NSF Broader Impact (BI) Conversations:

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Overview

• NSF and the Broader Impact (BI) Culture
• NSF Broader Impacts (BI)- what does this mean?
• NSF BI Concept to writing
• NSF Merit Review Criteria
NSF Broader Impacts (BI):

• Encompasses the potential to benefit society and contribute to achievement of specific desired societal/relevant outcomes (NSF 15-1).
NSF Core Values: 2011-2016

- **Visionary**—imagining the future, working at the frontier, realizing the full potential of the research and education community, embracing risk, advancing promising ideas wherever and whenever they arise, and encouraging creativity and initiative;

- **Dedicated to Excellence**—investing optimally the resources entrusted to us, realizing the full potential of our people and managing a capable and motivated organization that provides an inclusive and positive work environment, and rewarding accomplishment;

- **Learning and Growing**—continually improving our ability to identify opportunities, promoting learning and growth for the S&E community and the agency, and sharing our best insights with others;

- **Broadly Inclusive**—seeking and including contributions from all sources while reaching out, especially to groups that are underrepresented, serving scientists, engineers, educators, students, and the public across the nation, and exploring opportunities for partnerships, both nationally and internationally; and

- **Accountable**—operating with integrity and transparency, and maintaining quality in administration, management, and oversight.

NSF Strategic Plan 2011-2016
NSF Core Values: 2014-2018

- **Scientific Excellence** – engaging the vision and expertise of our staff with that of the scientific community to create a portfolio of awards that support transformation and innovation;

- **Organizational Excellence** – investing the resources entrusted to us optimally and efficiently, and realizing the full potential of our people in managing a capable, motivated, inclusive, and positive work environment;

- **Learning** – continually identifying opportunities for learning and professional growth inside and outside the agency, and sharing our best insights with others;

- **Inclusiveness** – seeking and embracing contributions from all sources, including underrepresented groups, regions, and institutions;

- **Accountability for Public Benefit** – operating with integrity and transparency, and maintaining the highest standards of performance in administration, business processes, management, and oversight, thereby providing the best value to the U. S. taxpayer.

NSF Strategic Plan 2014-2018
Potential STEM and Social Science Stakeholders

- **74.3 Taxpayers Kids Ages 0-17**
- **20.3 Students in Higher Education**
- **1.56 Higher Education Staff and Faculty**
- **200 US Taxpayers**

References:
How Do **YOU** Specifically Demonstrate Your Stakeholders Have Made a Wise Investment?

References:
- IRS Tax Statistics
- US Department of Labor--Statistics
  http://www.dol.gov/oes/roles/statistics/
- Census for students
  http://www.census.gov/hhes/school/data/cps/2010/tables.html
- Higher education staff/faculty
NSF Broader Impacts (BI) Goals/Priorities

- **Broader Impacts (BI)** encompasses the potential to benefit society and contribute to achievement of specific desired societal/relevant outcomes (NSF 15-1).

- **Strategic Goal/Priority 1:** Transform the Frontiers of Science and Engineering

- **Strategic Goal/Priority 2:** Stimulate Innovation and Address Societal Needs through Research and Education

- **Strategic Goal/Priority 3:** Excel as a Federal Science Agency
Priority 1: Transform the Frontiers of Science and Engineering

• Producing new ideas, developing important new fields of research and, periodically transforming the way we do science, education, and business, and changing the way we live

• Creation of new knowledge to prepare future (next generation including women and underrepresented populations) of research leaders and tomorrow’s STEM workforce who are equipped with up-to-date knowledge and the experience needed to address society’s current and future challenges
Priority 2: Stimulate Innovation and Address Societal Needs through Research and Education

• To guide the community to open up new avenues to address, to advance the national health, prosperity, and welfare; to secure the national defense

• To engage the community in addressing particular urgent challenges which often requires the formation of partnerships and sponsors to build capacity, leverage resources and increase the speed of translation from discovery to innovation

• To support research and development on STEM education and learning to prepare a diverse, globally competent STEM workforce and STEM-literate citizenry
Priority 3: Excel as a Federal Science Agency

• Incorporate a culture of continuous improvement to ensure effective, inclusive, and accountable programs that provide the greatest value for taxpayer dollars (our stakeholders)

• To recruit, to retain, and deepen the expertise and capabilities of our entire workforce

• To embrace a diverse and continually changing workforce
NSF Broader Impact Priorities: Stakeholder Benefits

1. Full participation of women, person with disabilities, and underrepresented groups in NSF focused areas.

2. Improved STEM education and educator development at any level.

3. Increased public scientific literacy and public engagement in science and technology.

4. Improved well-being of individuals in society.

5. Development of diverse, globally competitive workforce.

6. Increased partnership between academia, industry, and others.

7. Improved national security.

8. Increased economic competiveness of the United States.


*Broader impacts may be accomplished through the research itself, through the activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. NSF GPG: [http://www.nsf.gov/pubs/policydocs/pappguide/nsf14001/gpg_index.jsp](http://www.nsf.gov/pubs/policydocs/pappguide/nsf14001/gpg_index.jsp)*
The (BIR PAF) of your Research, Scholarship, Creative Activity: From Concept to Implementation

1. Know why you care and what you love to talk about concerning your research, scholarship, creative activity

2. Develop sustainable long-term relationships and partnerships
   - communicate, cooperate, collaborate

3. Know your audience, figure out how to communicate, continue communicating, and always let the audience communicate back to you (bip & bia)...

- 200 US Taxpayers
- 74.3 Taxpayers Kids Ages 0-17
- 20.3 Students in Higher Education
- 1.56 Higher Education Staff and Faculty

Numbers in Million
Where would you stand along a BI Continuum?

- Low Quality BI
  - Single communication
  - Exclusive
  - Assimilative
  - Internal Funding
  - Junior Faculty
  - No Sustainable BI Infrastructure
  - Teaching with no connection to research, scholarship, and creative activity

- High Quality BI
  - Multiple partnerships, collaborations, etc
  - All Inclusive
  - Systemic
  - Endowed Chairs
  - Established Productive Faculty
  - Well Sustained BI Infrastructure
  - Teaching with high...

- There is a spectrum of BI that ranges from low quality to high quality BI based on several connected factors
- Broader impacts is a cumulative not a one time activity
- The better one (creative and transformative) gets at this activity the more inclusive one becomes- how do we become better at this activity?
- BI involves understanding the cultures, values, and ways of communication of the different groups within our society about research, scholarship, and creative activities.
4. Process: Proposal Writing on BI and bia

Know Your Solicitation !!!
## Process continued: writing NSF (BI) and bia

<table>
<thead>
<tr>
<th>Criterion Defined</th>
<th>Intellectual Merit</th>
<th>Broader Impacts</th>
<th>When proposals are reviewed, where are the gaps in understanding most visible?</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Intellectual Merit criterion encompasses the potential to advance knowledge</td>
<td>The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes</td>
<td>Project summary, project description, biosketch, FEOR, DMP, PMP – almost everywhere</td>
<td></td>
</tr>
<tr>
<td>To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?</td>
<td>PIs might remember to write about the innovation of their research and how it is potentially transformative</td>
<td>Most PIs do not think this way about broader impacts (but now they need to)</td>
<td>Project summary, project description</td>
</tr>
<tr>
<td>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?</td>
<td>Most PIs see this as describing their methodology, giving details so that reviewers can see that PIs know how to perform their research. Most PIs assume that assessing success comes in publications (although planned dissemination should be described in the proposal)</td>
<td>Most PIs vaguely list that they want to work with particular groups (e.g., HS students, teachers, the public) but give no details as to how they will do this or evaluate its success (but they need to)</td>
<td>Project summary, project description, FEOR</td>
</tr>
<tr>
<td>How well qualified is the individual, team, or organization to conduct the proposed activities?</td>
<td>Most PIs think about this in the context of their research (biosketch, research expertise, facilities available to the research, etc.)</td>
<td>Most PIs don’t address in their proposals (but they need to) that they have the expertise and people power to carry about the activities or have support at their institution</td>
<td>Biosketches, FEOR, Letters of Commitment, space in the proposal</td>
</tr>
<tr>
<td>Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?</td>
<td>Most PIs understand that they should describe what is available to perform the research or other collaborators and the expertise they bring to the project</td>
<td>Some PIs will have found others to partner with to carry out broader impacts activities (e.g., K20 Center, Outreach, OK EPSCoR office, etc.); others will try to do everything on their own.</td>
<td>Project summary, project description, biosketch, FEOR, DMP, PMP, Letters of Commitment – almost everywhere</td>
</tr>
</tbody>
</table>

**Reference:** Alicia Knoedler, Associate VP of Research
4. Process cont... Be mindful of the other BI areas

- a. Project Summary (required)
- b. Project Narrative/Description (required)
- c. Biosketch (publications, synergistic activities, collaborators, students)
- d. Current and Pending (pursuing funding related to broader impacts)
- e. Facilities, Equipment and Other Resources (FEOR)
- f. Letters of Commitment
- g. Data Management Plan
- h. Postdoc Mentoring Plan
- i. Suggested Reviewers
- j. BI language
- k. Ask for Help Early

Reference: Alicia Knoedler, Associate VP of Research- revised by Michael Thompson
The importance of photoperiod-dependent flowering relates to both natural ecology (e.g., timing flowering to seasons when seeds have the best chance for survival) and human-manipulated agricultural processes (e.g., suppressing early flowering in biofuels related crops). Understanding this process can expand our basic knowledge of plant physiology and direct our future ability to fine tune crops for increased biomass production. The proposed research focuses on the specific functions of NF-Y transcription factors in photoperiod-dependent flowering, but NF-Ys also have roles in other agriculturally important plant processes, including drought resistance, nitrogen fixing root nodulation, and embryogenesis. Thus, mechanistically dissecting the roles of NF-Y transcription factors in flowering will provide essential information for scientists broadly studying plant development and stress response programs. Additionally, students at the University of Oklahoma currently have limited access to research opportunities in plant molecular biology. Inquiry-based research will provide undergraduate students with opportunities to perform cutting-edge plant physiology and molecular biology. To achieve this goal, many of the proposed experiments will be integrated into a newly developed Plant Physiology course. Additionally, the development of "Oklahoma Plant Molecular Biology Forums" is proposed. During each forum, select labs (principal investigators and their students) from regional research institutes (OU, OSU, Noble Foundation, etc.) will meet to present their ongoing research activities and future plans. The goals of these workshops will be to 1) improve student and PI familiarity with the regional research community, 2) improve opportunities to receive professional feedback and find local collaborators, and 3) provide additional opportunities for graduate and undergraduate students to speak in small groups and interact with PIs.
Broader impact programs (bip) and Broader Impact Activities (bia): Broader impact programs (bip) have activities (bia) which are the specific ways and actions the stakeholders and you take, do, or implement research, scholarship, public outreach and creative activity with entities in society and society (actions that benefit society/stakeholders/taxpayers).
NSF BI Project Narrative/Description: BI, bip, and bia

• Include your BI statement
• Include your previous NSF supported bia and how it fits into your bip / portfolio
• Include any bia you have done before and/or results that is being expanded on because NSF funding
• Include your specific bia that will or are being used to achieve your goals to benefit all stakeholders
• Include how you specifically will assess/evaluate your success
Examples of *Synergistic Activities for NSF Biographical Sketches

Unless otherwise noted, NSF biographical sketches may include up to five synergistic activities that “…demonstrate the broader impact of the individual’s professional and scholarly activities…”

1. Executive Committee, UC Industry-University Cooperative Research Program (IUCRP) (2010)
   - Executive Committee, UC Biotechnology Research & Education Program (UC BREP), (2008-2011)
   - Co-Chair: MEMS/MOEMS Components & Their Applications, SPIE Photonics West (2009-2010); Co-Chair, Silicon Photonics, SPIE Photonics West (2009)
   - NSF Review Panel for Electronics, Photonics & Device Technologies (ongoing)

2. Our laboratory has pioneered the use of nanopore methods in analyzing nucleic acids. We have six patents in this arena, which have recently been licensed to a company. Our expectation is that a nanopore device will be on the market in the next few years, with applications in clinical diagnostics and basic research.

   In 2008, I established the first bioethics course at UC Santa Cruz in collaboration with Prof. Ellen Suckiel, Department of Philosophy. The course is unique in its approach, with extensive use of speakers from industry, medicine and government laboratories. It is a general education course, and fills one of our larger lecture halls with over 200 students when it is offered.

   While at UC Davis I was co-PI on an NSF-funded program called EXCITES (Excellence in Teaching Elementary Science.) The program ran every summer for three years between 1991 and 1994, and 75 K-6 teachers were invited to campus (with stipends) to interact directly with scientists and thereby get a better idea of how research was carried out in laboratories.

3. Development and/or refinement of research tools. Co-Developed a five-minute paper-and-pencil dominance scale to quantify the language dominancy of bilingual participants. The tool allows researchers to make predictions based on a gradient assessment rather than simple dichotomous groupings such as balanced bilingual or weighted bilingual (Dunn & Fox Tree, 2009).

   Innovations in teaching and training, new pedagogical method. Developed an undergraduate course where each student contributes to new research in psycholinguistics. Students record and transcribe talk, code phenomena, organize data for analysis, test hypotheses, and report findings.

   Innovations in teaching and training, new curricular materials. Developed an undergraduate course on rejecting pseudoscience using knowledge from cognitive psychology. Students complete both a scholarly paper and some form of public education, such as an op-ed piece, a webpage, or a grade school lesson plan.

   Innovations in teaching and training, new curricular materials. Developed a graduate course on grant writing. Students have earned about $80,000 worth of funding with submissions from this course (course taught six times).

   Broadening the participation of groups underrepresented in science, mathematics, engineering and technology: Both women and people of color are under-represented in cognitive psychology. Most of my PhD students and undergraduate advisees are female. My work on Spanish-English bilingual language use has been especially effective at attracting Latino/as to work in the laboratory.

* Any activities that relate to your research
Letter of Commitment vs Letter of Support

• **Letter of support**- state that a community group endorses or approves of a particular project.

• **Letter of commitment**- is a statement of active participation in the project. It specifies resources that the group will commit to the project and identifies what role it will play in bringing the project to a successful conclusion
  
  • Identification, Roles and Responsibilities, Authorization,
  • Motivation- broader impact highlights what the collaborator sees as outcomes of the project (invoke a mission)

Reference: [http://www.rit.edu/research/srs/grant-writing-tips-writing-effective-letters-commitment](http://www.rit.edu/research/srs/grant-writing-tips-writing-effective-letters-commitment)
4. Remember... Be mindful of the other BI areas

- a. Project Summary (required)
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- g. Data Management Plan
- h. Postdoc Mentoring Plan
- i. Suggested Reviewers
- j. BI language
- k. Ask for Help Early (the earlier the better-BI does not happen overnight or in 2 days)

Reference: Alicia Knoedler, Associate VP of Research- revised by Michael Thompson
5. Post-Process: NSF BI, bip, and bia (it’s not over)

• Keep lines of communication open between collaborators and partners
  • Talk often with collaborators
  • Some relationships take longer to attend to than others

• Start discussing plans to continue your bip and bia

• All other inquiries about post-award responsibilities—go to:
  • ORS