Research and Partnerships

Funding and Grant Writing Help

Funding and Grant Writing

The goal of the EVPRP Research Development staff is to assist faculty in the development of research and education proposals. EVPRP staff provide a broad range of services and resources related to funding and grantsmanship. Below are some of the ways we can assist.

Funding Resources

The funding page provides information on internal, external, seed, and early investigator funding opportunities. Links to helpful funding search tools and e-mail alerts can also be found here.

Limited Submissions

Check here for details on internal competitions including deadlines, templates and submission guidelines.

Grant Writing

Research Development staff can provide assistance with both large and small proposals. This page explains our services and provides links to other useful proposal preparation resources.

Site Visits

Our staff can assist with the logistics and coordination of site visits allowing the research team to focus on their science and team. Follow this link to find out more about these services.

Events

The events page provides information on upcoming grantsmanship workshops and events including dates, times, and registration information. Presentations from previous events can also be accessed from this site.

Other Useful Links

Our Guide to the Grants Process at Purdue University and information on potential education and outreach partners are available here as well as links to other grantsmanship resources.
Where Do I Go for Help with....?

http://www.purdue.edu/research/funding-and-grant-writing/flow-chart.php
Where Do I Go for Help with....?

http://www.purdue.edu/research/funding-and-grant-writing/flow-chart.php
Research Development Cheat Sheet
Proposal Prep 101

OFFICE OF THE EXECUTIVE VICE PRESIDENT FOR RESEARCH AND PARTNERSHIPS
Proposal Prep 101

- Need assistance setting up your Pivot account to locate funding?
  Contact Kristyn Jewell (kristynj@purdue.edu) for one-on-one help.

- Interested in NIH funding opportunities?
  Contact Perry Kirkham (pkirkham@purdue.edu) for NIH-specific guidance.

- Ready to start budget and authorization?
  Visit www.purdue.edu/business/sps/preaward.

- Need a grant writer?
  Contact Sally Bond (sbonde@purdue.edu) for larger, multidisciplinary proposal services and proposalcoordinator@purdue.edu for consultations and assistance on single-investigator proposals.

- Want an internal review of your proposal before submission?
  Contact Sally Bond (sbonde@purdue.edu).

- Looking for boilerplate text on Purdue resources?
  Visit our e-Pubs site at http://docs.lib.purdue.edu/opvr/.

- Planning a site visit from your funding agency?
  Contact Sue Grimes (sgrimes@purdue.edu) for logistical help.

ACCESS THE FUNDING AND GRANT WRITING WEBSITE
www.purdue.edu/research/funding-and-grant-writing/overview.php

...for key resources such as:

- Registration for workshops
- Self-help proposal development tools and data management plan templates
- Instructions and templates for Purdue limited submissions
- Rolodex of potential broader impact partners
- Guide to the Grants Process at Purdue booklet

Follow us on Twitter at @Research_Purdue. Join the conversation with @PUGrantwriter.
Distinctives...Examples...Process
What Makes a Good CAREER Proposal?

Not your typical NSF research proposal

• more “path” than project
What Makes a Good CAREER Proposal?

Not your typical NSF research proposal

• more “path” than project
• strategic fit with institution
What Makes a Good CAREER Proposal?

Not your typical NSF research proposal

• more “path” than project
• strategic fit with institution
• clearly transformative research direction
What Makes a Good CAREER Proposal?

Not your typical NSF research proposal

• more “path” than project
• strategic fit with institution
• clearly transformative research direction
• creative and integrated education and research
Research Path Not Project

Funds academic career development of new faculty

....should contain a well-argued and specific proposal that will, over a 5-year period, build a firm foundation for a lifetime of contributions to research and education in the context of the Principal Investigator’s organization.”

(Section V in CAREER solicitation)
Research Path Not Project

What is your strategic plan?

YOU ARE HERE

what a Great Career!
"All CAREER proposals should describe an integrated path that will lead to a successful career..." (section II in CAREER solicitation)
Research Path Not Project

What is your strategic plan?

Where do you want to be in 5 years? 10 years? 20 years?
Research Path Not Project

You want your review panel to say this too

"...has made an excellent case for how the proposed research and education plan will help her achieve her personal career vision."

Reviews from Senay Purzer, 2012 Purdue CAREER Awardee
Assistant Professor of Engineering Education
Ask yourself blue sky questions...

• What problem do you feel passionate about?
• Where do you want to have a transformative impact?
• In what ways are you prepared to push the frontiers of knowledge?
• Where can you contribute to national needs and priorities?
1.3 Career objectives

The long term career goal of the PI is to integrate excellence in the science and engineering of nano-structured semiconductor devices with education of future scientists and engineers. Achieving this goal will contribute significantly to the fundamental knowledge about band, polarization, and strain engineering of nitride nanostructures and will bring these materials to the level of maturity necessary for infrared commercial applications. The research plans detailed in this proposal naturally continue the PI’s previous studies of infrared lasers, and current investigations of correlations between semiconductor structure and infrared optical properties. The proposed program will expand prior and ongoing work to a novel class of nanostructured devices, the nonpolar nitride infrared devices, devices that hold promise for new functionalities in the underdeveloped spectral regions of the infrared. By improving fundamental understanding of the physics and material science of nitride materials, this work will enable ultra-fast and versatile infrared light emitting and detecting devices that will ultimately enhance the performance and wide-acceptance of commercial infrared systems for spectroscopy, telecommunications, sensors, etc.

Oana Malis, 2013 Purdue CAREER Awardee
Assistant Professor of Physics
Vision and Impact

The goal of my interdisciplinary research is to develop a robust and scalable computational framework for the emerging field of computational population biology. Ultimately, this research will enable biologists in their scientific inquiry to take advantage of new data by focusing on its underlying qualitative (rather than numerical) and explicitly dynamic structure.

Tanya Berger-Wolf CAREER (Univ of Illinois, Chicago)
Long-Term Pathway

Be specific about what has been done, will be done, and will be done in future

- Sibling relationships in diploid organisms
  NSF IIS-SEI 0612268
- Amalgamation of pedigrees
- Non-hierarchical pedigrees
- Pedigrees of non-diploid organisms
  Design and evaluate controlled breeding strategies using pedigree information
- Spreading processes
- Interaction prediction
- Network comparison
  Processing--data collection feedback. Partial processing on the data chip
  Integration of heterogeneous data sources
- Combining and comparing pedigrees and social networks
  Genetic inference using social interactions and vice versa
  Combining genetics, behavior, social interactions, environment physiology and other aspects

Tanya Berger-Wolf CAREER (Univ of Illinois, Chicago)
1.3 Career objectives

The long term career goal of the PI is to integrate excellence in the science and engineering of nano-structured semiconductor devices with education of future scientists and engineers. Achieving this goal will contribute significantly to the fundamental knowledge about band, polarization, and strain engineering of nitride nanostructures and will bring these materials to the level of maturity necessary for infrared commercial applications. The research plans detailed in this proposal naturally continue the PI’s previous studies of infrared lasers, and current investigations of correlations between semiconductor structure and infrared optical properties. The proposed program will expand prior and ongoing work to a novel class of nanostructured devices, the nonpolar nitride infrared devices, devices that hold promise for new functionalities in the underdeveloped spectral regions of the infrared. By improving fundamental understanding of the physics and material science of nitride materials, this work will enable ultra-fast and versatile infrared light emitting and detecting devices that will ultimately enhance the performance and wide-acceptance of commercial infrared systems for spectroscopy, telecommunications, sensors, etc.

Oana Malis, Purdue CAREER Awardee
Assistant Professor of Physics
Institutional Fit
Institutional Fit
Institutional Fit
Transformative Research

Why is this work essential?

• Needs to be solved now?
Transformative Research

Why is this work essential?

• Needs to be solved now?
• Says who?
Transformative Research

Why is this work essential?

• Needs to be solved now?
• Says who?
• Facts and figures of cost to country/industry/communities
Transformative Research

Why is this work essential?

• Needs to be solved now?
• Says who?
• Facts and figures of cost to country/industry/communities
• What industries/communities will be positively impacted by your work?
Transformative Research

Why is this work essential?

• Needs to be solved now?
• Says who?
• Facts and figures of cost to country/industry/communities
• Industries/communities will be positively impacted by your work?

Cannot be incremental
Integrating Education and Research
Integrating Education and Research

Integration is critical...cannot be an afterthought. Innovative but doable.

• What are you passionate about?
Integrating Education and Research

Integration is critical...cannot be an afterthought. Innovative but doable.

- What are you passionate about?
- Where do you have a track record to build on?
Integrating Education and Research

Integration is critical...cannot be an afterthought. Innovative but doable.

• What are you passionate about?
• Where do you have a track record to build on?
• Do not reinvent the wheel!
Integrating Education and Research

Integration is critical...cannot be an afterthought. Innovative but doable.

• What are you passionate about?
• Where do you have a track record to build on?
• Do not reinvent the wheel!
• Both “vanilla” and creative initiatives
Integrating Education and Research

Integration is critical...cannot be an afterthought. Innovative but doable.

• What are you passionate about?
• Where do you have a track record to build on?
• Do not reinvent the wheel!
• Both “vanilla” and creative initiatives
• Sustainable
Integrating Education and Research

Integration is critical...cannot be an afterthought. Innovative but doable.

• What are you passionate about?
• Where do you have a track record to build on?
• Do not reinvent the wheel!
• Both “vanilla” and creative initiatives
• Sustainable
• Based on best practices
“Such activities should be consistent with research and best practices in curriculum, pedagogy, and evaluation.”
Evidence-based Education

ERIC (Education Resource Information Center) https://eric.ed.gov

Collection Thesaurus

STEM research experience high school Search Advanced Search Tips

Peer reviewed only Full text available on ERIC

Showing 1 to 15 of 12,232 results Save | Export

Experiences and Perceptions of STEM Subjects, Careers, and Engagement in STEM Activities among Middle School Students in the Maritime Provinces
Franz-Edendaal, Tamara A.; Biotnicki, Karen; French, Frederick; Joy, Philip - Canadian Journal of Science, Mathematics and Technology Education, 2016

To enhance understanding of factors that might improve STEM career participation, we assessed students’ self-perceptions of competency and interest in science/math, engagement in STEM activities outside of school, and knowledge of STEM career requirements. We show that the primary positive influencer directing students to a STEM career is high...

Descriptors: Foreign Countries, Middle School Students, Student Attitudes, Student Experience

Early Undergraduate Research Experiences Lead to Similar Learning Gains for STEM and Non-STEM Undergraduates

Undergraduate research is touted as a high-impact educational practice yielding important benefits such as increased retention and notable learning gains. Large-scale studies describing benefits of mentored research programs have focused primarily on outcomes for science, technology, engineering and mathematics (STEM) undergraduates. The Students...

Descriptors: Undergraduate Students, Student Research, STEM Education, Mentors

The Relationships among High School STEM Learning Experiences and Students’ Intent to Declare and Declaration of a STEM Major in College
Botta, Martha Covcia; Stearns, Elizabeth; Mickelson, Roslyn Arlin; Moller, Stephanie; Parker, Ashley Dawn – Teachers College Record, 2015

Background/Context: Schools are integral to augmenting and diversifying the science, technology, engineering, and mathematics (STEM) workforce. This is because K-12 schools can inspire and reinforce students’ interest in STEM, in addition to academically preparing them to pursue a STEM career. Previous literature emphasizes the importance of...

Descriptors: STEM Education, Secondary School Science, Science Careers, High School Students

STEM-focused High Schools as a Strategy for Enhancing Readiness for Postsecondary STEM Programs

The logic underlying inclusive STEM high schools (ISHs) posits that requiring all students to take advanced college preparatory STEM courses while providing student-centered, reform-oriented instruction, ample student supports, and real-world STEM experiences and role models will prepare and inspire students admitted on the basis of STEM interest...

Descriptors: STEM Education, College Readiness, High Schools, Secondary School Curriculum

AUTHOR

PROQuest LLC 1576
Online Submission 156
Teachers College Record 98
Journal of STEM Education 94
Society for Research on 76
Journal of Research in 56
CBE Life Sciences Education 39
Journal of Science Education 37
Physical Education and Sport 35
International Journal of 34
Journal of Chemical Education 32

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Since 2010 920
Since 2006 683
Since 1998 8399

DESCRIPTOR

Foreign Countries 2119
High School Students 1504
Student Attitudes 1659
High Schools 1765
Interviews 1576
Academic Achievement 1479
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International Journal of 34
Journal of Chemical Education 32
Evidence-based Education

ASEE Journal of Engineering Education

https://asee.org/papers-and-publications/publications/jee

Welcome

Welcome to the Journal of Engineering Education (JEE), the research journal for engineering education. JEE is a peer-reviewed international journal published quarterly by the American Society for Engineering Education (ASEE) in partnership with a global community of engineering education societies and associations. JEE is the journal of choice for over 8,500 subscribers in nearly 80 countries.

Articles published in JEE are now available at Wiley Online Library.

ASEE members click here to view the JEE articles.

As an ASEE member, you can access the JEE articles by logging into your ASEE account. Non-members may be able to view articles through their institutional subscriptions.

Prospective authors should consult the journal’s author guidelines.

Authors should avoid predatory journals with similar titles that promise rapid publication with insufficient time for rigorous peer review.

NOTE: Clicking the guidelines link takes you to JEE’s pages on Wiley; it does not provide you with member access to JEE papers. You must be logged in to the ASEE website for such access.
Think Beyond Business as Usual

• Cross-listed course
• Innovative undergraduate instruction
• Involve K-12 teachers and students
• Outreach through summer camps
• Partnerships with museums and informal science learning organizations
  Citizen science and building public STEM literacy
• Service learning
• Entrepreneurship (include I-Corps!)
Consider Diversity for Broader Impact

• How will you attract and mentor diverse students?
Consider Diversity for Broader Impact

• How will you attract and mentor diverse students?
• Underserved rural areas, disabled, gender diversity, veterans
Consider Diversity for Broader Impact

• How will you attract and mentor diverse students?
• Underserved rural areas, disabled, gender diversity, veterans
• Don’t quantify
Consider Diversity for Broader Impact

• How will you attract and mentor diverse students?
• Underserved rural areas, disabled, gender diversity, veterans
• Don’t quantify
• Can involve teachers recruited from schools with particular demographics
Integrating Education and Research

You MUST assess educational initiatives
# Integrating Education and Research

**Logic model helpful to develop even if not included in proposal**

<table>
<thead>
<tr>
<th>For Whom</th>
<th>Assumptions (Theory of Change) <em>Moving from...</em></th>
<th>Inputs</th>
<th>Strategies/Activities <em>through...</em></th>
<th>Outputs</th>
<th>Outcomes <em>through...</em></th>
<th>Impact</th>
</tr>
</thead>
</table>

---
Integrating Education and Research

Consider an integrated advisory board. Need commitment letters.

XI. PROJECT ADVISORY BOARD

Members of my CAREER Advisory Board, listed below, are experts in engineering, cognitive psychology, and innovation education. The assessment review panel will formally meet five times during the project. I will also have on-one-one meetings with my advisors when necessary throughout the project. I have already had detailed meetings with each one of them as I prepared this proposal.

Mary Besterfield-Sacre (Associate Professor and Fulton C. Noss Faculty Fellow, Swanson School of Engineering, Industrial Engineering, University of Pittsburgh): Dr. Besterfield-Sacre’s research expertise includes engineering education evaluation methodologies and quality improvement in manufacturing and service organizations. She is a renowned expert in assessment and evaluation in engineering education and for her research on innovation, which has been funded by the NSF and NCIIA.

Nathalie Duval-Couetil (Director, Certificate in Entrepreneurship and Innovation Program, Associate Director, Burton Morgan Center for Entrepreneurship): Dr. Duval-Couetil has launched and currently leads Purdue’ university-wide multidisciplinary undergraduate entrepreneurship program. This program has involved over 2,000 students from all majors since 2005. She also leads initiatives on leadership education for women. Dr. Duval-Couetil also has experience in market research and business strategy consulting in Europe and the United States. She will contribute to this project in significant ways through her diverse expertise and by helping recruit student participants.

Vincent Duffy (Associate Professor, Industrial Engineering and Agricultural and Biological Engineering,

Senay Purzer, 2012 Purdue CAREER Awardee
Assistant Professor of Engineering Education
Integrating Education and Research

Letters of collaboration for educational partners?

Must follow the single-sentence format:

“If the proposal submitted by Dr. [insert the full name of the Principal Investigator] entitled [insert the proposal title] is selected for funding by the NSF, it is my intent to collaborate and/or commit resources as detailed in the Project Description or the Facilities, Equipment or Other Resources section of the proposal.”
## Integrating Education and Research

**Use a unified schedule**

<table>
<thead>
<tr>
<th>Year</th>
<th>Semester</th>
<th>Research Plan</th>
<th>Educational Plan</th>
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</thead>
</table>
| 1    | Spring'12| - Detailed planning of the data collection and data analysis  
     |         | - Train graduate and undergraduate students in data collection & analysis.  
     |         | - Pilot data collection in the ELO lab (complete 10 interviews & verbal protocols) | - Develop assessment tools, such as rubrics, for classroom use.                                  |
|      | Summer'12| - Analyze pilot data  
     |         | - Refine and finalize coding protocols  
     |         | - Refine procedures for data preparation for analysis: editing, chunking, etc. |                                                                                  |
|      | Fall’13  | - Contact engineering faculty to recruit additional participants  
     |         | - Recruit student participants  
     |         | - Start data collection | - Develop short course activities on innovation.                                                  |
| 2    | Spring'13| - Continue data collection (complete 75 interviews & verbal protocols  
     |         | with senior engineering students)  
     |         | - Data preparation, editing, and coding | - Develop an innovation-focused teacher professional development module for PBS Teacher Line    |
|      | Summer’13| - Data analysis (coding)  
     |         | - Develop case studies  
     |         | - Present findings at ASEE | - K-12 teacher professional development as part of SLED and INSPIRE                            |
|      | Fall’13  | - Present findings at FIE  
     |         | - Data analysis (frequency calculations) | | - Present findings at the industry advisory board                                                 |
| 3    | Spring'14| - Continue data collection (complete 75 interviews & verbal protocols  
     |         | with senior engineering students)  
     |         | - Submit conference proposals on preliminary findings  
     |         | - Present findings at NCIIA | - NCIIA faculty workshop  
     |         | - Analyze pilot first-year engineering survey data |                                                                                  |
|      | Summer’14| - Data analysis (case studies)  
     |         | - Submit a journal manuscript to JEE | | - Develop a graduate course on innovation and research methods                                    |

---

Senay Purzer, 2012 Purdue CAREER Awardee  
Assistant Professor of Engineering Education
# Integrating Education and Research

*If interested, contact [sbond@purdue.edu](mailto:sbond@purdue.edu) for help with timeline graphic*

<table>
<thead>
<tr>
<th>Activity</th>
<th>YEAR 1</th>
<th>YEAR 2</th>
<th>YEAR 3</th>
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<tbody>
<tr>
<td>Phase 1: Name</td>
<td>Project Cost: $XXX</td>
<td>Activity 1</td>
<td>Activity 2</td>
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<tr>
<td>Phase 2: Name</td>
<td>Project Cost: $XXX</td>
<td>Activity 1</td>
<td>Activity 2</td>
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<tr>
<td>Phase 3: Name</td>
<td>Project Cost: $XXX</td>
<td>Activity 1</td>
<td>Activity 2</td>
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- Deliverable
# Plan of Action

## Proposal Preparation Timeline

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<td>Read abstracts of funded CAREERS for directorate/division fit</td>
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<td>• What has been done already to address this problem?</td>
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<td>• How do you propose to address this gap?</td>
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<td><strong>Research and education goals</strong></td>
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<td>If you have international component, contact relevant country program officer to discuss</td>
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<td>Email one-pager to PO/request appt</td>
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<td>Revise storyline based on PO feedback</td>
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<td><strong>Proposed Outline</strong></td>
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Search Awards by CAREER Code 1045

**Overview of Award Search Features**

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<th>Awardee Information</th>
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<td>Principal Investigator Last Name</td>
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HINT: The "Program" box searches both program element and program reference names and codes.

Reference Code: 1045
Choose Directorate

Awards Advanced Search

1. Principal Investigator First Name
2. Principal Investigator Last Name
3. Include Co-Principal Investigator in name search
4. NSF Organization
5. Element Code
6. Reference Code
7. Program
8. Program Officer
9. Keyword

HINT: The "Program" box searches both program element and program reference names and codes.

HINT: Data prior to 1976 may be less complete.
### Or Search by CAREER and Programs

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**HINT:** The "Program" box searches both program element and program reference names and codes.
Sorted by Start Date

Advanced Search Results

Export up to 3,000 Awards:
 CSV | XML | Excel | Text

Sort By: Start Date | Results size: 30 per page

- CAREER: Engineering Human CNS Morphogenesis Ex Vivo: Spinal Cord
  Award Number: 1651645; Principal Investigator: Randolph Ashton; Co-Principal Investigator: Organization: University of Wisconsin-Madison; NSF Organization: CBET Start Date: 07/01/2017; Award Amount: $540,609.00; Relevance: 64.0;

- CAREER: Modeling dorsal root ganglia: electrophysiology of microelectrode recording and stimulation
  Award Number: 1653080; Principal Investigator: Timothy Bruns; Co-Principal Investigator: Organization: University of Michigan Ann Arbor; NSF Organization: CBET Start Date: 07/01/2017; Award Amount: $549,524.00; Relevance: 64.0;

- CAREER: Design of Matching Markets
  Award Number: 1653477; Principal Investigator: Yashodhan Kanoria; Co-Principal Investigator: Organization: Columbia University; NSF Organization: CMMI Start Date: 07/01/2017; Award Amount: $500,000.00; Relevance: 64.0;

- CAREER: Integrated Research and Education on Bio-Inspired Burrowing
  Award Number: 1653567; Principal Investigator: Junliang Tao; Co-Principal Investigator: Organization: University of Akron; NSF Organization: CMMI Start Date: 07/01/2017; Award Amount: $549,139.00; Relevance: 64.0;

- CAREER: Advanced data analytics and high-resolution cervical auscultation can accurately predict dysphagia
  Award Number: 1652203; Principal Investigator: Ervin Sejdic; Co-Principal Investigator: Organization: University of Pittsburgh; NSF Organization: CBET Start Date: 07/01/2017; Award Amount: $549,139.00; Relevance: 64.0;

- CAREER: Robust aquatic habitat representation for water resources decision-making
  Award Number: 1653452; Principal Investigator: Sarah Null; Co-Principal Investigator: Organization: Utah State University; NSF Organization: CBET Start Date: 07/01/2017; Award Amount: $510,095.00; Relevance: 64.0;

- CAREER: Structures as Sensors: Elder Activity Level Monitoring through Structural Vibrations
  Award Number: 1653550; Principal Investigator: Hae Young Noh; Co-Principal Investigator: Organization: Carnegie-Mellon University; NSF Organization: CMMI Start Date: 07/01/2017; Award Amount: $500,000.00; Relevance: 64.0;

- CAREER: Novel redox-active electrolyte additives to enhance efficiency and direct product selectivity in electroreduction reactions
  Award Number: 1653430; Principal Investigator: Bryan McCloskey; Co-Principal Investigator: Organization: University of California-Berkeley; NSF Organization: CBET Start Date: 07/01/2017; Award Amount: $510,095.00; Relevance: 64.0;
**Abstracts**

**Award Abstract #1651645**

**CAREER: Engineering Human CNS Morphogenesis Ex Vivo: Spinal Cord**

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<td>February 23, 2017</td>
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<td>Award Instrument:</td>
<td>Standard Grant</td>
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| Program Manager: | Michele Grimm  
CBET Div Of Chem, Bioeng, Env, & Transp Sys  
ENG Directorate For Engineering |
| Start Date: | July 1, 2017 |
| End Date: | June 30, 2022 (Estimated) |
| Awarded Amount to Date: | $540,809.00 |
| Investigator(s): | Randolph Ashton rashton2@wisc.edu (Principal Investigator) |
| Sponsor: | University of Wisconsin-Madison  
21 North Park Street  
MADISON, WI 53715-1216 (608)262-3822 |
| NSF Program(s): | BIOMEDICAL ENGINEERING |
| Program Reference Code(s): | 1045, 8091, 9102 |
The goal of this project is to develop methods for engineering human cord organoids displaying spinal cord grey matter architecture and CNS-like neuronal circuitry. Success could lead to a paradigm shift relative in spinal cord injury research and drug screening. The proposed methods can be implemented to engineer diverse neural, heart, and gut organoids.
The recently observed ability of combinations of human pluripotent stem cells (hPSCs) to spontaneously transform in vitro into "cerebral organoids" containing diverse brain tissues suggests the possibility that organoids can be engineered ex vivo to generate brain and spinal cord tissues with structure, composition and function (including neural circuits) that can mimic many features of the human Central Nervous System (CNS). The availability of controlled ex vivo CNS models can lead to platforms for 1) investigating human developmental biology and physiology, 2) investigating degenerative diseases and traumatic injury, 3) enhanced drug screening and personalized medicine and 4) eliminating the need for unnecessarily relevant animal studies. The goal of this project is to develop methods for engineering human spinal cord organoids displaying spinal cord grey matter architecture and CNS-like neuronal circuitry. Success could lead to a paradigm shift relative to spinal cord injury research and drug screening. The proposed methods can be implemented to engineer diverse neural, heart, and gut organoids. The education and outreach plan includes: 1) development of a comprehensive "Stem cell-based Tissue Engineering & Morphogenesis (STEM)" website to serve as an educational resource for BME courses and middle and high school teachers and as a site for sharing research findings; 2) outreach programs designed to expose underrepresented minority (URM) students, including at elementary and middle school levels, to STEM experiences and 3) creation of a live "Building a Human Spinal Cord" exhibit to engage the public in stem cell and tissue engineering research.

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# Plan of Action

## Proposal Preparation Timeline

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Tell a Compelling Story

Four helpful questions

• What is the problem?
• What has been done already to address the problem?
• What is the gap that remains?
• How do you propose to address this gap?
Tell a Compelling Story

Logic flow goes from broad to narrower

• What is the problem?
• What has been done already to address the problem?
• What is the gap that remains?
• How do you propose to address this gap?
Despite the crucial link between engineering and innovation, research on engineering innovation education is limited. The challenge, however, is not the volume of studies on this topic but the integration and application of research. Prior studies conducted by cognitive scientists, design researchers, and business scholars highlight some of the individual characteristics important for creativity, characteristics of innovators and entrepreneurs, and the critical role of organizations in supporting innovation. However, very little is known about how engineering students approach innovation and ways to measure these processes and their outcomes. Hence, this study will examine engineering students’ cognitions, motivations, and predispositions using interviews and think-aloud protocols. Their processes will then be analyzed to identify possible curricular, gender, and cultural differences among students.

Senay Purzer, Assistant Professor of Engineering Education
In 2013, 61% of raw energy (namely, coal, natural gas, and oil) was wasted as heat because of the low efficiency of power conversion. A thermophotovoltaic (TPV) system desirable for its low maintenance and quiet, portable operation can uniquely capture this waste heat as electricity by using thermal photons (discrete units or quanta of light) whose energies match the bandgap of the photovoltaic (PV) cell. However, TPV systems emit the vast majority of thermal photons at low energies, thus greatly reducing efficiencies. To overcome this barrier, we propose to develop a highly innovative approach to TPV, which we call thermo-photonics (TPX), by redirecting thermal photons into useful energies matching the PV cell. TPX can significantly increase the efficiency of TPV converters up to 50%. What is more, this device may efficiently utilize standard silicon PV technology, thus ensuring a relatively easy transfer to commercial development when the concept is proven.

Peter Bermel, Assistant Professor of Electrical and Computer Engineering, 2014 Purdue CAREER Awardee
Storyline is Basis for PO Discussion

Create a one-page brief

One-page project description includes:

• concise storyline
• career vision/integrative goals
• brief qualifications...why you?
• overview of methodology/approach
• impact and why this is novel
Contacting Your Program Officer

Do not make a ‘cold call’ to PO

• Find the right program
  • RFP has link for contact list
    http://www.nsf.gov/crssprgm/career/contacts.jsp
• Contact PO(s) to request conversation
  • include one-page project description
# Know Reviewing Mechanism

<table>
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<th>Ad hoc +/- Panel</th>
<th>Mostly Panel</th>
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Questions to Ask Program Officer

Contact by middle of May at the latest. Get moving on that storyline!

Ask questions such as:

1. Does my research goal fit well with your program?
2. Is this the right scope? Do I need more preliminary data?
3. What is the typical award size?
4. What type of review? Ad Hoc or Panel?
5. What is preference for RET/REUs?
Outline before Writing

Be kind to reviewers. Make your proposal easy to read. Format consistently.

Possible Outline for CAREER Project Description

- Use "I" instead of "we" or "our" because this is about YOUR five-year career path. (However, one-page summary is required to be third person.)
- 15 pages for project narrative
- 1" margin
- Allowed fonts: Arial, Courier new, Palatino Linotype at 10 points or larger; Times New Roman at 11 point or larger.
- No bold allowed except in the references
- Avoid passive voice whenever possible
- Include quality graphics and figures with clear captions

1. Significance and Rationale (~1 page)
   - Compelling storyline that excites your reviewers with the logic flow of:
     - What is the problem?
     - What has been done already to address this problem?
     - What is the gap that still remains?
     - How do you propose to address this gap?
   - Vision for how this will launch you into novel contributions in your career
     - You must be proposing novel work rather than incremental
   - State both research and education goals
   - Concisely state what will be the impact on the field when you are successful with your proposed CAREER

1.1 Intellectual Merit
   - State potential to advance

1.2 Broader Impacts
   - Read NSF Grant Proposal Guide for instructions on this required section. How is your research benefiting society? In what ways are you broadening accessibility?
   - Refer to Broader Impacts resources on Research Development website at:
     https://www.purdue.edu/research/vpr/racdev/proposal_prep_resources.php
   - Entrepreneurship activity?

2. Approach
   - Provide an overview of your overall approach to the research plan before you go into details on your plan
   - If you have any collaborators, clearly explain their roles in the appropriate section
   - If you will need special equipment or instruments, include text on how you will acquire these resources or gain access to existing ones

2.1 Background
   - This is not a literature review for your dissertation. Cite key references strategically particularly in light of "what has been done already to address this problem?"
   - Can include your relevant preliminary studies within this section or have separate section
## Submitting

### Proposal prep timeline

<table>
<thead>
<tr>
<th>Task</th>
<th>Complete Collaborators and Other</th>
<th>Affiliations Spreadsheet</th>
<th>Write postdoc mentoring plan, if needed</th>
<th>Write budget justification</th>
<th>Write facilities document (use epubs)</th>
<th>Write one-page summary</th>
<th>Final check of references</th>
<th>Final budget, justification, and draft narrative due to Pre-Award</th>
<th>Submit all documents except narrative</th>
<th>Submit project narrative</th>
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</thead>
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Submitting

Follow PreAward deadlines at the minimum!

Welcome to Pre-Award Services

Calculate Your Processing Timeline (MM/DD/YYYY):

07/19/2018
Enter Sponsor Deadline

Your Processing Timeline          Due to Pre-Award
1. Initial notification/initial budget request          6/27/2018
2. Final budget, justification, and draft proposal/SOW    7/12/2018
3. Final documents for submission (excl. final SOW)     7/17/2018
4. Final SOW/project description/research strategy     7/18/2018
Follow PreAward Deadlines as Minimum

https://www.purdue.edu/business/sps/preaward/

Welcome to Pre-Award Services

Calculate Your Processing Timeline (MM/DD/YYYY):
07/19/2018
Enter Sponsor Deadline

Your Processing Timeline

1. Initial notification/initial budget request
   Due to Pre-Award: 6/27/2018

2. Final budget, justification, and draft proposal/SOW
   7/12/2018

3. Final documents for submission (excl. final SOW)
   7/17/2018

4. Final SOW/project description/research strategy
   7/18/2018
Compliance Check

Read NSF Grant Proposal Guide as well as RFP

NSF returns many CAREERs without Review. Remember...

• Include department chair letter
• Font, margin, page count follows GPG
• Budget in allowable range
• No Co-PIs
• No unauthorized documents, e.g. support letters
New Template for Affiliations

Effective April 24, 2017, NSF requires the submission of a spreadsheet template to identify collaborators and other affiliations.

https://www.nsf.gov/bfa/dias/policy/coa.jsp
Top 10 CAREER Mistakes

10. Difficult to read with small fonts, illegible figures, too many acronyms
9. Unsubstantiated use of “innovative,” “novel,” “transformative”
8. Poor distinction between preliminary results and proposed work
7. Incremental research with narrow focus
6. Long sentences and unclear writing
5. Too similar to PhD work
4. Business-as-usual education plan
3. Little impact in broader impacts
2. Treating as a regular proposal instead of long-term trajectory
1. Research plan lacking cohesion
   - Collection of loosely related ideas
   - No gap identified to provide rationalization

Tell a story with your narrative
Internal Review

Because sometimes what is obvious to you is not obvious to others
Key Online Resources

EVPRP e-Pubs for searchable, citable, up-to-date institutional text

http://docs.lib.purdue.edu/ovpr/
Key Online Resources

EVPRP e-Pubs for searchable, citable, up-to-date institutional text
Key Online Resources

Virtual Rolodex for broader impact partners at Purdue

http://catalog.e-digitaleditions.com/i/256966-256966-edoutreachpart37
CAREER Resource Websites

NSF Program Officer Contacts by Divisions
http://www.nsf.gov/crssprgm/career/contacts.jsp

CAREER FAQs

Mock Review Panel for CAREER