Broader Impacts 2.0: Seeing—and Seizing—the Opportunity

ROBERT FRODEMAN, J. BRITT HOLBROOK, PATRICIA S. BOUREXIS, SUSAN B. COOK, LAURA DIEDERICK, AND RICHARD A. TANKERSLEY

Since its implementation in 1997, the National Science Foundation's (NSF) Merit Review Broader Impacts Criterion has often been viewed by scientists and engineers as a distraction. The real work of science was captured by outlining a project's intellectual merit; *broader impacts* meant an additional burden in the lives of increasingly harried researchers. Over the years, some members of the scientific community have even argued for its elimination from the merit review process.

Nonetheless, the Broader Impacts Criterion has survived. Congress included a requirement for the NSF to attend to the broader impact of its sponsored research in the America COMPETES Reauthorization Act of 2010, and with the December 2011 revision of the Merit Review Criteria by the National Science Board (NSB) and the subsequent release of the NSF's new Proposal and Award Policies and Procedures Guide in October 2012, the status of the Broader Impacts Criterion within the Merit Review process has increased significantly. The NSF's revisions more explicitly integrate the Broader Impacts and Intellectual Merit Criteria, require a separate Broader Impacts section in grant proposals, and mandate a detailed account and assessment of a project's broader impacts in grantee reports. More important, the revisions raise the bar on how broader impacts are evaluated by applying the same five review elements now used to assess intellectual merit. Rather than going away—as some scientists had hoped it would—a new, more prominent Broader Impacts Criterion is emerging. Say goodbye to Criterion 2, and say hello to Broader Impacts 2.0.

Active promotion

Now is the time to reframe our debate over broader impacts. Broader Impacts 2.0 should be viewed as an opportunity for us to apply the creativity that we exercise with intellectual merit to identifying and articulating how the results of our research have the potential to benefit society and to contribute to the achievement of a growing list of desired societal outcomes. Broader Impacts 2.0 exhorts us to go beyond our traditional notions of supporting graduate students or disseminating project results through publicly available Web pages to actively promoting the contributions of our scientific knowledge to policy, our economy, our culture, and pressing societal needs.

For individual scientists and groups of collaborators, the new criterion is a spur to innovation, as well as a challenge. Since intellectual merit and broader impacts are now cast as integrated and interdependent criteria within the NSF's review process, there is some expectation that scientists and stakeholders are both engaged in the research enterprise and mutually benefit from it. Consider, for example, the success of a recent project spearheaded by Stephen Box of the Smithsonian Institution that was aimed at working with local indigenous and government leaders in Honduras to establish a sustainable fishery for the residents of the Moskitia Coast. In response to an imminent ban on the scuba-diving lobster fishery in La Moskitia that threatens an already struggling local economy, Box and his team used spatial ecology and bathymetry data to identify the optimal boundaries for a proposed 1.45-million-hectare shallow-water marine preserve that will be open to harvest by only local, artisanal fishermen. By using sound science to inform policy and by engaging those directly affected, Box and his colleagues will help ensure a safe and sustainable way of life for the nearly 3000 Honduran fishermen.

A role for institutions

Universities, professional societies, and other institutions that support research have a golden opportunity to embrace Broader Impacts 2.0 by supporting efforts that require a community-wide response. Take, for example, the recent work of the American Society of Human Genetics (ASHG) to engage its membership in a concerted effort to improve public understanding of science, particularly the role that genetics plays in society, human health, and the environment. The ASHG chose the strategy of improving secondary-school genetics education. Since 2007, the ASHG has adopted a policy statement on the importance of the direct participation of scientists in K–12 science education; leveraged its policy position through its annual meetings, publications, and national events; and—with NSF support—established over 70 geneticist–teacher partnerships developing high school lessons that address common misconceptions in genetics. The ASHG's work has had an impact, not only on how genetics is taught in K–12 schools but also on geneticists' commitment to quality K–12 education and how they target student misconceptions in their own university teaching.

The NSB's integration of intellectual merit and broader impacts means seeing the connections between knowledge production and society at large. In the twenty-first century, even basic

research must take place in the context of the needs of the users of that knowledge. However, most academic preparation does not include training in making these connections, and scientists who have not been encouraged to consider how their research may contribute to the realization of desired societal outcomes should not be expected to automatically comprehend how to address Broader Impacts 2.0. Once again, professional societies, universities, and other research institutions have an opportunity—perhaps an obligation—to foster and promote professional development programs that help scientists conceptualize their research work and articulate its relevance and potential societal benefits to a range of stakeholders. Fortunately, successful models for such training already exist, including the NSF's Becoming the Messenger Program and communication workshops developed by the Aldo Leopold Leadership Program, the Communication Partnership for Science and the Sea, and the Center for Ocean Science Education Excellence–Florida.

Finally, Broader Impacts 2.0 is an opportunity for the scientific community to make its case to those who actually fund our research. The NSF is under increasing pressure to substantiate that its $7 billion research portfolio serves the nation's needs and long-term interests. Pressing this argument is especially important, given the funding climate that the NSF—and the entire scientific and engineering community—is likely to face in the coming years.

The bottom line is that the NSB and Congress have presented us with merit review criteria that challenge us to undertake research that marries scientific merit and broader impacts in a way that benefits the research community, our funding sources, and our society. This represents an opportunity that we should seize, not a burden we must bear.

Robert Frodeman and J. Britt Holbrook direct the Center for the Study of Interdisciplinarity, at the University of North Texas, in Denton. Patricia S. Bourexis is affiliated with The Study Group, in Kill Devil Hills, North Carolina. Susan B. Cook is affiliated with the Center for Ocean Sciences Education Excellence–Florida, at Indian River State College, in Fort Pierce, Florida. Laura Diederick is affiliated with the Smithsonian Marine Station, in Fort Pierce, Florida. Richard A. Tankersley (rtankers@fit.edu) is affiliated with the Department of Biological Sciences, at the Florida Institute of Technology, in Melbourne. Please address correspondence to RAT.

doi:10.1525/bio.2013.63.3.2