broader Impacts

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An NSF Funded Center of Excellence in the Advanced Technological Education Program
About The Presenter

- I have had the privilege to be a PI and Reviewer for both NIH and NSF grants since 1989
- My technical background is chemical physics with a lot of focus on applications of laser technology in science and medicine
Have You

Ever Served as PI on proposal?

A. Yes
B. No
Have You

Ever had a proposal rejected?
A. Yes
B. No
All NSF Proposals Are Evaluated Through Two Merit Review Criteria

- Intellectual Merit
- Broader Impacts

- Image of 3-D, synthetic, DNA-like crystals.
  NSF/CNSI, UCLA-Department of Energy Institute of Genomics and Proteomics
Avoid Your Proposal Being Returned Without Review

• Proposals that do not separately address both criteria within the one page Project Summary will be returned without review.
**Intellectual Merit:** As technology advances, enhancing our access to distribution and utilization of electricity will become an important aspect of the STEM workforce. The EUC will insure that the STEM content is developed and anticipate the technologies that will be used to optimize energy use and support student success in electric energy related technology fields.

**Broad Impact:** The EUC will encourage students to enter the workforce needs of our community and the region by thoughtfully aligning educational programs. Technician education and training curricula, and faculty professional development will be created through a comprehensive marketing approach. The nation’s interest in energy will help insure the use of the center’s materials and services.
Intellectual Merit and Broader Impacts

- These criteria are not just for the summary page
- They are integrated into the proposal
- Reviewers are looking for words about these criteria to help construct their review

- NSF/UAF photo by Todd Paris
In This Web Seminar You Will Enhance The Success of Your NSF Proposals By:

1. Learning the relevant, Intellectual Merit and Broader Impacts Criterion as defined by the National Science Board
2. Learning how to address NSF review criteria in the project summary page
3. Discovering the reviewer’s perspective for the “intellectual merit” and “broader impact” statement as well as additional review criteria
4. Framing the broader impacts of the activities you propose to undertake
5. Thinking beyond local impact to the possible benefits to society
To Whom Are You Writing When You Submit The Proposal?

- The reviewers
- They are required to use the Intellectual Merit and Broader Impacts Criteria to rate your proposal
- You have 90 minutes of their attention!
NSF uses two Merit Review Criteria for all proposals, and these criteria include a list of potential considerations that you might employ in your evaluation.

A holistic review that discusses strengths and concerns is generally more useful than one that addresses each individual review criterion.
Question

- When a reviewer is considering how creative, original or potentially transformative a proposal might be are they considering:
  A. Intellectual Merit?
  B. Broader Impacts?
Intellectual Merit

- How important?
- How well qualified?
- How creative, original or potentially transformative?
- How well conceived and organized?
- How well resourced?
Who Said: Imagination is More Important Than Knowledge?

A. Albert Einstein
B. Yogi Berra
C. Larry Ellison
D. President Obama
Speaking to Intellectual Merit

- The reviewer must offer how important he or she views the work
- So help the reviewer with language – give them something they can use
- Make a *scientist to scientist* connection using the language of the discipline
- An urgent need or a timely issue can capture a reviewer’s attention
Use Short Summary Statements At The End of Sections to Help The Reviewer

- This work is important because…
- The investigators are very well qualified on the basis of their background and experience…
- The most creative aspect of the proposed work is…
- There are potentially transformative aspects of the proposed work, which if successful, could…
Speaking To Broader Impacts

- Are we advancing discovery and understanding while promoting teaching and learning?
- Are we addressing under-represented groups?
- Are we enhancing the infrastructure for research and education?
- Are we disseminating broadly?
- Are there societal benefits?
Hopefully the reviewer won’t say

- There is no doubt that this program will offer a useful service and help build the strength of the XYU academic program. However it has a limited potential to become a model or to act to catalyze innovation in any broad sense beyond the confines of the project.
More About Broader Impacts

- Sometimes harder to address than Intellectual Merit
Broader Impacts: Advance Discovery and Understanding While Promoting Teaching, Training and Learning by:

- Developing research-based educational materials or contribute to databases useful in teaching (e.g., K-16 digital library)
- Partnering with researchers and educators to develop effective means of incorporating research into learning and education
- Encouraging student participation at meetings and activities of professional societies
- ...
Professional Societies

- Can offer great dissemination and impact opportunities
  - Society Of Manufacturing Engineers
  - IEEE
  - ACS
Broader Impacts: Broaden Participation of Underrepresented Groups

- Make campus visits and presentations at institutions that serve underrepresented groups
- Establish research and education collaborations with faculty and students at community colleges, colleges for women, undergraduate institutions, and EPSCoR institutions
- Mentor early-career scientists and engineers from underrepresented groups who are submitting NSF proposals
- …

OK, so how do you find these community colleges?

- Contact one of the NSF Advanced Technological Education Centers that are located at community colleges
  - [www.atecenters.org](http://www.atecenters.org)

- There are 39 centers spanning a variety of technical disciplines
Integrate research with education activities in order to communicate in a broader context

Partner with museums, nature centers, science centers, and similar institutions to develop exhibits in science, math, and engineering

Present research and education results in formats useful to policy-makers
Broader Impacts: Benefits to Society

- Demonstrate the linkage between discovery and societal benefit
- Partner with academic scientists, staff at federal agencies and with the private sector to integrate research into broader programs and activities of national interest.
- Analyze, interpret, and synthesize research and education results in formats understandable and useful for non-scientists
- ...

November 10, 2010
PIA
Intellectual Merit and Broader Impacts Are Not the Only Review Criteria

- Each Solicitation has the identical statement regarding intellectual merit and broader impacts
- Each solicitation also gives “additional review criteria”
- These additional criteria are cast in the language of intellectual merit and broader impacts
http://www.nsf.gov/funding/
Examples of Additional Review Criteria

- Cyber-Enabled Discovery and Innovation (CDI)
  - From NSF 11-502
  - The proposal should define a bold multidisciplinary research agenda that, through computational thinking, promises paradigm-shifting outcomes in more than one field of science and engineering.
In this Web Seminar We

- Learned the relevant, Intellectual Merit and Broader Impacts Criterion as defined by the National Science Board
  - These apply to all NSF funded proposals

Biomechanical Modeling, NSF/Sung-Hee Lee, Eftychios Sifakis and Demetri Terzopoulos, University of California, Los Angeles
We Know To Call Out In The Summary Page

Intellectual Merit: As technology advances, enhancing our distribution and utilization of electricity will become an important STEM workforce. The EUC will insure that the STEM content and anticipate the technologies that will be used to optimize energy support student success in electric energy related technology.

Broad Impact: The EUC will encourage students to enter the workforce needs of our community and the region by thought electrical utilization programs. Technician education and training curricula, and faculty professional development will be created through a comprehensive marketing approach. The nation’s interest will help insure the use of the center’s materials and services.
We Realize the Reviewers Perspective and Know How to Help Them Construct Their Review

- Through highlighting and summarizing key intellectual merits and broader impacts in the proposal

- Using the language of the review criteria
  - *The proposed activity advances knowledge and understanding within the field of cyber-enabled bioinformatics…*
We Now Have

- Good examples of how to frame the broader impacts of our proposed activities

Tip of an Atomic Force Microscope
NSF/University of Illinois
We Can Now

- Think beyond local impact to the possible benefits to society
Successful Proposers

- Are aware of review criteria from the very beginning (detailed in solicitation)
- Write with the reviewer in mind
- Integrate Intellectual Merit and Broader Impacts throughout the proposal
- Highlight the Intellectual Merit and Broader Impacts in the summary page

- Happy Proposing!
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- [ ] Medical Care  
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—Dr. Nedal Hamdi Arar, Ph.D. Associate Professor UT Health Science Center, San Antonio

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