Why Should Undergraduates and Undergraduate Institutions be Involved in Transformative Research?

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Research at Predominantly Undergraduate Institutions (PUIs) versus Undergraduate Research
Purpose of Doing Research at a PUI?

- Discovery of new knowledge – CUR’s roots

- Education of undergraduates – of course, but not to the exclusion of the discovery of new knowledge
UNDERGRADUATE RESEARCH is an inquiry or investigation conducted by an undergraduate that makes an original intellectual or creative contribution to the discipline

- Original
  - High level of proof
  - Better learning experience

- Contribution to the discipline
  - Publications in peer-reviewed journals
TRANSFORMATIVE RESEARCH is defined as research driven by ideas that has the potential to radially change our understanding of an important existing scientific or engineering concept or leading to the creation of a new paradigm or field of science or engineering. Such research also is characterized by its challenge to current understanding or its pathway to new frontiers.
TRANSFORMATIVE RESEARCH has the capacity to revolutionize existing fields, create new subfields, cause paradigm shifts, support discovery, and lead to radically new technologies.
Should we encourage faculty members at PUls to participate in transformative research?

- How could anyone answer no to this question?
- Everyone – the institution, faculty, students, society – benefits from participation in transformative research
Is it possible to conduct transformative research at a PUI?

- Substantial barriers do exist
  - Lack of infrastructure
  - High teaching load
  - Inexperience of undergraduates

- Substantial opportunities exist as well
  - Not driven by productivity expectations – can try high-risk, high-gain project
Key Factors to Undertaking Transformative Research

- Transformative problems and transformative ideas for solving them
  - Not easy to generate ideas at PUIs – isolated

- Serendipity
  - More difficult – smaller groups, fewer projects, inexperienced investigators

- Collaboration
  - Not a limitation but takes initiative
Promoting Transformative Research at PUIs?

- Institutions and departments that expect faculty to be research-productive (peer-reviewed publications)
- Faculty members who strive to be research-productive
- Support to help faculty generate ideas
- Environment that promotes collaborations
Should faculty members at PUIs be concerned about inclusion of TR in NSF review guidelines?

- Depends – on how reviewers and program officers respond to this
- NSB report specifically notes that science progresses in two fundamental and equally valuable ways
  - Vast majority occurs incrementally
  - Revolutionary work occurs less frequently
Essential that we recognize that not all work needs to be transformative to be judged worthy of doing and worthy of funding.

Essential that we maintain exceptionally high standards for what we consider transformative research.

Transformative research singled out in NSB report because high-risk, high-gain work does not necessarily fare that well through the review process.
On the NSF proposals you’ve reviewed during the past three years, what percentage have constituted transformative research (TR)?

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<tr>
<th>Percentage Range</th>
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<tr>
<td>Less than 10 %</td>
<td>61.5%</td>
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<td>10-25%</td>
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<td>26-50%</td>
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<td>51-75%</td>
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<td>76-100%</td>
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<td>Not sure what TR is</td>
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In the past three years, what percentage of the research proposals that you submitted to NSF constituted TR?

- Less than 10%: 24.2%
- 10-25%: 14.5%
- 26-50%: 15.6%
- 51-75%: 13.0%
- 76-100%: 22.0%
- Not sure what TR is: 10.7%
Will PIs “spin” their work to sell it as transformative?

- If so, I suspect that reviewers will see through it – could work against the proposal writer
- As a faculty member at a PUI, I do not feel threatened by the inclusion of the words “potentially transformative research” into the intellectual merit review criteria
Should the phrase “potentially transformative” be included in an assessment of the broader impacts?

- Participation in research is transformative for many undergraduates, but ...
- A research grant from NSF does not ask us to document and assess whether participation in the research was transformative for the participants – and I don’t think we want to go down that path
Implicit assumptions with a research grant (that I like)

- Undergraduates benefit by participating in original research
- Better if undergraduates work on high-quality research
- The best of which is potentially transformative