

# NSF CAREER Proposal Preparation

April 2018


Sally Bond

Assistant Director of Research Development Services  
Proposal Coordination

Office of the Executive Vice President for Research and  
Partnerships

# Research and Partnerships

## Funding and Grant Writing Help



Office of the Executive Vice President for Research and Partnerships

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### 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.

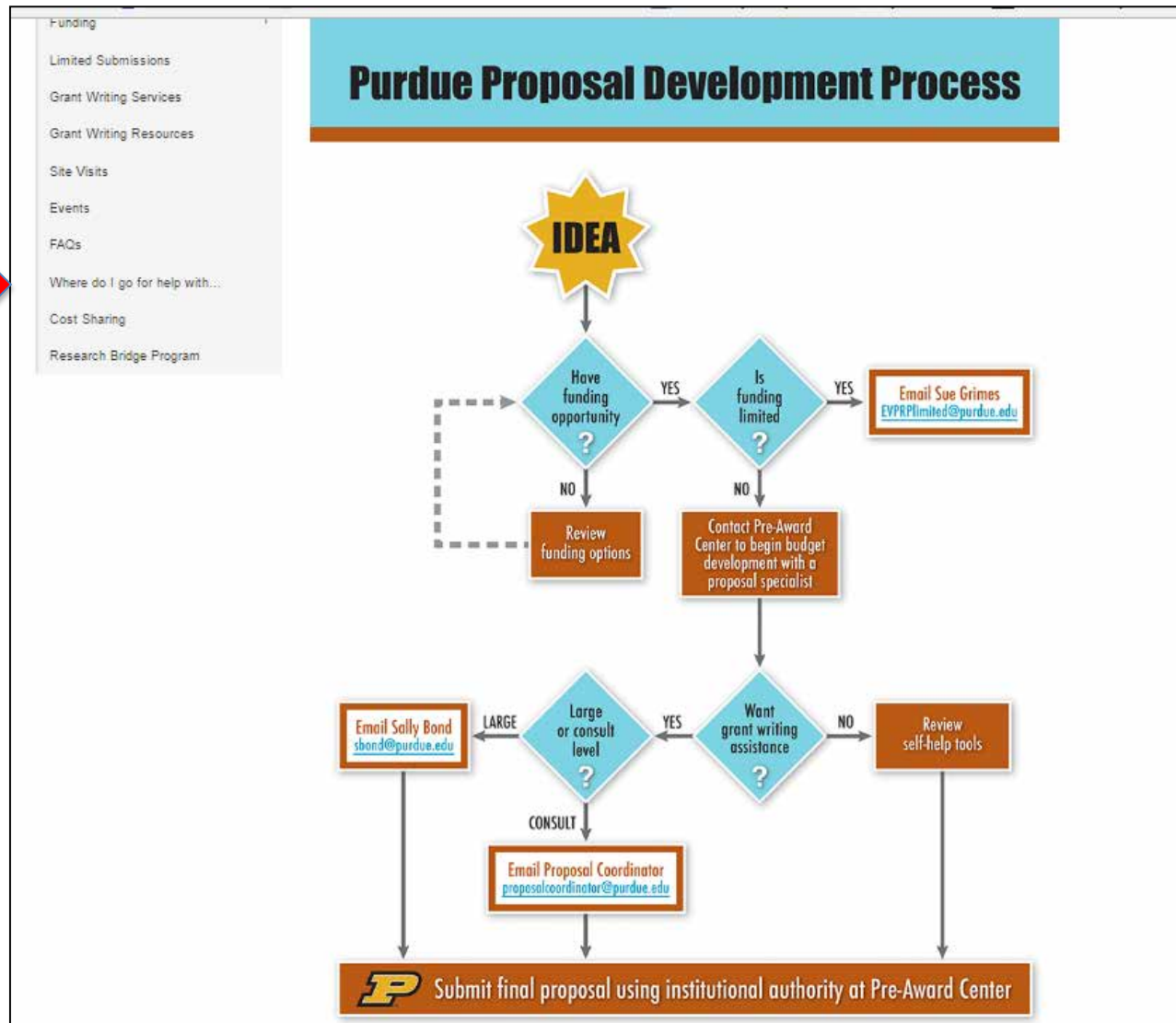
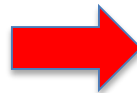


#### Other Useful Links

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.

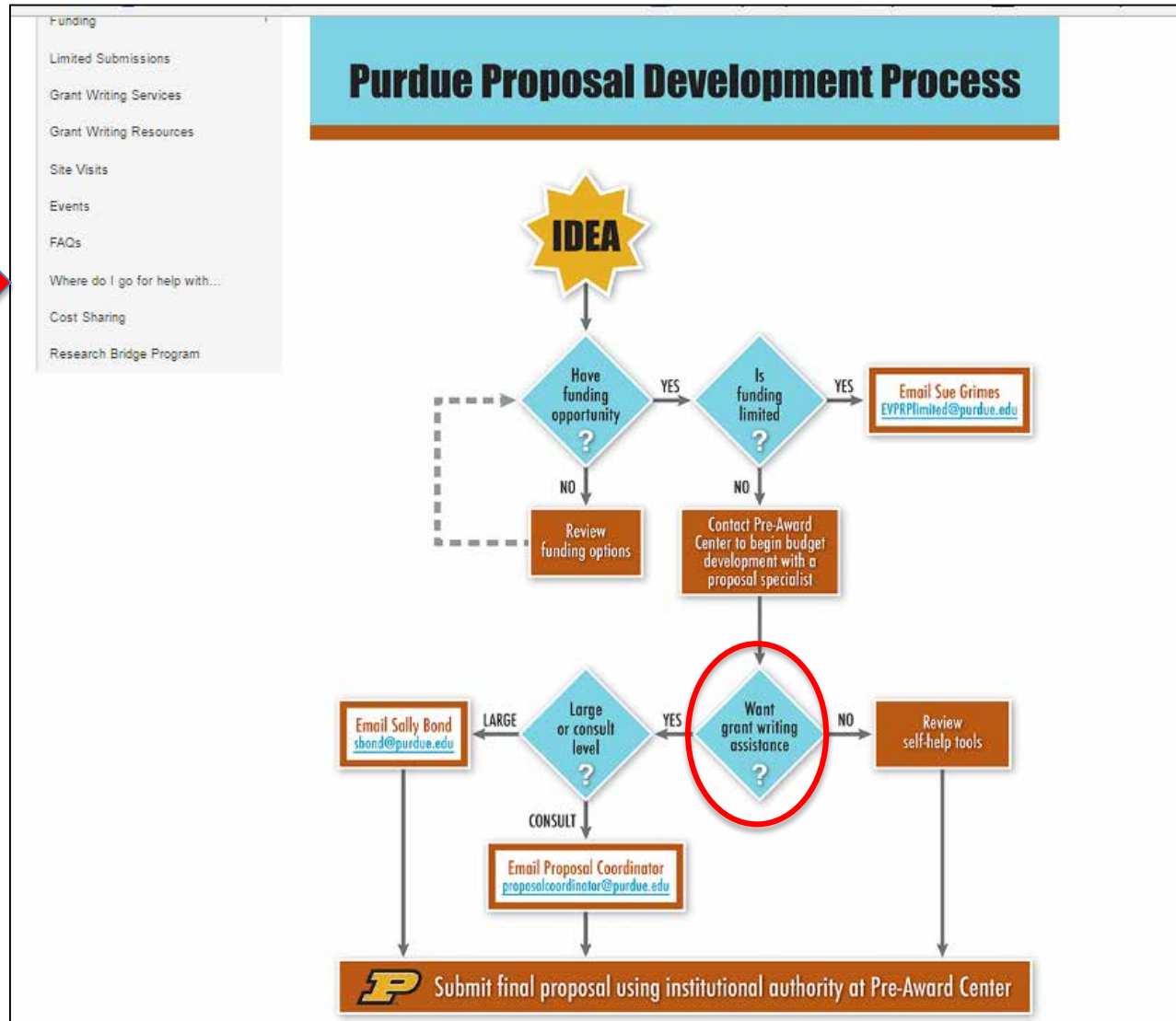
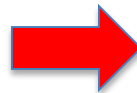
# Where Do I Go for Help with....?

<http://www.purdue.edu/research/funding-and-grant-writing/flow-chart.php>



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<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](mailto:kristynj@purdue.edu)) for one-on-one help.
- **Interested in NIH funding opportunities?**  
Contact Perry Kirkham ([pkirkham@purdue.edu](mailto:pkirkham@purdue.edu)) for NIH-specific guidance.
- **Ready to start budget and authorization?**  
Visit [www.purdue.edu/business/sps/preaward](http://www.purdue.edu/business/sps/preaward).
- **Need a grant writer?**  
Contact Sally Bond ([sbond@purdue.edu](mailto:sbond@purdue.edu)) for larger, multidisciplinary proposal services and [proposalcoordinator@purdue.edu](mailto:proposalcoordinator@purdue.edu) for consultations and assistance on single-investigator proposals.
- **Want an internal review of your proposal before submission?**  
Contact Sally Bond ([sbond@purdue.edu](mailto:sbond@purdue.edu)).
- **Looking for boilerplate text on Purdue resources?**  
Visit our e-Pubs site at <http://docs.lib.purdue.edu/ovpr/>.
- **Planning a site visit from your funding agency?**  
Contact Sue Grimes ([sgrimes@purdue.edu](mailto:sgrimes@purdue.edu)) for logistical help.

**ACCESS THE FUNDING AND GRANT WRITING WEBSITE**  
[www.purdue.edu/research/funding-and-grant-writing/overview.php](http://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.

**PURDUE**  
UNIVERSITY

4/3/2015



**Distinctives...Examples...Process**

# What Makes a Good CAREER Proposal?

Not your typical NSF research proposal

- more “path” than project

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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

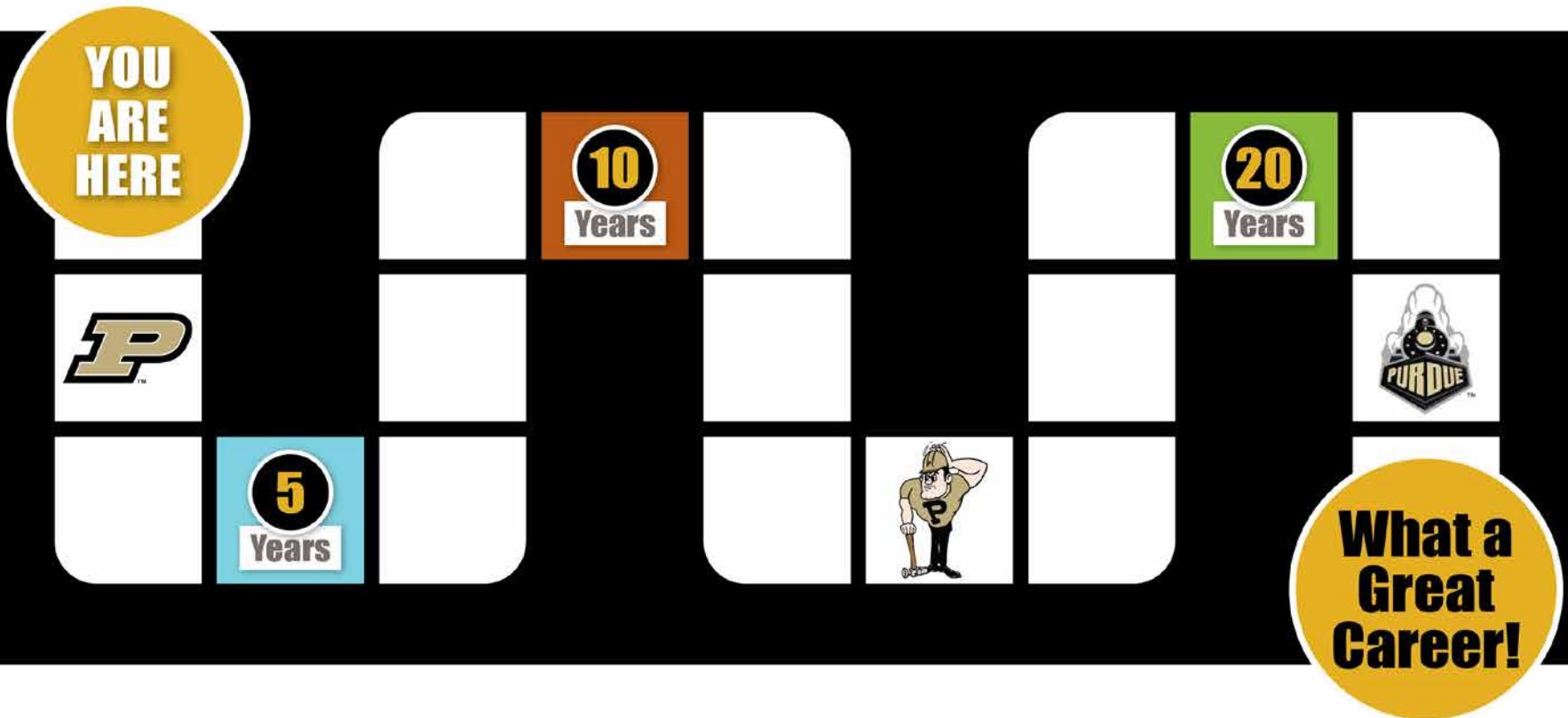
Funds academic career development of new faculty

....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)

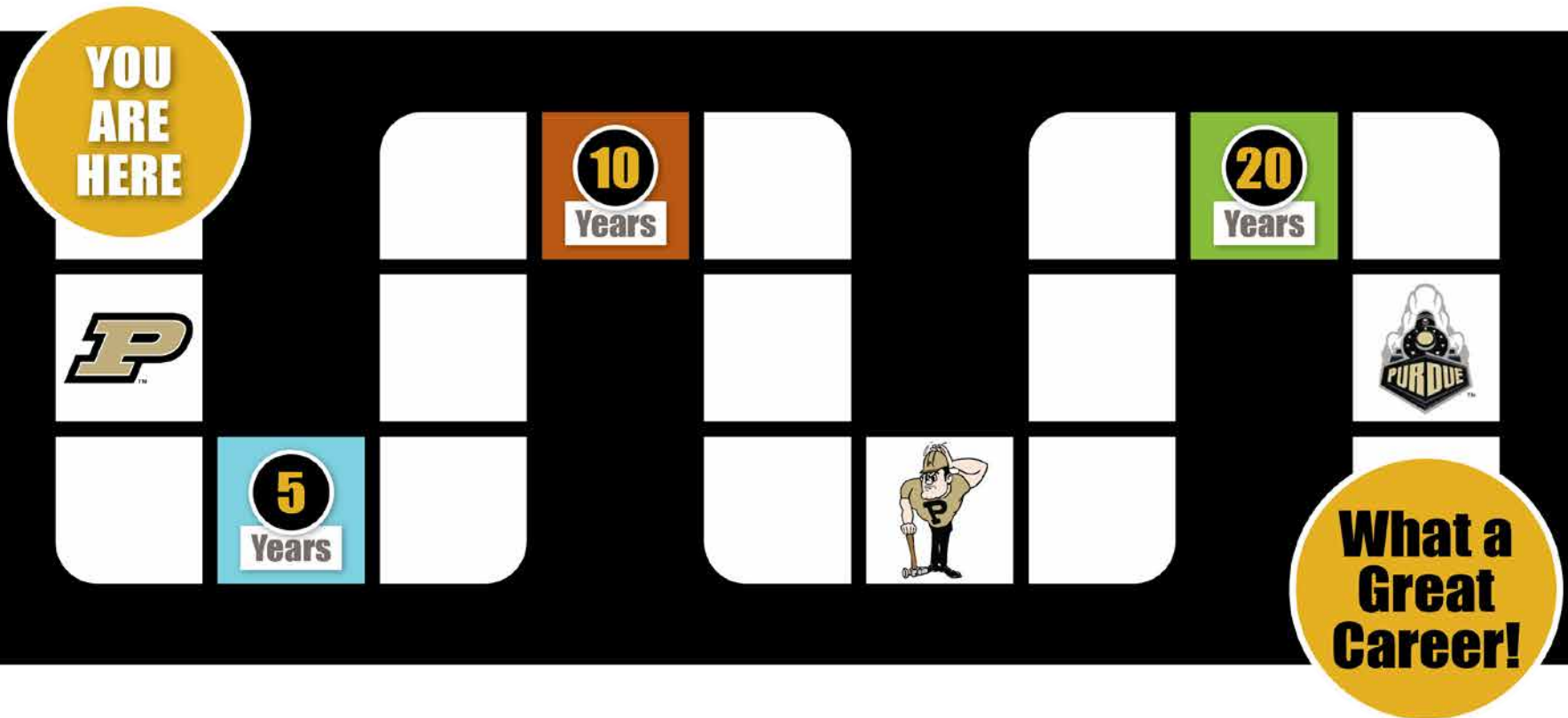
# Research Path Not Project

What is your strategic plan?



# Research Path Not Project

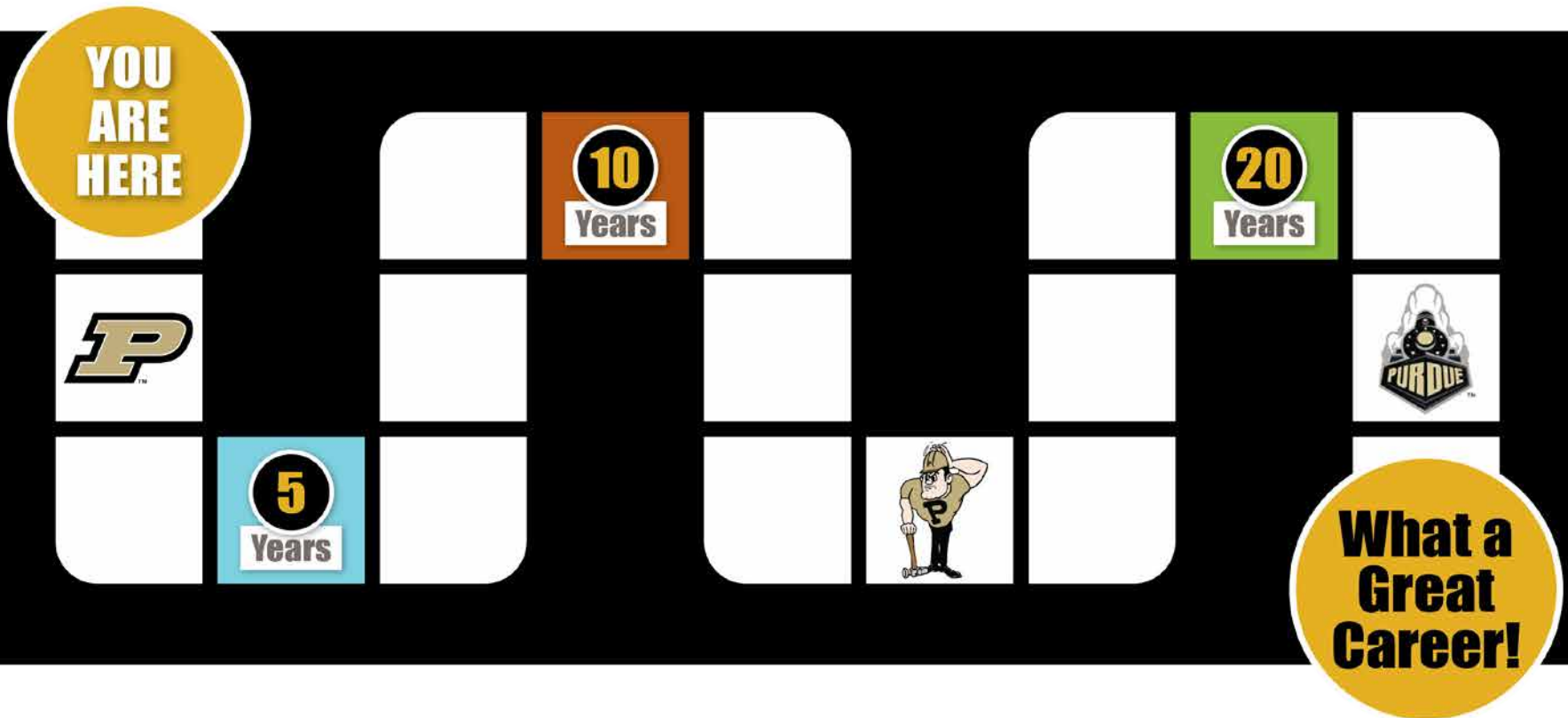
What is your strategic plan?



“All CAREER proposals should describe an integrated path that will lead to a successful career...” (section II in CAREER solicitation)

# Research Path Not Project

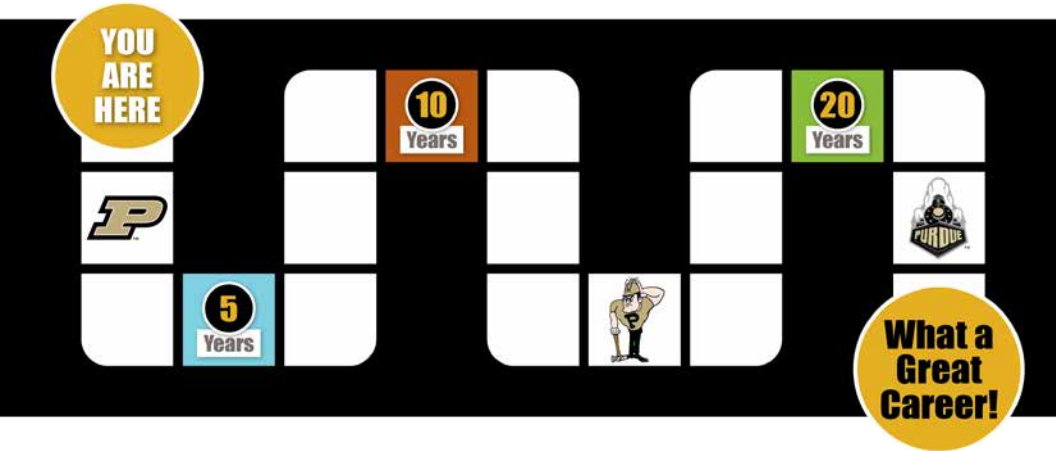
What is your strategic plan?



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?

# Clear Career and Research Goals

## 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

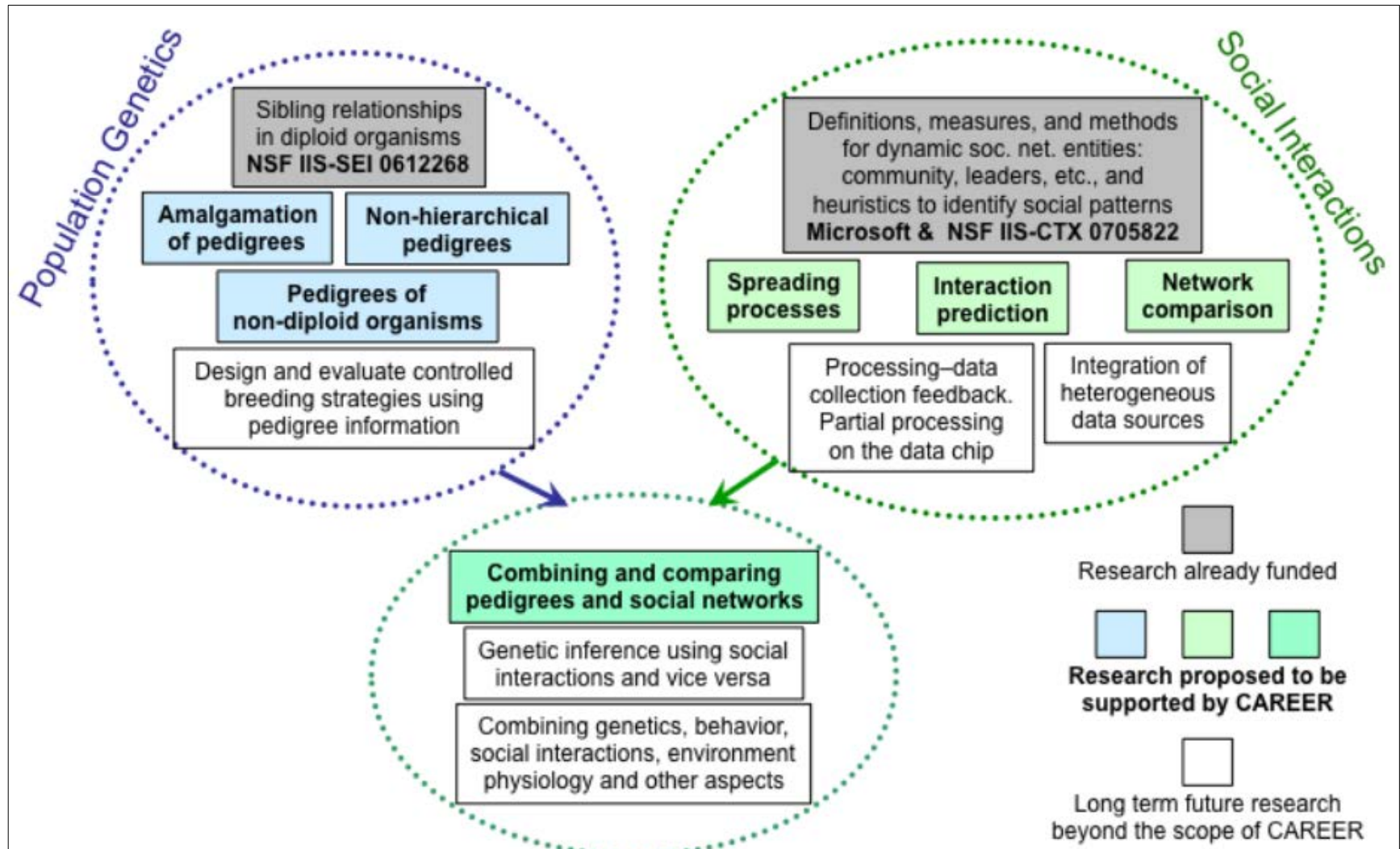
# Vision and Impact

*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



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Oana Malis, Purdue CAREER Awardee  
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# Institutional Fit



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# Transformative Research

Why is this work essential?

- Needs to be solved now?

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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

**Cannot be incremental**

...issues  
...issues/communities will be  
positively impacted by your work?

# Integrating Education and Research



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

- What are you passionate about?

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- 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

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Tips

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☐ Peer reviewed only ☐ Full text available on ERIC

Showing 1 to 15 of 12,232 results [Save](#) | [Export](#)

## PUBLICATION DATE

In 2017	76
Since 2016	768
Since 2013 (last 5 years)	3021
Since 2008 (last 10 years)	6354
Since 1998 (last 20 years)	8399

## DESCRIPTOR

Foreign Countries	2119
High School Students	1934
Student Attitudes	1859
High Schools	1765
Interviews	1576
Academic Achievement	1479
Teaching Methods	1451
Higher Education	1312
Qualitative Research	1245
Teacher Attitudes	1177
Program Effectiveness	1054

[More ▼](#)

## SOURCE

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

[More ▼](#)

## AUTHOR

### [Experiences and Perceptions of STEM Subjects, Careers, and Engagement in STEM Activities among Middle School Students in the Maritime Provinces](#)

Franz-Odendaal, Tamara A.; Blotnicky, Karen; French, Frederick; Joy, Phillip – 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

Peer reviewed

[Direct link](#)

### [Early Undergraduate Research Experiences Lead to Similar Learning Gains for STEM and Non-STEM Undergraduates](#)

Stanford, Jennifer S.; Rocheleau, Suzanne E.; Smith, Kevin P. W.; Mohan, Jaya – Studies in Higher Education, 2017

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

Peer reviewed

[Direct link](#)

### [The Relationships among High School STEM Learning Experiences and Students' Intent to Declare and Declaration of a STEM Major in College](#)

Bottia, Martha Cecilia; 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

Peer reviewed

[Direct link](#)

### [STEM-focused High Schools as a Strategy for Enhancing Readiness for Postsecondary STEM Programs](#)

Means, Barbara; Wang, Haiwen; Young, Viki; Peters, Vanessa L.; Lynch, Sharon J. – Journal of Research in Science Teaching, 2016

The logic underlying inclusive STEM high schools (ISHSs) 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

Peer reviewed

[Direct link](#)

# Evidence-based Education

## ASEE Journal of Engineering Education

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



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### PUBLICATIONS

- ▶ ASEE Publications
  - ▶ Prism
  - ▶ College Profiles
  - ▶ Journal of Engineering Education (JEE)
    - ▶ Editor Search
    - ▶ History of JEE
    - ▶ The Strategic Plan
  - ▶ JEE Partners
  - ▶ Engineering Education Research Networks
  - ▶ Individual Subscriptions
  - ▶ Institutional Subscriptions
- ▶ Advances in Engineering Education (AEE)
- ▶ eGFI - Engineering Go For It! - Magazine & Poster
- ▶ Division Publications
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- ▶ News & Surveys
- ▶ Case Study Series

### 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 in to 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?

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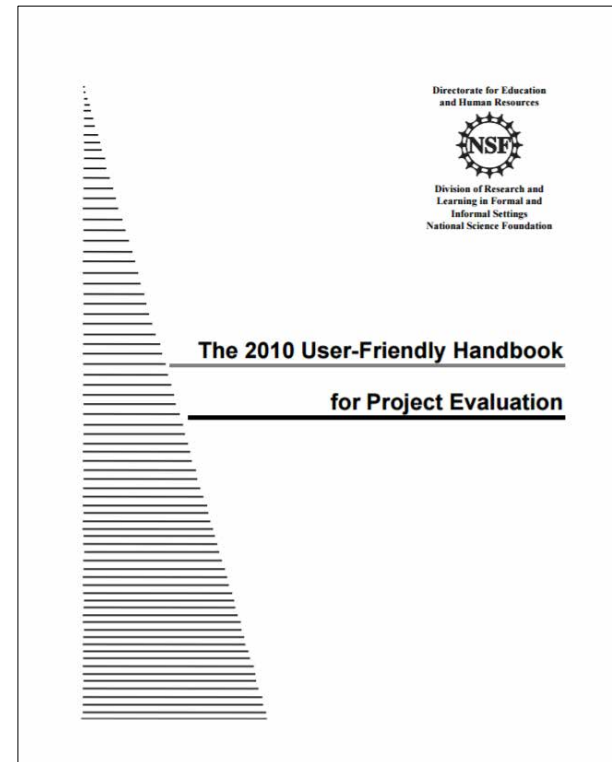
- How will you attract and mentor diverse students?
- Underserved rural areas, disabled, gender diversity, veterans
- Don't quantify
- Can involve teachers recruited from schools with particular demographics

# Integrating Education and Research

You MUST assess educational initiatives



*W.K. Kellogg Foundation  
Logic Model Development Guide*



Logic model helpful to develop even if not included in proposal

A large, solid gray arrow pointing to the right, spanning the width of the grid. It is positioned horizontally across the middle of the grid, starting from the left edge and ending at the right edge. The arrow has a rectangular body and a triangular head. The grid lines are visible through the arrow, indicating its position relative to the grid.

# 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's 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,*

# 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

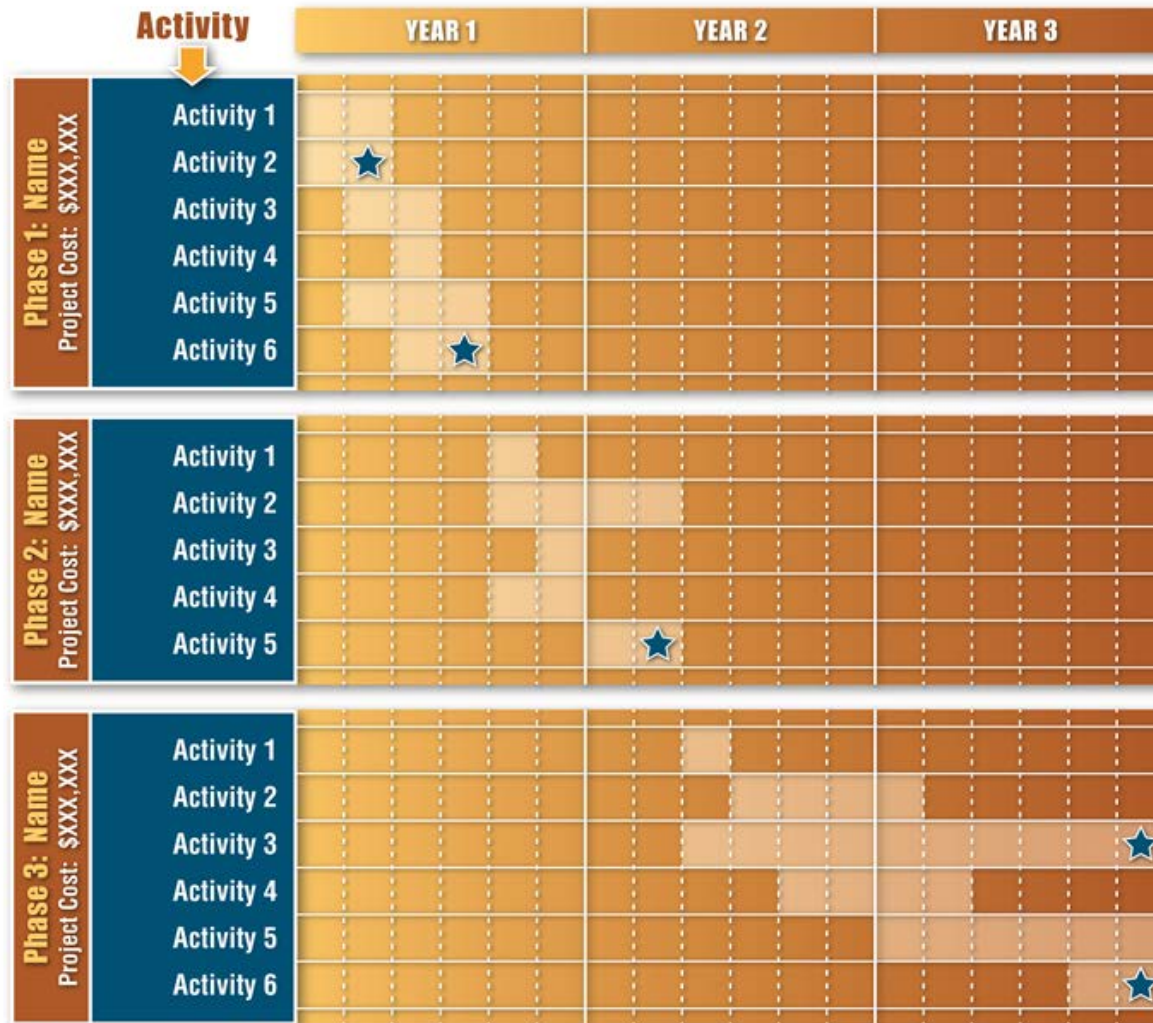
## Use a unified schedule

	Semester	Research Plan	Educational Plan
Year 1	Spring'12	<ul style="list-style-type: none"> <li>Detailed planning of the data collection and data analysis</li> <li>Train graduate and undergraduate students in data collection &amp; analysis.</li> <li>Pilot data collection in the ELO lab (complete 10 interviews &amp; verbal protocols)</li> </ul>	
	Summer' 12	<ul style="list-style-type: none"> <li>Analyze pilot data</li> <li>Refine and finalize coding protocols</li> <li>Refine procedures for data preparation for analysis: editing, chunking, etc.</li> </ul>	<ul style="list-style-type: none"> <li>Develop assessment tools, such as rubrics, for classroom use.</li> </ul>
	Fall'13	<ul style="list-style-type: none"> <li>Contact engineering faculty to recruit additional participants</li> <li>Recruit student participants</li> <li>Start data collection</li> </ul>	<ul style="list-style-type: none"> <li>Develop short course activities on innovation.</li> </ul>
Year 2	Spring'13	<ul style="list-style-type: none"> <li>Continue data collection (complete 75 interviews &amp; verbal protocols with senior engineering students)</li> <li>Data preparation, editing, and coding.</li> </ul>	<ul style="list-style-type: none"> <li>Develop an innovation-focused teacher professional development module for PBS Teacher Line</li> </ul>
	Summer'13	<ul style="list-style-type: none"> <li>Data analysis (coding)</li> <li>Develop case studies</li> <li>Present findings at ASEE</li> </ul>	<ul style="list-style-type: none"> <li>K-12 teacher professional development as part of SLED and INSPIRE</li> </ul>
	Fall'13	<ul style="list-style-type: none"> <li>Present findings at FIE</li> <li>Data analysis (frequency calculations)</li> </ul>	<ul style="list-style-type: none"> <li>Present findings at the industry advisory board</li> </ul>
Year 3	Spring'14	<ul style="list-style-type: none"> <li>Continue data collection (complete 75 interviews &amp; verbal protocols with senior engineering students)</li> <li>Submit conference proposals on preliminary findings</li> <li>Present findings at NCIIA</li> </ul>	<ul style="list-style-type: none"> <li>NCIIA faculty workshop</li> <li>Analyze pilot first-year engineering survey data</li> </ul>
	Summer'14	<ul style="list-style-type: none"> <li>Data analysis (case studies)</li> <li>Submit a journal manuscript to JEE</li> </ul>	<ul style="list-style-type: none"> <li>Develop a graduate course on innovation and research methods</li> </ul>

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



# Plan of Action

## Proposal Preparation Timeline

**CAREER 2018 Proposal Preparation Timeline** \* Red denotes must do this before writing any proposal text

	Mon 4/23	Mon 4/30	Mon 5/7	Mon 5/14	Mon 5/21	Mon 5/28	Mon 6/4	Mon 6/11	Mon 6/18	Mon 6/25	Mon 7/2	Mon 7/9	Fri 7/13	Mon 7/16	Thu 7/18
<b>Analysis and Planning</b>															
Read abstracts of funded CAREERS for directorate/division fit															
Notify Pre-Award Center for assigned specialist															
<b>Storyline Development</b>															
• 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?															
Map out long-term pathway and vision															
Research and education goals															
Identify win themes/discriminators															
<b>Program Officer Input</b>															
Draft one-pager for PO															
One-pager reviewed internally															
Identify appropriate program / PO															
If you have international component, contact relevant country program officer to discuss															
Email one-pager to PO/ request appt															
Revise storyline based on PO feedback															
<b>Proposed Outline</b>															
Develop detailed outline															
Identify graphics needed															
<b>Partnerships</b>															
Recruit any collaborators, if needed															
Recruit advisory board members, if needed															
Identify assessment partner, if needed															
Collect any letters of collaboration (required TEMPLATE)															
Request department head about letter															
<b>Proposal Writing and Editing</b>															
Develop NSF bio to reflect research & education															
Use outline to write sections															
Edit															
Internal review of near final draft															
Revise based on review															
Write data management plan															

# Search Awards by CAREER Code 1045



National Science Foundation  
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## Awards Advanced Search

### [Overview of Award Search Features](#)

Awardee Information	
<input type="text" value="Principal Investigator First Name"/>	<input type="text" value="Organization"/>
<input type="text" value="Principal Investigator Last Name"/>	<input type="text" value="State"/> Select one
<input type="checkbox"/> Include Co-Principal Investigator in name search	<input type="text" value="Zip Code"/>
	<input type="text" value="Country"/> Select one

Program Information	
<input type="text" value="NSF Organization"/> Select one	<b>HINT:</b> The "Program" box searches both program element and program reference names and codes.
<input type="text" value="Element Code"/>	<input type="text" value="Program"/> *chem
<input type="radio"/> Any <input checked="" type="radio"/> All	
<input type="text" value="Reference Code"/> 1045	<input type="text" value="Program Officer"/>
<input type="radio"/> Any <input checked="" type="radio"/> All	

# Choose Directorate



National Science Foundation  
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## Awards Advanced Search

**Principal Investigator First Name**

**Principal Investigator Last Name**

☐ **Include Co-Principal Investigator in name search**

**NSF Organization**

- DBI - Division Of Biological Infrastructure
- DEB - Division Of Environmental Biology
- DFM - Division Of Financial Management
- DGA - Division Of Grants and Agreements
- DGE - Division Of Graduate Education
- DIAS - Division of Institution & Award Support
- DIS - Division Of Information Systems
- DMR - Division Of Materials Research
- DMS - Division Of Mathematical Sciences
- DOB - Budget Division
- DRL - Division Of Research On Learning
- DUE - Division Of Undergraduate Education
- EAR - Division Of Earth Sciences
- ECCS - Div Of Electrical, Commun & Cyber Sys
- EEC - Div Of Engineering Education and Centers
- EF - Emerging Frontiers
- EFMA - Emerging Frontiers & Multidisciplinary Activities
- EHR - Direct For Education and Human Resources
- ENG - Directorate For Engineering**

ENG - Directorate For Engineering ▼

**Element Code**

☐ Any ☒ All

**Reference Code**

1045

☐ Any ☒ All

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

**Program**

\*chem

**Program Officer**

**Additional Information**

**Keyword**

**HINT:** Data prior to 1976 may be less complete.

# Or Search by CAREER and Programs

Awardee Information	
<input type="text" value="Principal Investigator First Name"/>	<input type="text" value="Organization"/>
<input type="text" value="Principal Investigator Last Name"/>	<input type="text" value="State Select one"/>
<input type="checkbox"/> Include Co-Principal Investigator in name search	<input type="text" value="Zip Code"/>
	<input type="text" value="Country Select one"/>

Program Information	
<input type="text" value="NSF Organization Select one"/>	<b>HINT:</b> The "Program" box searches both program element and program reference names and codes.
<input type="text" value="Element Code 7909"/>	<input type="text" value="Program"/>
<input type="radio"/> Any <input checked="" type="radio"/> All	
<input type="text" value="Reference Code 1045"/>	<input type="text" value="Program Officer"/>
<input type="radio"/> Any <input checked="" type="radio"/> All	

# Sorted by Start Date



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Email this Link | Export All Results

Sort By: Start Date Results size: 30 per page

Page 31 of 31

Displaying 901 - 930 of 930

Table | List

You Searched For:

NSF Organization Directorate For Engineering

Reference Code 1045

Active Awards true

Refined by

Refine Search

State

Alaska(1)

Alabama(9)

Arkansas(4)

Arizona(18)

California(80)

Show More ...

Award Amount

Less than or equal \$50,000(4)

Between \$50,001 - \$100,000(8)

Between \$100,001 - \$500,000(479)

Between \$500,001 - \$1,000,000(439)

Award Instrument

Standard Grant(834)

Continuing Grant(96)

**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:\$500,000.00; 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

# Abstracts +



## Award Abstract #1651645

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

<b>NSF Org:</b>	<a href="#">CBET</a> <a href="#">Div Of Chem, Bioeng, Env, &amp; Transp Sys</a>
<b>Initial Amendment Date:</b>	February 23, 2017
<b>Latest Amendment Date:</b>	February 23, 2017
<b>Award Number:</b>	1651645
<b>Award Instrument:</b>	Standard Grant
<b>Program Manager:</b>	Michele Grimm CBET Div Of Chem, Bioeng, Env, & Transp Sys ENG Directorate For Engineering
<b>Start Date:</b>	July 1, 2017
<b>End Date:</b>	June 30, 2022 (Estimated)
<b>Awarded Amount to Date:</b>	\$540,609.00
<b>Investigator(s):</b>	Randolph Ashton rashton2@wisc.edu (Principal Investigator)
<b>Sponsor:</b>	University of Wisconsin-Madison 21 North Park Street MADISON, WI 53715-1218 (608)262-3822
<b>NSF Program(s):</b>	BIOMEDICAL ENGINEERING
<b>Program Reference Code(s):</b>	1045, 8091, 9102

# Abstract+

PI: Ashton, Randolph S.

Proposal #: 1651645

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 questionably relevant animal studies. 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 education and outreach plan includes: 1) development of a comprehensive "Stem cell-based Tissue Engineering & Morphogenesis (STEM) BME courses and middle and high school findings, 2) outreach programs design students, including at elementary and creation of a live "Building a Human Spinal Cord" and tissue engineering research.

This project will use innovative culture for reproducibly engineering human spinal cord organoids with simplified tissue morphological objectives with related hypotheses: 1) neural tube (PNT) tissue structure--The morphology at developmental length tested using a novel molding technology engineer annular tubes of polarized, biomimetic of early PNT structure, 2) Engineering (D/V) cytoarchitecture mimetic of spinal exogenous morphogen gradients can composition and tissue cytoarchitecture "Stamp-On" microfluidics to generate whether they can recapitulate D/V pattern cytoarchitecture within cylindrical hPSC organoids with rostrocaudal (R/C) cytoarchitecture--The hypothesis that directed formation of biomimetic neural will be tested by using organoids generated from cervical, thoracic, and lumbar hPSCs and testing whether their directed assembly yields a composite spinal cord organoid with biomimetic R/C tissue cytoarchitecture and functional neuronal circuitry. The 4th objective is to promote development of a diverse workforce for future hPSC-based tissue engineering industries by integrating a multifaceted approach for inspiring and educating the general public and students, especially underrepresented minorities. Though Human PSC-derived organoids possess tremendous possibilities for modeling human biology and physiology, their utility is limited by a lack of control over their spontaneous morphogenesis processes, which produces random organoid structure and composition. Using a spinal cord organoid exemplar, this project will develop novel tools and methodologies for engineering human organoid morphogenesis at the micro-to-millimeter scale. Instructing reproducible ex vivo morphogenesis at this scale is critical for developing advanced biomanufacturing processes to produce functional, biomimetic tissues and organs. Engineering parameters identified as critical to instructing emergence of biomimetic 3-D spinal organoids could elucidate broadly applicable morphogenesis engineering principles and provide new insights into CNS development and disease. The tools and knowledge generated will significantly advance scientists' ability to engineer biomimetic human tissues, specifically providing the most humanoid experimental platform to date for investigating degenerative spinal cord diseases and traumatic injury. The proposed tools and methods are designed for simplicity, thus can be broadly disseminated and implemented for engineer human organoids. Captivating data and explanations of human organoid morphogenesis will be curated as an online educational resource and introduced to the general public and students to promote political support, interests, and workforce development.

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.

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# Plan of Action

## Proposal Preparation Timeline

**CAREER 2018 Proposal Preparation Timeline** \* Red denotes must do this before writing any proposal text

	Mon 4/23	Mon 4/30	Mon 5/7	Mon 5/14	Mon 5/21	Mon 5/28	Mon 6/4	Mon 6/11	Mon 6/18	Mon 6/25	Mon 7/2	Mon 7/9	Fri 7/13	Mon 7/16	Thu 7/18
<b>Analysis and Planning</b>															
Read abstracts of funded CAREERS for directorate/division fit															
Notify Pre-Award Center for assigned specialist															
<b>Storyline Development</b>															
• 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?															
Map out long-term pathway and vision															
Research and education goals															
Identify win themes/discriminators															
<b>Program Officer Input</b>															
Draft one-pager for PO															
One-pager reviewed internally															
Identify appropriate program / PO															
If you have international component, contact relevant country program officer to discuss															
Email one-pager to PO/ request appt															
Revise storyline based on PO feedback															
<b>Proposed Outline</b>															
Develop detailed outline															
Identify graphics needed															
<b>Partnerships</b>															
Recruit any collaborators, if needed															
Recruit advisory board members, if needed															
Identify assessment partner, if needed															
Collect any letters of collaboration (required TEMPLATE)															
Request department head about letter															
<b>Proposal Writing and Editing</b>															
Develop NSF bio to reflect research & education															
Use outline to write sections															
Edit															
Internal review of near final draft															
Revise based on review															
Write data management plan															

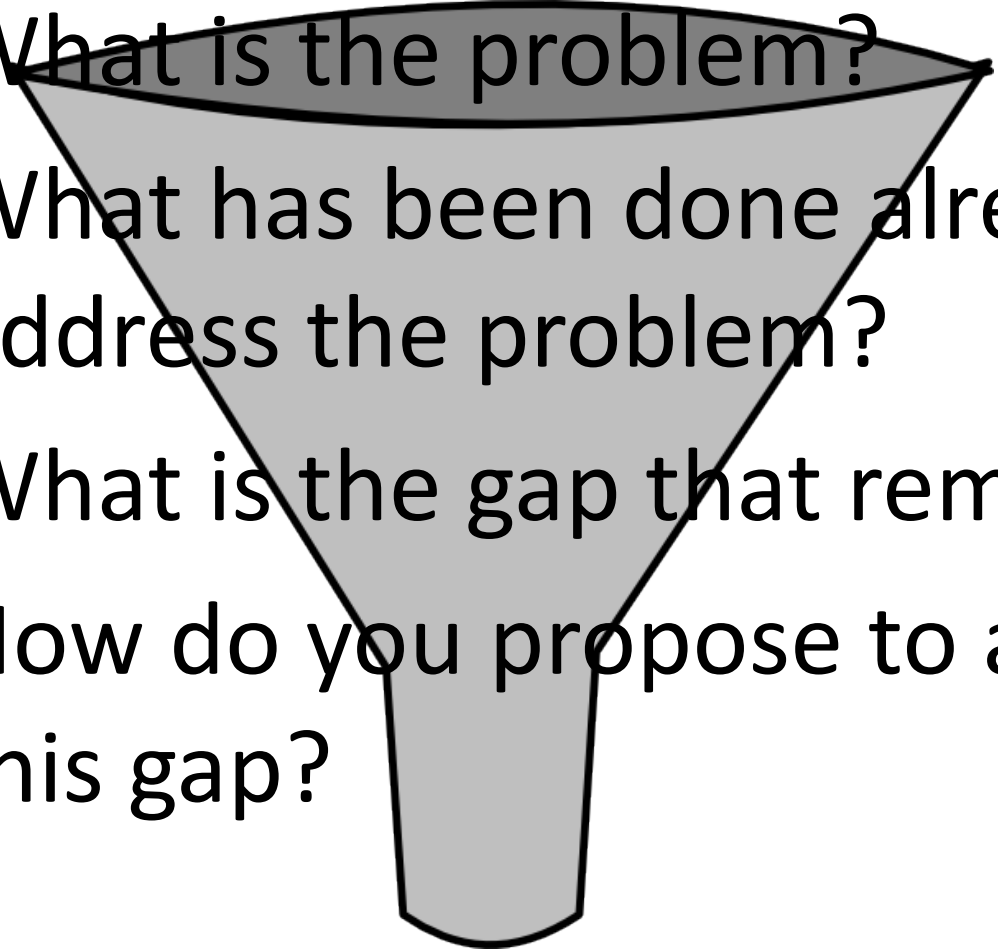
# Tell a Compelling Story

## 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?

# Tell a Compelling Story

Where? Very first part of your introduction.

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.

# Tell a Compelling Story

Sets up the logical flow and significance for your proposal. Hooks reviewer.

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<sup>62</sup>

# Storyline is Basis for P0 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

Ad hoc +/- Panel	Mostly Panel
GEO	ENG
BIO	CISE
SBE	HER
MPS: DHE, DMR	MPS: AST, DMS

# 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 10points or larger; Times New Roman at 11point or larger.
- No ~~urls~~ 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/rschdev/proposal\\_prep\\_resources.php](https://www.purdue.edu/research/vpr/rschdev/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

Complete Collaborators and Other Affiliations Spreadsheet															
Write postdoc mentoring plan, if needed															
Write budget justification															
Write facilities document (use epubs)															
Write one-page summary															
Final check of references															
Final budget, justification, and draft narrative due to PreAward															
Submit all documents except narrative															
Submit project narrative															

# Submitting

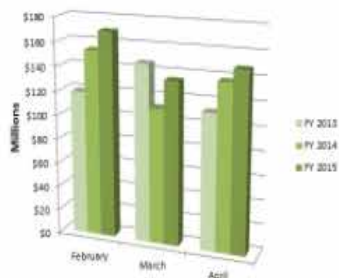
Follow PreAward deadlines at the minimum!

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## Proposal Submissions



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Research at Pur...

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## 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

West Lafayette Campus only, for regional campus, please click here

EIN: 35-6002041

DUNS: 072051394

Cage/NCAGE Code: 6D418

Cognizant Federal Agency:

DHHS, Matthew Dito, 214-767-3261

F&A Rate

Mailing Address  
155 S Grant Street  
West Lafayette, IN 47907-2114

Need More

# Follow PreAward Deadlines as Minimum

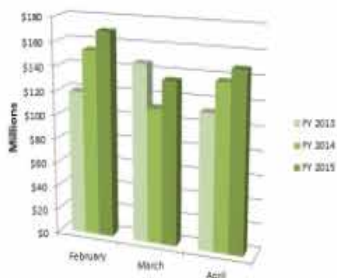
<https://www.purdue.edu/business/sps/preaward/>

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## Proposal Submissions



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## 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
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Need More

# 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

Table B: List names as Last Name, First Name Middle Initial, and provide organizational affiliations, if known, for the following.

Name	Organizational Affiliation	Optional (email, Department)
Frost, Jack	North Pole University	
	Moon State University (adjunct)	5/15/2020
	University of South Pole (interviewed)	6/15/2016

Table C: List names as Last Name, First Name, Middle Initial, and provide organizational affiliations, if known, for the following.

Name	Organizational Affiliation	Optional (email, Department)	Last Active
Cloud, Cirrus O.	Northeastern Dakota State	Aero/Astro Dept	12/1/14
Zephyr, Chill	Northeastern Dakota State		7/8/05
Dew, Morning A.	Northern Star State		8/1/16
Frost, Jill J.	Moon State Univ	jill@cs.nome.edu	

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

# NSF Top Ten Mistakes

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

# NSF Top Ten Mistakes

## 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/>

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UNIVERSITY

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

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UNIVERSITY

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**LIBRARIES**  
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[Next](#) >



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### Discovery Park General Facilities Description

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**Candiss Vibbert**, *Purdue University*  
**Purdue University Office of the Vice President for Research**

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<http://docs.lib.purdue.edu/genDES/2>

**Date of this Version**  
2-21-2014

# Key Online Resources

Virtual Rolodex for broader impact partners at Purdue

<http://catalog.e-digitalitions.com/i/256966-256966-edoutreachpart37>

**Education and Outreach Partners at Purdue Index**

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Center for Innovation through Visualization and Simulation (CIVS)  
Certificate in Entrepreneurship and Innovation Program  
Computer Science K-12 Outreach  
Confucius Institute at Purdue (CIP)  
Data Management Planning and Consulting  
DiaGrid – a resource for research, education, training and outreach  
Discovery Learning Research Center  
Duke Energy Academy at Purdue (DEAP)  
Engineering Projects in Community Service  
Entrepreneurial Leadership Academy  
Envision Center  
Extended Campus-Distance/Online Learning  
Fat Dogs and Coughing Horses  
Gifted Education Resource Institute (GERI)  
HUBzero – Platform for Scientific Collaboration  
Indiana 4-H Youth Development Program  
Institute for Accessible Science (IAS)  
Institute for P-12 Engineering Research and Learning (INSPIRE)  
Life Science Education Signature Area  
Minority Engineering Program

Purdue AgComm Traveling Exhibit  
Purdue Agriculture PK-12 Council  
Purdue Alliance for Graduate Education  
Purdue Extended Campus-Conference  
Purdue Mathematics K-12 Outreach  
Purdue NExT  
Purdue Science K-12 Outreach  
Purdue University Office of Marketing  
Purdue zipTrips  
Science Express  
Studio at Purdue  
Technical Assistance Program  
The Education Store for Purdue Extension  
The Foundry  
Veteran's Success Center  
Women in Engineering Program

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**HUBzero – Platform for Scientific Collaboration**

**Contact Information**  
Michael McLennan  
mmclenna@purdue.edu

**Program Mission**  
To create web sites or “hubs” for scientific collaboration, research, and education that support science and engineering.  
<http://hubzero.org/>

**How Can We Partner on Your Proposal**  
Nearly 30 HUBzero “science gateway” web sites together have served more than 750,000 unique visitors during the past 12 months. HUBzero can partner with you to help researchers:

- generate graphical user interfaces with integrated visualization capabilities accessible on an ordinary browser
- create and publish datasets and interactive simulation tools
- develop and make accessible seminars, tutorials, teaching materials, and other supporting resources
- develop relational databases with tools for data mining

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# CAREER Resource Websites

## NSF Program Officer Contacts by Divisions

<http://www.nsf.gov/crssprgm/career/contacts.jsp>

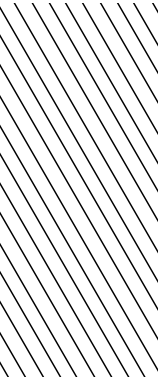
## CAREER FAQs

[https://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=nsf17050](https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf17050)

## Mock Review Panel for CAREER

<http://www.nsf.gov/eng/cbet/multimedia/webinar.jsp>





# Questions?