NSF Support for Potentially Transformative and Interdisciplinary Research

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Ask Early, Ask Often!

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“Take-home” message - PTR

- Proposals for potentially transformative research (PTR) are encouraged in all NSF programs.
- NSF reviewers and program staff are all expected to help identify PTR proposals.
- NSF can, and will, support risky proposals that have the potential for transformative research.
- Contact your Program Officer

What is Transformative Research?

Transformative research can be hard to define.

NSF's current working definition:

Transformative research involves ideas, discoveries, or tools that radically change our understanding of an important existing scientific or engineering concept or educational practice or leads to the creation of a new paradigm or field of science, engineering, or education. Such research challenges current understanding or provides pathways to new frontiers.

Transformative Research Working Definition (Cont.)

Transformative research results often do not fit within established models or theories and may initially be unexpected or difficult to interpret; their transformative nature and utility might not be recognized until years later.

Possible characteristics of transformative research:

- may challenge conventional wisdom;
- could lead to unexpected insights that enable new techniques or methodologies;
- might redefine boundaries of science, technology, engineering, education

What might Constitute Potentially Transformative Research?

- Note that the definition does not restrict PTR to only those truly paradigm-changing breakthroughs often mentioned in this context (relativity, plate tectonics, etc.). Some examples:
  - Using magnetic resonance imaging to monitor brain function, which greatly expanded the limits of behavioral research
  - Using polar ice sheets as neutrino detectors, originally tested in Greenland through an NSF SGER award
  - Research into large-scale, hypertext web searches that eventually led to current state-of-the-art search engines.
- Further illustrative examples will be available on the NSF web pages, along with a list of FAQs

Challenges and Expectations for NSF funding of PTR

- Many exciting projects cannot be funded with the low NSF success rate: proposals are not rejected *because* they are PTR but because they were not competitive amongst proposals received
- High risk research may, of course, fail: the amount of risk acceptable to a given program can vary widely
- Judgment of high risk/high return versus high risk/low return
- Not all PTR is risky: some is serendipitous
- Risky PTR proposals compete with excellent proposals for fundamental research that is guaranteed to advance a field (low risk, high return)

Challenges and Expectations for NSF funding of PTR (cont.)

- Perceptual disconnect: surveys show PIs consistently consider their work to be PTR, but when reviewing they find few PTR proposals;
- Although PTR can be hard to identify, reviewers and the community are increasingly aware of, and sensitive to, this need;
- Proposals are not automatically more worthwhile just because they are for PTR;
- Need to maintain a balanced portfolio which includes fundamental productive research and a managed amount of PTR, risky and otherwise.

Possible NSF Mechanisms which can be used to support PTR

- Some funding opportunities will mention this specifically;
- Some proposals identified by the merit review as PTR can be supported by special arrangement, perhaps after negotiation between the PO and the PI to adjust the project scope;
- RAPID and EAGER;
- Creativity extensions or accomplishment based renewals;
- There are very different approaches and preferences in different directorates, offices, and divisions;
- Contact your Program Officer (or did we already say that?).

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“Take-home” message - IDR

- Disciplines are continually emerging, melding, and reinventing themselves.
- NSF can play a key role in stimulating and supporting cutting-edge interdisciplinary research (IDR) discoveries.
- NSF will foster a culture that welcomes and actively enables support for promising IDR.

What is Interdisciplinary Research?

NSF follows the National Academies' definition…

Interdisciplinary Research (IDR) is a mode of research by teams or individuals that integrates information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines or bodies of specialized knowledge to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline or area of research practice.

Committee on Facilitating Interdisciplinary Research; Committee on Science, Engineering, and Public Policy (2004). *Facilitating interdisciplinary research.* National Academies. Washington: National Academy Press, page 2.

Possible NSF Mechanisms which can be used to support IDR

- NSF has a number of programs that are explicitly interdisciplinary and receive IDR proposals.
- Unsolicited proposals may also be interdisciplinary and not clearly fit within a single program.
- There are very different approaches and preferences in different directorates, offices, and divisions;
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