Discussion of critical elements of competitive NSF grant proposals submitted to the Division of Undergraduate Education (DUE)

199th Conference of the Two-Year College Chemistry Consortium
Arizona Western College, Yuma, AZ – November 10, 2012

David R. Brown, Program Director
Division of Undergraduate Education
National Science Foundation
A strong proposal starts with a good idea... and generates a convincing argument.

Important considerations:

- Be passionate about your idea for a project.
- Choose an appropriate program to fit the idea.
- Read the Program Solicitation thoroughly.
- Utilize resources from NSF and others.
What constitutes a good project?

- It’s innovative (has potential impact on STEM education).
- It’s realistic (has reasonable scope for budget and resources).
- It’s worthwhile (contributes to the STEM community).
- It’s well-planned (sound goals, objectives, outcomes & evaluation).
Navigating to the EHR Directorate

Research Areas
- Biological Sciences
- Computer & Information Science & Engineering
- Cyberinfrastructure
- Education and Human Resources
- Engineering
- Environmental Research & Education
- Geosciences
- Integrative Activities
- International Science & Engineering
- Mathematical & Physical Sciences
- Polar Programs
- Social, Behavioral & Economic Sciences

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National Science Foundation
Division of Undergraduate Education (DUE)
Onward to the Division of Undergraduate Education
DUE Mission: *To promote excellence in undergraduate science, technology, engineering and mathematics (STEM) education for all students.*
Programs and Funding Opportunities

**Key:** 🟫 Crosscutting | 🟣 NSF-wide

**Advanced Technological Education (ATE)**

**Cooperative Activity with Department of Energy Programs for Education and Human Resource Development (Request for Supplement)** 🟫

**CyberCorps: Scholarship for Service (SFS)**

**Math and Science Partnership (MSP)**

**Nanotechnology Undergraduate Education (NUE) in Engineering**

**National STEM Education Distributed Learning (NSDL)**

**NSF Director's Award for Distinguished Teaching Scholars (DTS)**

**NSF Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM)**

**Presidential Awards for Excellence in Science, Mathematics and Engineering Mentoring**

**Robert Noyce Teacher Scholarship Program**

**Science, Technology, Engineering, and Mathematics Talent Expansion Program (STEP)**

**Science, Technology, Engineering, and Mathematics Talent Expansion Program Centers (STEP Centers)** 🟣

**Secure and Trustworthy Cyberspace (SaTC)**

**Transforming Undergraduate Education in Science, Technology, Engineering and Mathematics (TUES)**

**Featured NSF-wide Programs**

**View All NSF-wide Programs**

**NSF Educational Opportunities by Audience**

**For Undergraduate Students**
Where are details of the TUES Program Found?

What has the TUES Program Funded?

Useful for exploring your own ideas.
Transforming Undergraduate Education in Science, Technology, Engineering and Mathematics (TUES) Course, Curriculum, and Laboratory Improvement (CCLI)

PROGRAM SOLICITATION
NSF 10-544

REPLACES DOCUMENT(S):
NSF 09-529

National Science Foundation
Directorate for Education & Human Resources
Division of Undergraduate Education
<table>
<thead>
<tr>
<th>Award Number</th>
<th>Title</th>
<th>NSF Organization</th>
<th>Program(s)</th>
<th>Start Date</th>
<th>Principal Investigator</th>
<th>State</th>
<th>Organization</th>
<th>Awarded Amount to Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>123217</td>
<td>Development of a Case-Study Based Introductory Undergraduate Course</td>
<td>DUE</td>
<td>COLL-Type 1 (Exploratory), S-STEM:SOHLR SCI TECH ENGMATH</td>
<td>06/01/2012</td>
<td>Burko, Lior</td>
<td>AL</td>
<td>Alabama A&amp;M University</td>
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<td>124256</td>
<td>CPELL-Type 2 (Expansion), S-STEM:SOHLR SCI TECH ENGMATH</td>
<td>DUE</td>
<td>Collabative Research, Developing a tool for</td>
<td>08/15/2012</td>
<td>Sayre, Eleanor</td>
<td>KS</td>
<td>Kansas State University</td>
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<td>135576</td>
<td>CPELL-Type 1 (Exploratory), S-STEM:SOHLR SCI TECH ENGMATH</td>
<td>DUE</td>
<td>Developing a tool for teachers to assess</td>
<td>12/01/2011</td>
<td>Moore, John</td>
<td>WI</td>
<td>University of Wisconsin-Madison</td>
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<td>134265</td>
<td>CPELL-Type 1 (Exploratory), S-STEM:SOHLR SCI TECH ENGMATH</td>
<td>DUE</td>
<td>Authoring tools for a hands-on, on-line, lab</td>
<td>04/01/2011</td>
<td>Sidhe, Erna</td>
<td>MA</td>
<td>Five Colleges Inc</td>
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<td>102299</td>
<td>CPELL-Type 2 (Expansion), S-STEM:SOHLR SCI TECH ENGMATH</td>
<td>DUE</td>
<td>Engineering Cultures: Expanding Global</td>
<td>12/15/2010</td>
<td>Downey, Gary</td>
<td>VA</td>
<td>Virginia Polytechnic Institute and State University</td>
<td>$167,929.00</td>
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<td>1035112</td>
<td>CPELL-Type 2 (Expansion), S-STEM:SOHLR SCI TECH ENGMATH</td>
<td>DUE</td>
<td>Exploring Studio-Based Learning in Chemical</td>
<td>12/15/2010</td>
<td>Zollars, Richard</td>
<td>WA</td>
<td>Washington State University</td>
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<td>1021442</td>
<td>CPELL-Type 2 (Expansion), S-STEM:SOHLR SCI TECH ENGMATH</td>
<td>DUE</td>
<td>Extending SERAPH Demographically and Geographically to Test its Effectiveness in Diverse Populations of Learners at 2 Year and 4 Year Institutions</td>
<td>12/01/2010</td>
<td>Hoskins, Sally</td>
<td>NY</td>
<td>CUNY City College</td>
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<td>0942570</td>
<td>CPELL-Type 1 (Exploratory), S-STEM:SOHLR SCI TECH ENGMATH</td>
<td>DUE</td>
<td>Development of Self-Instructional Course in</td>
<td>12/01/2010</td>
<td>Arnold, Thomas</td>
<td>PA</td>
<td>Dickinson College</td>
<td>$199,900.00</td>
</tr>
</tbody>
</table>
Award Abstract #9942578

Development of an Interdisciplinary Course, Chemical Analysis in Chemical Ecology

NSF Org: DUE Division of Undergraduate Education
Initial Amendment Date: July 30, 2010
Latest Amendment Date: July 30, 2010
Award Numbers: 9942570
Award Instruments: Standard Grant
Program Manager: Pamela Brown, DUE Division of Undergraduate Education
EHR Directorate for Education & Human Resources
Start Dates: December 1, 2010
Expenses: November 30, 2010 (Estimated)
Awarded Amount to Date: $199,999

Investigator(s): Thomas Arnold, tarnold@dickinson.edu (Principal Investigator)
Amy Winter (Co-Principal Investigator)

Sponsor: Dickinson College
B.O. Box 1773
Carlisle, PA 17013

ABSTRACT

Intellectual merit

Global warming, Overpopulation, Renewable energy, National security, Access to clean water, Targeted therapeutics. The grand global challenges facing the 21st century world are complex and necessitate the creation of new educational models for training undergraduate scientists. To better prepare students to meet these challenges requires educators to radically re-think and restructure the way students experience the process of science in the laboratory. Current models no longer serve students well because they ignore fundamental realities of how science is conducted beyond the campus walls; in collaborative research teams comprised of scientists who bring multiple fields of expertise to the issues at hand. Student learning should no longer be artificially compartmentalized within disciplinary boundaries without providing students an opportunity to experience a more authentic model of the process of science early in their educational careers. To address this need, an upper-level interdisciplinary laboratory course entitled "Chemical Analysis in Chemical Ecology" is being created. The course is taught by an analytical chemist from the Chemistry Department and a chemical ecologist from the Biology Department. The course enrolls 24 students per semester (12 registered through the chemistry department and 12 through the biology department) who work together in research teams of six students (3 biologists/3 chemists) each. The teams learn a set of common analytical techniques to investigate four current research questions in chemical ecology, culminating in the application of this knowledge to an original research question utilizing these techniques.

Broader impact

A guiding principle in the development of the course is the recognition that undergraduate scientists need authentic research experience early in their undergraduate careers to help develop the critical-thinking skills needed to solve the world’s most pressing problems. Furthermore, the course is expected to: 1) generate excitement for science and its relevance in students’ lives; 2) provide students with realistic research experiences involving collaborative team-based problem solving approaches; 3) help students to develop confidence in the hands-on use of state-of-the-art HPLC instrumentation; 4) provide opportunities to cross disciplinary boundaries in seeking more complete answers to scientific questions; and 5) provide opportunities for students to clearly communicate their results to diverse audiences. The outcomes of this interdisciplinary course will be presented at two conferences. One, the annual meeting of the International Society for Chemical Ecology (ISCE), will introduce scientists in the field of chemical ecology to these efforts. The second, the Biennial Conference on Chemical Education, will disseminate the results to chemists familiar with new initiatives in undergraduate education.
Elements of an NSF DUE Grant Proposal

- Cover Sheet
- Certification Page
- Project Data Form
- Project Summary (Intellectual Merit and Broader Impacts)
- Table of Contents
- Proposal Narrative (Introduction, Management Plan, Purpose or Goals, Rationale, Objectives and Activities, Evaluation, Dissemination)
- References
- Biographical Sketches
- Budget and Budget Justification
- Current and Pending Support
- Facilities, Equipment, and Other Resources
- Supplemental Documentation, such as Letters of Support
NSF Provides Proposal Preparation Help

Research Areas
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- Integrative Activities
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National Science Foundation
Division of Undergraduate Education (DUE)
Funding - How to Prepare Your Proposal

Proposals to NSF must be submitted electronically via either the NSF FastLane System or Grants.gov.

Proposals submitted via FastLane should be prepared and submitted in accordance with the general guidelines contained in the NSF Grant Proposal Guide (GPG). The complete text of the GPG is available electronically at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov. Proposers are reminded to identify the program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

Proposals submitted via Grants.gov should be prepared and submitted in accordance with the NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov. The complete text of the NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide. To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

A list of other types of proposals is available on the Other Types of Proposals page.
Grant Proposal Guide, January 2011

Available Formats: [HTML] [PDF]
Document Type: General Information
Document Number: gpg11001

Public Comment: Effective for proposals submitted or due on or after January 18, 2011 through January 13, 2013. For proposals submitted or due on or after January 14, 2013, the guidelines in NSF 13-1 apply. Please see the FAQs associated with this guide.


For more information about file formats used on the NSF site, please see the Plug-ins and Viewers page.
A Proposal’s Trajectory

Can be returned without review/withdrawn

Award

Via DGA

Organization

Decline

NSF Program Officer

Program Officer Analysis and Recommendations

DD Concur

Ad Hoc

Panel

Combination

Internal

Research & Educational Communities

Submit

NSF Announces Opportunity

National Science Foundation
Division of Undergraduate Education (DUE)

Proposal Receipt at NSF

90 Days
Proposal Preparation

6 Months
Proposal Receipt to DD Concurrence of PO Recommendation

30 Days
DGA Review & Processing
NSFMeritReviewCriteria

All NSF proposals are evaluated using the two National Science Board approved merit review criteria.

**Intellectual Merit:** The Intellectual Merit criterion encompasses the potential to advance knowledge.

**Broader Impacts:** The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.
Intellectual Merit Review Criterion

• How important is the proposed activity to advancing knowledge and understanding in its own field or across other fields?

• How well qualified is the proposer (individual or team) to conduct the project?

• To what extent does the proposed activity suggest and explore creative, original, or potentially transformative concepts?

• How well conceived and organized is the proposed activity?

• Is there sufficient access to resources?
Broader Impacts Review Criterion

• How well does the activity advance discovery and understanding while promoting teaching, training and learning?

• How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)?

• To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks and partnerships?

• Will the results be disseminated broadly to enhance scientific and technological understanding?

• What may be the benefits of the proposed activity to society?
Read, rate and write a ~1 page review (10-12 proposals)

Attend panel meeting (in DC)
- Discuss each proposal with panel
- Modify rating / review if necessary
- Contribute to Panel Summary

Individual Reviews & Panel Summary
- Explicitly consider Intellectual Merit
- Explicitly consider Broader Impacts
- Strengths and weaknesses and particularly why strong or weak
<table>
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<tr>
<th>Reviewer Ratings</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>Outstanding, highest priority. May have a few flaws that can be improved.</td>
</tr>
<tr>
<td>Very Good</td>
<td>Has merit; fund if possible. Flaws can be corrected.</td>
</tr>
<tr>
<td>Good</td>
<td>Has some merit, not a high priority but could fund.</td>
</tr>
<tr>
<td>Fair</td>
<td>Lacking in several critical aspects; a recommendation against funding even if funds were available.</td>
</tr>
<tr>
<td>Poor</td>
<td>Many serious deficiencies; a potential waste of time for both the proposer and the reviewer.</td>
</tr>
</tbody>
</table>

No split ratings (e.g. VG/G) permitted for DUE programs.
Propose a Well-defined Problem

- Based on your local experience, expertise and knowledge
- Aligned with the Program Solicitation
- Offers potential for significant impact
Provide a Set of Clear Goals, Objectives and Outcomes

<table>
<thead>
<tr>
<th>Goals: “Big picture”</th>
<th>How will the project impact STEM education? Why is it important?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objectives:</td>
<td>What will you do to realize the goals?</td>
</tr>
<tr>
<td></td>
<td>What are your strategies?</td>
</tr>
<tr>
<td>Outcomes:</td>
<td>What has been produced that can be measured?</td>
</tr>
</tbody>
</table>

Ensure logical flow of proposal that connects these.

**Goals** ➔ **Objectives** ➔ **Outcomes**
Build on What Others Have Done

- Build on what others have done, and then add to the base of knowledge. Don’t reinvent the wheel.

- Read the literature, go to workshops & talk with others.

- Be current in STEM education activities (e.g., DBER).

- Discuss the value added of your project. What are you adding to the knowledge base?
Include a Detailed Project Management Plan

- Provide timeline for major project activities that includes milestones and dates for deliverables.

- Describe responsibilities of project personnel

- Elaborate on expertise of project personnel to carry out proposed work
Include Meaningful Project Evaluation

• Conducted by a credible & objective evaluator, using appropriate instruments.

• Evaluation (both formative and summative) should be clearly tied to project objectives and outcomes.

• Include numbers for quantitative evaluation. How many students and faculty were impacted? How many students succeed in the subsequent course?

• Build in evaluation from the beginning.
Include Plans for Broad Dissemination and Sustainability

• Provide details on project dissemination. Go beyond “standard” conference presentations and publications in journals. Offer workshops, target specific websites and projects as dissemination vehicles such as SERC, VIPER/IONiC, GEMs, cCWCS and others.

• Include MEANINGFUL letters of support from campus administrators that demonstrate sustainability of project after grant period. Letters should address purchases of consumables, maintenance contracts, faculty loads, etc.
Most Common Strengths Identified by Reviewers

Strengths Cited in More Than 20 % of the Panel Summaries

- Important, timely, or responsive
- PI's strong
- Collaboration details
- Potential for involving W&M
- Dissemination, contribution to KB
- Large impact
- Build on prior work or products
- Evaluation plan

Percent

0 10 20 30 40 50 60
Most Common Weaknesses Identified by Reviewers

Weaknesses Cited in More Than 20% of the Panel Summaries

- Collaboration details
- Large impact
- Innovative or novel
- Build on prior work or products
- Potential for involving W&M
- Dissemination & contribution to KB
- Activities doable & related to outcomes
- Evaluation plan
- Sufficient detail and clear plans
Now that the process is crystal clear…

Best of success!
Questions? and Thank you!

"And so you just threw everything together?... Mathews, a posse is something you have to organize."

Dave Brown – drbrown@nsf.gov