External Grant Support for Instruction and Research in STEM Disciplines

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Programs

- National Science Foundation
  - Transforming Undergraduate Education in STEM (TUES)
  - Research at Undergraduate Institutions (RUI)
  - Major Research Instrumentation (MRI)
  - Research Experiences for Undergraduates (REU)
  - CAREER Program
- National Institutes of Health
  - Academic Research Enhancement Award (AREA)
- Institutional – HHMI
- Others you want me to talk about (Research Corporation/Petroleum Research Fund)?

Review Criteria (NSF)

- Intellectual Merit
- Broader Impact

- Project summary must have a distinct paragraph on each – proposal must clearly address each
- Reviewers must specifically evaluate each (separate sections on reviewer's form)

Components of all NSF Proposals

- Project Summary (1 page)
- Project Description (15 pages)
- Literature References
- Biographical Sketch (2 pages)
- Budget and Justification
- Current and Pending Support
- Facilities and Equipment

Project Description (15 pages)

- Results of Prior NSF Support (up to 5 pages)

  -One NSF grant within the past 5 years

  -If directly related to new project – put first in proposal and use most, if not all, of the 5 pages

  - If unrelated to the new project – put last and keep as short as possible – show productivity (money well spent!)
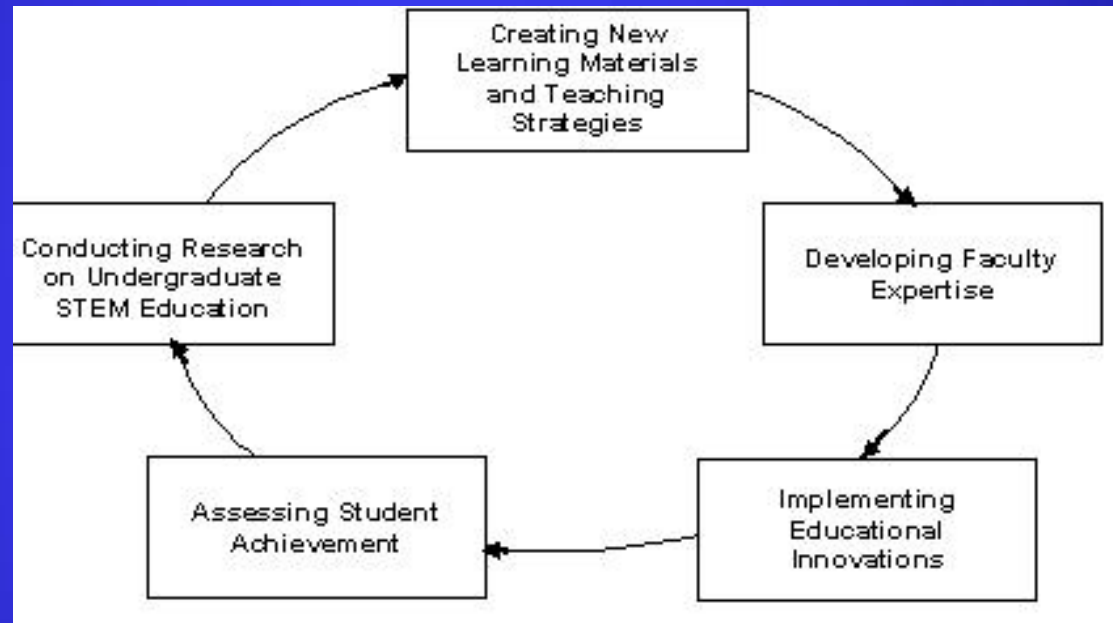
TUES Program

- Type 1 ($200K) - $250K if have significant involvement of a community college

- Type 2 ($600K) – must be multi-institutional

- Type 3 ($????) – national project

What does Transforming Mean?

- Developing a way to teach in your discipline that no one ever thought of before?

- Transforming the way you teach your courses?

Cycle of Learning

- Five steps:

- Phase 1 projects typically will address one program component and involve a limited number of students and faculty members at one academic institution.

Type 1 – What can you ask for?

- Instructional equipment
- Summer salary for laboratory/material development
  - Usually 1 month (2 months – must justify)
- Travel
  - To observe other methods
  - To disseminate results
- Consultant(s)
- Assessment

High Quality Learning Experience

- Must be new – can't just be replacing equipment to continue what is already being done

- Curriculum needs to move in a new and improved direction

- Inquiry/discovery-based experiences

Base on Prior Work

- NSF reports
- Other NSF-funded projects
- Other educational/scientific reports
- Other publications that inspire/guide your plans
- Pilot work you have already done

- Thorough literature review/references

Provide Specific Examples
of Discovery-Based Activities

- Sprinkling the words "discovery-based" throughout is not enough

- Do not provide example experiments that are cookbook

- If sample experiment is too long to include, put up on a web site and put URL in text of proposal

- Best if can provide specific examples for each course involved in proposal

NSF Research Grants (RUI/MRI/REU/Career)

- Culture of different divisions at NSF

- Interdisciplinary projects can provide opportunities as well as challenges

Definition of Undergraduate Research

Undergraduate research is an inquiry or investigation conducted by an undergraduate that makes an original intellectual or creative contribution to the discipline

-Original work

-Peer-reviewed publications

Components of an RUI Proposal (Renewable)

- Project Summary (1 page)
- Project Description (15 pages)
- Literature References
- Biographical Sketch (2 pages)
- Budget and Justification
- Current and Pending Support
- Facilities and Equipment
- RUI Impact Statement (5 pages)

You must convince reviewers that:

(1) the work is significant – why the work you want to do is important and needs to be done

(2) that you have a well designed experimental plan that is likely to succeed

- You can mention aspects of the broader impacts throughout, but remember that there is an RUI impact statement. Make sure that discussions of the impact do not diminish or distract from developing the scientific research in the proposal

RUI Impact Statement

- A chance to promote your activities
  - Institutional
  - Departmental
  - Individual
- Importance of research to all three
- Success stories within all three
- The approach taken by any or all three to provide students with a better educational experience

Major Research Instrumentation(MRI)

- Funds allocated specifically for PUIs
- No match
- $50 - 500K (or even larger)
- Usually multi-user (especially if larger pieces of equipment)
- Research-based request
- No RUI impact statement

- Original research with expected outcomes
  - Publications/presentations
- External research support
  - Important to have or at least pursue
- Thorough descriptions with appropriate references
- Need research-active users – be very careful about including senior people as co-PIs with no/weak research records

- PUIs requesting replacement NMR spectrometer
  - But had high-field instrument for a dozen or more years and no or minimal research productivity to show for it

- Request for too high-end an instrument
  - Need existing research to justify the request – not enough to say that the extra capabilities might be needed in the future

- Show that traveling to another site to use the equipment being requested

- Contrast data from current capabilities with new request to show how new instrument is needed to provide the appropriate information

- Mention use in courses (1-2 pages) – but do not give impression that request is mostly based on curricular uses

Maintenance Plan

- Reviewers must be convinced that the instrument will be well maintained – that the department has the ability to integrate the instrument into its holdings
- Where housed?
- Service contract (?)
- Support staff for maintenance and operation

REU Site Program (Renewable)

- A research program – not curriculum
  - 8-12 students for summer research
  - Publications/external funding – not much room for research descriptions so biographical information and current/pending support crucial
  - Not enough to just involve students in the work
  - Need high quality mentors with strong programs
- Provides added value to research program that is already strong (although may be NSF division-dependent)

Follow-through on Research

- If there is a way to continue the work beyond the summer – will strengthen the request
  - Faculty participants from other institutions
  - Students continue collaboration (may be easier at PUI since half of participants can be from the home campus)

Theme?

- Divisions may have different views on this – especially for PUIs

- Needs to be authentic – should build on existing expertise and not an "invented" theme

- Needs to lead to publication – in chemistry, measuring pollutants in a nearby stream likely won't be enough

Student Participants

- PUIs – usually half on-campus, half students from other institutions

- Describe selection process/criteria

- Desire to serve students who would not otherwise have a chance to participate in research

- Desire to serve underrepresented minorities
  - Can't just say that will have 50% of participants from minority groups without showing established links – perfunctory letters of support are not enough

Professional Development

- Group of students must interact and not simply be dispersed into individual labs
- Orientation
- Meetings/presentations/workshops
- Closing poster session
- Social activities over summer
- Reunion at professional meeting

NSF CAREER Program

- Early faculty (assistant professor without tenure)

- Five-year award ($400K-500K minimum)

- Supports research and educational activities
  - Probably originated to get faculty from R1s to think about education too – but open to PUI faculty as well

- Best if the research and educational activities are integrated – don't invent "artificial" outreach programs

NIH AREA PROGRAM (R15) (Renewable)

- $300K direct support (1-3 years)
- Match with institute or center within NIH
- Can only submit the same project twice – directly respond to reviewer's criticisms in a resubmission
- Meritorious research
  - Significant novel question or hypothesis
  - Significant impact

Review Criteria

- Significance – quality of research
- Approach – experimental method
- Innovation – novelty of work
- Investigator – expertise/record in field
- Environment – infrastructure to support work

Components of Proposal

- Specific Aims (1 page)

- Research Strategy (12 pages)

Research Strategy (12 pages)

- Significance
- Innovation
- Approach – divide by each specific aim
  - Introductory paragraph
  - Justification and feasibility
    - Review relevant literature
    - Preliminary studies
  - Research design
  - Expected outcomes
  - Potential problems/Alternative strategies
- Timetable
- Future Directions

Renewal Applications

- Plan for renewal immediately upon receipt of grant

- Fix renewal submission date in your head

- Start short-term projects

- Start long-term projects

Institutional Grants (HHMI)

- Increasingly value interdisciplinary curricular and research activities – communication and collaboration – think as a division
- Involvement of underrepresented groups
- Innovation/effective practices
- Research outcomes
- A vibrant faculty
- Elements of coherence (no pork barrel)
- Name names! Project buy in!

Research Corporation

- Chemistry/physics-related projects (some biologists, etc. can apply)
- Cottrell College Science Program (Single PI)
  - Only eligible in first three years
  - $35K plus $10K institution match
  - Preliminary letter due 9/15 – proposal on 11/15
- Cottrell College Science Program (Multi PI)
  - Must be two departments – one or two in first six years, other one can be senior

Petroleum Research Fund (PRF)

- P is for Petroleum – but broadly defined – chemists and geologists usually apply

- Undergraduate New Investigator (UNI) - first 3 years ($50K/2 years)

- Undergraduate Research (UR) - established investigator ($65K/3 years)

Activities to Promote Proposal Writing

- **Attend CUR Conferences**
  - National Conference (even years)
  - ***Dialogue (every year)

- **Attend CUR Institutes**
  - Proposal-writing institute
  - How to institutionalize undergraduate research