

# **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?

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- 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 radically 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 PUIs 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?

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- 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?

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- 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

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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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■ Less than 10 %	61.5%
■ 10-25%	23.1%
■ 26-50%	6.1%
■ 51-75%	2.2%
■ 76-100%	1.1%
■ Not sure what TR is	6.0%

## **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?

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- 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)

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