Designing Broader Impacts
How to Prepare an Excellent Plan

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Science, Technology, Engineering, and Math Careers through Outreach, Research, & Education

**Services for Faculty and Natural Science Departments:**

1. Help faculty develop **competitive proposals**, with systematized emphasis on **Broader Impacts**
2. **Recruit** K-12 and community college students **to the undergraduate program**, emphasizing students from underrepresented groups
3. Organize and expand **outreach efforts** to all audiences
4. Support **evidence-based teaching** approaches and **science communication skills** by faculty, GTFs, and learning assistants
5. Collaborate in developing the undergraduate **teaching track serving majors** interested in teaching secondary science

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What are Broader Impacts?

- Your Ideas?
- What are your BI activities?
What are Broader Impacts? Often considered in categories:

1. Teaching, training, and learning (integrating research and education)
2. Broadening participation of underrepresented groups
3. Enhancing infrastructure for research and education
4. Disseminating results broadly
5. Providing societal benefits
1. BI: Teaching and Training

• Improved education and educator development at any level;
• Increased public literacy and public engagement with research and scholarship;

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2. BI: Broadening Participation

- Full participation of women, persons with disabilities, and underrepresented minorities;
- Development of a diverse, globally competitive workforce (also education & training and providing societal benefits)

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3. BI: Enhancing Infrastructure for Research & Education:

- Increased partnership between academia, industry, and others
4. BI: Disseminating Results

• Use of science and technology to inform public policy
5. BI: Societal Benefits

- Improved health and well-being of individuals in society
- Improved national security
- Increased economic competitiveness of the United States
Characteristics of Effective Broader Impacts

• Achievable
• Substantive
• Assessible
• Personal
Consider Broader Impacts as an opportunity to:

• Help advance your research and research agenda
• Add to your university service record in engaged scholarship
• Benefit your students and mentees in their careers
• Contribute to your fulfillment as a scientist and educator
What is Your Broader Impacts Identity?

• Reflect on your current and previous BI activities--is there a theme?
• What are you passionate about?
• Over the course of your career, what do you aim to accomplish?
Advice for Developing your BI Plan (1)

- Use your BI identity and BI agenda to guide your plan
- Identify clear, achievable and measurable goals
- Support with evidence-based practices - cite literature
- Connect with research plan
- Detail plan: who, what, how
Advice for Developing your BI Plan (2)

- Build on existing activities and infrastructure
- Involve others, including lab team & partners with needed expertise
- Maximize impact, e.g., via dissemination
- Include assessment plan and identify who will report
- Budget appropriately - demonstrate commitment with $
- Balance creative and tried-and-true aspects
- Refer to BI Guiding Principles

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“The broader impacts criterion is pushing members of the research community to think beyond the boundaries of their science to a broader mindfulness of their work in the context of the nation’s future.”

– Arden L. Bement, Jr., NSF Director 2004-2010
“It is now more vital than ever for us, the research community, to make a convincing case to the public about the tangible societal benefits that flow from science and technology, and the importance of investing adequately in research and education.”

–Neal Lane, NSF Director 1993-1998
NSF merit review criteria:

1. What is the potential for the proposed activity to: (a) Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and (b) Benefit society or advance desired societal outcomes (Broader Impacts)?

2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?

3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?

4. How well qualified is the individual, team, or organization to conduct the proposed activities?

5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?
Resources are adequate

Well-qualified PI & team

Potential to advance knowledge and benefit society

Original, potentially transformative

Well-organized, justified, & plan to assess

Intellectual Merit & Broader Impacts

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Leverage established connections and education expertise…

Example Projects and Opportunities

• Partner with our Teacher Programs
  • Teacher Workshops (virtual and face-to-face)
  • GTF roles – supporting teachers (GK-12 model)

• Contribute to our library of teaching materials
  • E.g., table top scanning electron microscope
  • Offer remote access to scientific equipment

• Offer research internships for undergrads, teachers, or future teachers
  • Teachers can join the community supported by STEM CORE

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Leverage established connections and education expertise…

**Example Projects Continued**

- Organize bridge to college programs
  - Build on existing partnerships with K-12, CCs

- Citizen science projects – involve students
  - Recruit and involve underrepresented groups

- Develop courses blending science and pedagogy content

- Partner with after school programs, museums, & local education providers and involve UO students via coursework or paid roles

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Resources

• **Broader Impacts Guiding Principles and Questions for NSF Proposals** – guide for PIs, program managers, and reviewers

• **Perspectives on Broader Impacts** – Report from the 2014 Broader Impacts Infrastructure Summit including:
  • Perspectives from NSF
  • Perspectives from university leaders
  • Perspectives from university participants including example activities

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Education Plan: CAREER

Research Activities
Education Plan

“Broader Impacts” must be a separate section
Example Objectives (1)

The Broader Impacts plan includes five complementary objectives:

1. Improve middle school students’ attitudes toward math
2. enhance students’ awareness of how math is used in different STEM careers
3. increase students’ interest in pursuing careers involving math
4. improve teaching and communication skills of graduate students, and
5. support teachers’ professional growth and development.
Figure 10. Logic model for Broader Impacts showing relationships between Objectives, Activities & Practices, and Outcomes.
Panel Summary Example #1

The educational plan was excellent. Participation in the STEM lab school was very highly rated. The methods applied were also expected to have high impact on the broader field of human neuroimaging.
This appears to be an excellent broader impacts plan. The goal of improving middle school students’ attitudes to math is of high societal relevance and desirability. The program will also enhance the training of graduate students in terms of teaching/mentoring and public engagement, and the training of teachers in terms of cutting edge scientific research. The results could be transformative, providing a model for math-attitude-improvement programs elsewhere. The plan is very detailed and based on a solid rationale. The concrete plans to measure the success of the program are commendable. The PI seems to have adequate resources and appropriate collaborators within the Oregon community to implement the plan.
Example Objectives (2)

The overall goal for all broader impacts efforts is to increase interest and understanding of biochemistry broadly and protein evolution specifically among high school age students, especially among students who identify as members of underrepresented groups.

The phases are as follows:

1) host 2-4 teachers for immersive summer research experiences;
2) collaborate with teachers to develop innovative and authentic lesson sequences;
3) support the delivery of lessons drawing on the NSF GK-12 model in which graduate students and the PI co-lead high school lessons;
4) revise, document, and share research-connected lesson plans;
5) conduct teacher professional development workshops...
Broader Impact Strengths: The broader impacts of this proposal are a strong combination of graduate training and K-12 STEM outreach. The graduate student training is well integrated into the research program. The STEM outreach takes advantage of a STEM Core program to provide teacher training and curriculum development. Importantly, the PI plans on co-delivery of developed curriculum which is critical for curriculum updates and CAREER training. There is a strong approach to software development and distribution with a clear commitment to open access via GitHub.

Broader Impact Weaknesses: No weaknesses in the broader impacts were noted by the panel.
Example Objectives (3)

This CAREER proposal has two primary educational broader impact goals: 1) to have (primarily female) STEM majors broaden their understanding of what a scientist is and does to recognize the importance of history of science and social studies of science; and 2) to expose these female STEM majors to social science research methods (primarily historical and anthropological) and train them to use these methods in their future careers.
<table>
<thead>
<tr>
<th>Goal</th>
<th>Activity</th>
<th>Audience</th>
<th>Outcome/Evaluation</th>
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| **AWARENESS** | **Broadening the understanding of role of history in global health interventions** | Writing and submission of:  
– Monograph to Duke or Cornell UP  
– 4 academic articles published in STS, history, global health, ethics journals  
– Co-authored blog posts with undergrads  
– Op-ed or article in mainstream media/magazine article  
– Conference papers at STS, History of Science, Global Health, and Global Health Ethics Conferences | – STS, African Studies, History of Science, Global Health scholars  
– Global Health Policy Makers  
– Undergraduate & Graduate Students  
– General Public | – Publication of monograph with academic press  
– Book reviews of the monograph in history, STS, anthropology, global health journals  
– Publication of articles in targeted academic and mainstream outlets  
– References in STS, history, global health books, articles, policy papers  
– Number of conferences & think tank presentations |
| **KNOWLEDGE/IDENTITY** | **Broaden understanding of what scientist is**  
**Recognize importance of history of science**  
**Exposure to social science methods** | Develop 3 new courses for Honors College and History Department on STS, History of Science, African Studies topics  
Syllabi & research packages of primary source materials (archival, oral, visual, epidemiological) | – High School Students (SAIL)  
Undergraduate & Graduate Students  
– Honors College  
– Female STEM Majors  
– Writing theses on STS, Global Health, African Studies | – Teach 3 new classes, estimated 14 times during grant with estimated 500 students taught  
– Have undergraduates choose to write theses on Global Health, STS, African Studies topics using data collected for this project |
| **SKILLS** | **Train to use historical & anthropological methods in future research careers of STEM students** | – Run weekly global health research group for 12-15 students  
– Hire and mentor undergraduate research assistants  
– Advise undergraduate theses integrating primary source data  
– Archival research trip to WHO with undergraduate RA  
– Co-write, submit, & present blog post or peer-reviewed article with RAs  
– Student presentations to high school students  
– 8-12 undergraduate research assistants (2-3/year)  
– 12-15 research group participants/year (estimated 36 total)  
– 3-5 primary advisees/year | – Run weekly global health research group for 12-15 students/year  
– Publication of blog piece or article co-authored with RA  
– Undergrad presentations to high school students, research symposiums, conferences  
– Female STEM majors able to incorporate historical & anthropological skills in future research and careers |
Panel Summary of Example 3

The panel found that proposal does a good job of integrating the research into the teaching mission of the undergraduate honors program. The goals of reaching female STEM students and exposing students to STS and history research methods are especially good. The PI will also develop new courses, advise a post-doc on public health and Africa, and make connections to public health agencies with the goal of raising the ethical implications associated with concluding intervention and bringing to light lessons from past failures. The panel thought there were opportunities for enhancing the broader impacts by developing connections to relevant NGOs and public health agencies.
What are your ideas for your BI plans?

- How does your idea align with departmental and university priorities?
- What existing programs and resources can you tap?
- Does your plan include creative and established BI components?
If you are considering a proposal, start considering broader impacts early in the process and engage potential partners in the conversation. Just as great research plans take time to develop, so too do great broader impacts plans!
• “Broader impact is very strong, including mentoring in lab, undergraduates in lab, high school advisory board and inclusion of high school students in research, and STEM CORE participation for training high school teachers. No weaknesses were noted by the panel.”

• “The broader impacts of the proposal are generally quite strong…. We appreciate the partnership with the university's STEM CORE program to facilitate effective outreach. The involvement of several undergraduates is commendable.”

• “As a CAREER proposal, the broader impacts of the project, particularly those associated with education, should be extensive and excellent. Those proposed met these expectations. Contacts have been made with a STEM Laboratory middle school that serves an under-represented group. The project would develop a summer teacher workshop, followed by regular interactions during the year to develop curricula materials. Students would have access to the data being generated by the project and maintain blogs to develop their language skills. The curriculum would be based on state and national standards.”
What are Broader Impacts More Specifically?

- Full participation of women, persons with disabilities, and underrepresented minorities;
- Improved education and educator development at any level;
- Increased public literacy and public engagement with research and scholarship;
- Improved health and well-being of individuals in society;
- Development of a diverse, globally competitive workforce;
- Increased partnership between academia, industry, and others;
- Improved national security;
- Increased economic competitiveness of the United States; and
- Enhanced infrastructure for research and education
Your Turn to Review BI Plans!

- Use the Guiding Principles
- Be prepared to report out to the group

https://tinyurl.com/yc4ug2bm