White Paper:

Your NSF Funding: Crucial Changes to Merit Review
Get ready for a variety of changes to how NSF handles the Merit Review criteria in your grant proposals. The National Science Board (NSB) recently released a wide array of recommendations for altering the NSF’s Merit Review. In many respects, the new revisions will be helpful for PIs and institutions, particularly with better clarity and guidance.

The NSB’s report was the product of extensive interviewing and surveying on topics relating to Merit Review. The Board formed a Task Force on Merit Review, finding at its basis that the two Merit Review criteria -- Intellectual Merit and Broader Impacts -- are truly on-target for meeting the NSF’s goals.

The Task Force also found, however, that significant revisions were necessary to better define the meaning of the Merit Review criteria and clarify how you should apply them to your research projects. The NSB’s report also addresses many of the hot-button questions that institutions and PIs have had about Merit Review.

**New ‘Principles’ to Shape Your Grant Requirements**

In addition to the myriad of revisions, the NSB produced new core principles as the basis for defining the Merit Review criteria. The Board outlined three key “principles:”

1. All NSF-funded projects should be of the highest quality and have the potential to advance, if not transform, knowledge and science.

2. NSF projects, in the aggregate, should contribute more broadly to achieving societal goals. PIs may accomplish their projects’ Broader Impacts through the research itself, through activities that are directly related to the research, or through activities that are supported by, but are complementary to, the project.

3. NSF should base its meaningful assessment and evaluation of funded projects on appropriate metrics, “keeping in mind the likely correlation between the effect of broader impacts and the resources provided to implement projects,” the NSB states. “If the size of the activity is limited, evaluation of that activity in isolation is not likely to be meaningful. Thus, assessing the effectiveness of these activities may best be done at a higher, more aggregated, level than the individual project.”
Perhaps what’s most interesting about the NSB’s three principles is the idea that the NSF should evaluate the success of Broader Impacts activities “in the aggregate,” instead of examining it on an individual project level. Still, the NSB contends that you should still be accountable for carrying out the Broader Impacts activities that you detailed in your proposal.

**What ‘Stakeholders’ Say about Merit Review**

The NSB Task Force on Merit Review contracted with SRI International to evaluate the interviews and surveys. SRI employed interviewing and web surveys to collect data from “stakeholder groups.” The more than 4,500 responding stakeholders included:

- PIs and university representatives;
- Panel reviewers and ad-hoc reviewers;
- NSF Advisory Committee members;
- NSF senior leadership (assistant directors and deputy assistant directors of NSF directorates, as well as directors and deputy directors of NSF offices); and
- NSF program officers, division directors and deputy division directors.

The interviews and web surveys asked stakeholder respondents seven key questions:

1. Are the two Merit Review criteria clearly explained?

2. How are the Merit Review criteria being interpreted by principal investigators, reviewers, NSF staff?

3. How are the two Merit Review criteria weighted by principal investigators, reviewers, NSF staff?

4. What are the strengths and weaknesses of the current criteria?
5. Have the criteria had an impact on the way principal investigators think about shaping their research projects?

6. What is the appropriate role of the principal investigator’s institution?

7. How can the outcomes of activities relevant to each criterion be assessed?

**NSB’s Conclusions: 5 Key Themes**

From the collected responses, the NSB Task Force identified five key “themes.” The Board’s recommendations to the NSF are based on these themes as well. The first theme is that the introduction of the Merit Review criteria to NSF’s grant process has impacted how scientists think about their research. The four additional themes include:

1. **Although the Intellectual Merit criterion is generally well-understood and clearly defined, the concepts of “transformative research” and “qualifications of the principal investigator” are not.** When it comes to the two Merit Review criteria, Intellectual Merit is by far the best understood, mainly because Intellectual Merit is scientific and technical in nature, according to the responses.

   What respondents expressed confusion over were the concepts of transformative research and the PI’s qualifications. “‘Transformative concepts’ is a poorly defined and vague term. If you ask 100 people what that means, you’ll get 100 different answers,” one respondent says.

   The same complaint came from not only the PIs and grant reviewers, but also the surveyed NSF officials and advisory committee members. “It is impossible to give a good definition of what is transformative, and certain groups of reviewers have latched onto the word as something to write on every proposal that they want funded,” one official commented. “Many times I’ve seen reviews that said that the proposal was transformative without any statement about what, exactly, this transformation was.”

   Another point of contention is the proposal-review criterion based on the PI’s qualifications. PIs and NSF officials alike found this review item somewhat unfair to newer investigators. One PI said: “In my opinion, the statement ‘How well qualified is the proposer to conduct the project…’ favors senior scientists with previous NSF
grants. For an early career scientist is more difficult to receive an NSF grant since she/he cannot be judged on prior work."

Program officers agreed, with one commenting: "Reviewers sometimes use the Intellectual Merit guidelines as an excuse for rewarding principal investigators based only on name recognition. There should be more emphasis on the internal consistency and work plan of a project, independent of prior accomplishments. Sometimes principal investigators with strong track records achieve very high ratings on poorly presented or conceived projects."

**Changes:** NSF should standardize the definitions and applications of “transformative research” and “qualifications of the PI.” Look for more detailed, clarified information in the Grant Proposal Guide (GPG) when NSF revises it.

2. The Broader Impacts criterion is a mystery to many PIs, reviewers and NSF officials. Although most respondents agreed that the Broader Impacts criterion’s goals were on-target, the NSF has not provided enough information for solid understanding of the criterion. Respondents did agree, however, that the major goal of the Broader Impacts criterion is to solidify a connection between the scientific research and society.

The NSB asked respondents to rank the different guidance in the GPG. Based on the responses, the NSB concluded that PIs, institutions, program officers and other NSF officials all appear to understand the Intellectual Merit criterion far better than the Broader Impacts criterion.

Respondents called for specific examples of Broader Impacts activities, including those that were successful or not successful, as well as guidance on financial commitments for these activities. Stakeholders complained that the NSF offered no guidance on how to budget for Broader Impacts activities.

As one respondent said, “The [Broader Impacts] guidance needs to be much more specific and should include discussion of how one might reasonably fulfill this requirement (independently, as part of a bigger effort? In collaboration with others?), whether or not the Broader Impacts has to be tied to the Intellectual Merit, how much of the award’s budget should go to the activity, whether or not the activity has to be novel?"

A grant reviewer wrote: “If Broader Impacts are going to be taken seriously, the principal investigator must
request funds and time to support these activities. Half a page at the end of a proposal describing broader impacts with no obvious source of funding is not credible.”

Another source of confusion that respondents expressed was the number and scope of the Broader Impacts activities that PIs should address in their proposals. Although the GPG gives you a bulleted list of possible activities, it does not state how many of these types of activities you must include in your proposal.

Interviewed and surveyed PIs told the NSB that they didn’t know whether they should treat the bullets like a checklist, particularly in light of the increasingly competitive funding landscape. “Guidance should make clear whether the items on the list should have 100% coverage or if a good proposal that does an excellent job of addressing one or two items on the list should be scored the same or higher than a proposal that treats it more like a grocery list,” one PI wrote.

“It likely would be helpful to highlight that while NSF expects at least one of the bullets to be considered in assessing Broader Impacts, in most cases there is not the expectation that the investigators take action in response to all of them,” an NSF official states.

**Changes:** NSF should beef up its guidance and information on Broader Impacts, including the types and amount of activities and the level of effort expected. Specifically, the NSF should provide:

- Specific examples of successful and non-successful Broader Impacts activities;

- Guidance on the financial commitment involved with these activities and how to present them in the grant proposal’s budget; and

- Clarify the number and scope of activities that NSF wants PIs to address in the proposal.

3. **Reviewers should weigh the Intellectual Merit criterion more than Broader Impacts during proposal review.** Most respondents said they assumed that the Intellectual Merit criterion weighed more in the review process than the Broader Impacts criterion, but that guidance was lacking in this respect.

Interestingly, responses on this point from reviewers differed from those of other stakeholders. Only 55 percent
of reviewers said that Intellectual Merit weighed more than Broader Impacts, as opposed to far higher percentages of PIs (68 percent) and NSF officials (85 percent on average). And 76 percent of reviewers said that they believed Intellectual Merit should weigh more than Broader Impacts, compared with lower percentages of PIs and NSF officials (69 percent) who said the same.

“These differences suggest that that there may be a disconnect between stakeholders who have responsibility for establishing policy (NSF Officials and Advisory Committee Members) and stakeholders who implement and respond to policy (reviewers and principal investigators),” the NSB states in its report.

**Changes**: NSF should issue improved guidance on how each criterion is weighed and used in the review process.

**4. Your institution should play a bigger role in supporting Broader Impacts activities.** Many respondents said that institutions need to provide more support for PIs’ Broader Impacts activities, and NSF officials in particular said they’d like to see institutions develop “support systems” for these activities.

“Colleges and universities can create a framework that allows principal investigators to hook into so that their burden is lessened. If each principal investigator has to think up afresh what to do and how to do it, I think its lost effort,” one NSF official said. Another official commented that institutions should “create a central point on campus for thinking about Broader Impacts.”

Numerous NSF officials and advisory committee members commented that NSF should reward proposals that demonstrate institutional support through a letter or documentation, to encourage PIs’ institutions in supporting Broader Impacts activities. For example, officials suggested that NSF should ask institutions to show, through a letter of support or similar documentation, commitments in supporting the PI in achieving the Broader Impacts goals and activities.

NSF can also help institutions to publicize their existing programs and resources that they use to support Broader Impacts activities, respondents said. In some cases, institutions already have programs in place and don’t need to come up with new programs to support activities, they added.

About half of the comments from interviewed PIs and reviewers indicated that institutions should “consolidate
Broader Impacts activities on campus through information dissemination, Broader Impacts offices, expert staff and institution-wide programs," according to the NSB.

**Changes:** NSF will enable and encourage institutional support for PIs’ Broader Impacts activities.

5. **NSF’s post-award assessment of Broader Impacts activities is weak.** Although respondents did not believe that NSF needed to bolster assessment for Intellectual Merit, many respondents – particularly NSF officials and reviewers – indicated that the assessment of Broader Impacts needs improvement.

**Changes:** NSF should improve its post-award assessment of Broader Impacts activities. Specifically, NSF officials and advisory committee members suggested that NSF should:

- Revise the reporting procedures in that the annual report submission format should become a computer-readable format for easier assessment;

- Allow for reporting for many years beyond the award termination date; and

- Include a specific Broader Impacts section in the annual and final reporting process.

**Get Ready for These Revisions**

When the NSF digests the NSB’s report, you’re going to see a whole host of changes to the proposal, award and post-award processes. Thankfully, you should experience a more standardized – and thus, fairer – review process as a result of these changes. Based on the NSB’s recommendations, NSF reviewers will evaluate Intellectual Merit as “the potential to advance knowledge,” and Broader Impacts as “the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.”

When evaluating both Merit Review criteria, NSF reviewers will consider whether your proposed research project:

1. Advances knowledge and understanding within its own field or across different fields;
2. Benefits society or advances desired societal outcomes;

3. Suggests and explores creative, original or potentially transformative concepts;

4. Has a well-reasoned, well-organized plan for carrying out the proposed activities, based on sound rationale; and

5. Incorporates in its plan a mechanism to assess success.

Also, the NSB continues to support the review items of:

- How well-qualified is the PI, team or institution to conduct the proposed activities?

- Are there adequate resources available to the PI, either at the home institution or through collaborations, to carry out the proposed activities?

The NSB Task Force has now tasked NSF with developing an implementation plan for evaluating the two Merit Review Criteria to provide more clarity and consistency when reviewing and deciding upon grant proposals. Specifically, in its plan NSF should require that you:

- Treat both Merit Review criteria as important;

- Include a separate section in the Project Description describing the proposed activities’ Broader Impacts;

- Describe your accomplishments relating to both Merit Review criteria in separate sections contained in the “Results of Prior Support” (renewal proposals); and

- Describe how the project addresses both criteria in all public award abstracts.

Also, keep your eyes peeled for the NSF to issue:
• Decision documents that now include descriptions of how your project addresses both Merit Review criteria;

• New annual and final project report templates that include spaces to address progress specific to all project activities, including Broader Impacts activities that are not directly related to the research;

• New guidance on the review criteria’s elements and intent;

• Enforcement of the requirement that your public award abstract describe how the project addresses both Merit Review criteria;

• FAQs for both review criteria, specifically addressing the most commonly misunderstood areas, using consistency across agency units;

• New methods for encouraging institutional support of Broader Impacts activities, such as helping institutions to develop programs to leverage assets and utilize cooperative opportunities; and

• Procedures that will draw more scrutiny on your post-award assessment, specifically for achieving the Broader Impacts activities.

In the last bullet, the NSB is recommending that NSF should increase accountability for carrying out Broader Impacts activities. In fact, the NSB states in its report that “assessing the effectiveness and impact of outcomes of these activities one project at a time may not be meaningful, particularly if the size of the activity is limited. Thus, assessing the effectiveness of activities designed to advance broader societal goals may be best done at a higher, more aggregated, level than the individual project.”

Instead, NSF should focus its assessments on larger, campus-wide activities or aggregated activities of multiple PIs. The NSB also recommends that you shouldn’t need to include evaluation costs in your project budget, but instead NSF “should provide guidance on when project-level assessment would be appropriate, what broader impacts data are important for future assessment purposes, and when assessment at a program or institutional level would be more reasonable.”
The Bottom Line

Despite the promises of increased scrutiny of your project's ability to satisfy the Merit Review criteria, the NSB's report will likely yield many positive changes for PIs and NSF officials alike. More consistency and transparency with how reviewers weigh, review and ultimately rank the criteria, as well as how you'll need to address the criteria in your proposal, will greatly improve the grant process.

Remember: Pay close attention to changes in the GPG and any new mandates for how you craft your grant proposal materials, as well as your annual and final reports.

NIH Short Form: Answers to 16 Frequently Asked Questions

When NIH instituted the new short form grant application in January 2010, the agency provided little guidance regarding how to tackle the various sections of this instrument. Nonetheless, Principal Investigators have to use the form to obtain funding from the agency.

Listed inside this complimentary white paper are 16 frequently asked questions directly from PIs just like you. And the answers have been provided by grant-winning experts with advice they have gleaned from years in the award-seeking trenches and serving as NIH reviewers!

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