About CAREER Awards

- Purpose is career development
  - NSF’s most prestigious award in support of junior faculty
  - All proposals must have a creative and integrated research and education plan at their core
- NSF’s Presidential Early-Career Awards in Science & Engineering (PECASE) are selected from recent CAREER awardees
Success Rate

Source: NSF

Purdue Success Rates

*to date
Who Can Apply?

- Eligibility
  - Must hold a doctoral degree by July deadline
  - As of October 1, have appointment as a tenure-track assistant professor; but not tenured
  - No more than two previous attempts
  - No previous CAREER awards

Deadlines for 2015

- July 21
  - Biological Sciences (BIO)
  - Computer & Information Science & Engineering (CISE)
  - Education & Human Resources (EHR)
- July 22
  - Engineering (ENG)
- July 23
  - Geosciences (GEO)
  - Mathematics & Physical Sciences (MPS)
  - Social, Behavioral & Economic Sciences (SBE)
Awards

- Minimum of $400,000 over five years for most directorates
- Minimum of $500,000 for ENG, BIO and PLR
- Most directorates prefer to fund close to these minimums
  - Talk to program manager (see handout)
  - Review previously funded projects
- Supplements
  - Career-Life Balance
  - European Research Council & German DFG (talk to your program manager)
  - Research Experiences for Undergraduates (REU)

Allowable Expenses

- Salary support only for PI as senior personnel
- Can include funds for postdocs, grad students, undergrads, summer salary, education & outreach activities, travel, evaluators, and consultants
- Additional funding available for equipment/instrumentation (See GPG II.C.2.g.iii)
- Include F&A (55%)
Ready to Apply?

- Best time to apply is after first year
- Do you have current integrating research and education experience that you can build on for your proposal?
- Have you discussed your idea with a program manager?
- Is your department supportive?

Department Letter

- Two pages max
- Outlines the following:
  - The PI’s project is supported by and integrated into the organization’s/ department’s research and education goals
  - CAREER project matches PI’s goals and job responsibilities as well as department’s commitment to mentoring for PI’s for career development
  - Affirmation of PI’s eligibility
Results

- Most applicants will hear back within six months of the submission deadline
- Some divisions will make awards up to the next round

For Assistance

- Read the RFP and the Proposal and Award Policies and Procedures Guide (especially Part 1 – Grant Proposal Guide)
- EVPRP Proposal Coordinators – help with proposal planning and grant writing
- Discovery Learning Research Center – help with idea development, space & facilities, evaluation & assessment planning
- Purdue University Research Repository (PURR) – help with data management plans
- Research Integrity & Regulatory Affairs – help with IRB or IACUC approvals (start early!)
Not Successful?

- Try, try again...
- You can submit to CAREER up to three times
- Subsequent submissions have a better chance of being funded
- Get reviews, carefully consider the comments, and make appropriate revisions
- Ask others to review your proposal
- Make revisions while information is still fresh in your mind

Questions?
NSF CAREER Proposal Preparation
April 2015

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

[Image of a webpage from Purdue University focused on research and partnerships]

Shaping up to fight
targeted at diseases and disorders of the bone, joint, and soft tissue.
What Makes a Good CAREER Proposal?

In some ways, not your typical NSF proposal

• more “path” than project
• must fit with institution too
• transformative research
• strong emphasis on integrating innovative 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.”
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.”

Research Path Not Project
What is your strategic plan?

YOU ARE HERE

10 Years

20 Years

5 Years

What a Great Career!
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
Research Path Not Project

Your CAREER should position you to make an impact on a larger scale

• a stepping stone to your long-term professional goals
• compatible with Purdue University institutional goals
• a significant contribution to society

Research Path Not Project

Think blue skies. Balance doable vs risky.

• 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?
**Research Path Not Project**

**Career as well as research goal should be clear**

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

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**Research Path Not Project**

**Sample vision**

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)
Research Path Not Project

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

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

Research Path Not Project

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

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
Fit with Purdue Goals
Be explicit...how does it fit your college, school, or department?

University X is a major, urban research institution with over xx% doctoral students who are either Latino or African-American. The College of Biology at X states that diversity is a core value in the 2015 College Strategic Plan and names bioinformatics and big data as key research strengths. My interdisciplinary track record in computational biology and educational outreach aligns with the goals of my department, college, and university. I will leverage my cross-campus collaborations with faculty in biotechnology, computer science, statistics, public health, and bioinformatics. Professor Susan Catalfamo, director of NSF-funded Center for Analytics and Simulation, based in my department, will serve on my CAREER advisory board.

Transformative Research
Why is this work essential?

- Be convincing as to why the problem needs to be solved
- Says who?
- What are the facts and figures of how much this is costing the country/industry/communities?
- What industries/communities will be positively impacted by your work?
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! Leverage existing successful Purdue programs
• Do not need to be an educational researcher but must show initiatives based on best practices
• Include “vanilla” and creative initiatives

Integrating Education and Research

Address diversity but be authentic

• How will you attract and mentor diverse students?
• Diversity can include underserved rural areas or gender diversity (e.g. women in computer science)
• Can involve teachers recruited from schools with particular demographics
Integrating Education and Research

Assessment is essential.

- Read evaluation resources in RFP
- Leverage assessment expertise at Purdue
  - Discovery Learning Research Center
  - Center for Instructional Excellence
- Consider budget for assessment

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**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 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 Daval-Conceil (Director, Certificate in Entrepreneurship and Innovation Program, Associate Director, Burton Morgan Center for Entrepreneurship): Dr. Daval-Conceil 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. Daval-Conceil 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

### Use a unified schedule

<table>
<thead>
<tr>
<th>Semester</th>
<th>Research Plan</th>
<th>Educational Plan</th>
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<tbody>
<tr>
<td><strong>Year 1</strong></td>
<td></td>
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<tr>
<td>Spring 12</td>
<td>Detailed planning of the data collection and data analysis</td>
<td>Develop assessment tools, such as rubrics, for classroom use.</td>
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<td>Data graduate and undergraduate students in data collection and analysis</td>
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<td>Pilot data collection in the RED lab (complete 10 interviews &amp; verbal protocols)</td>
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<tr>
<td>Summer 12</td>
<td>Conduct pilot data</td>
<td>Develop short course activities on innovation.</td>
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<td>Refine and finalize coding protocols</td>
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<td>Refine procedures for data preparation for analysis, editing, coding, etc.</td>
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<tr>
<td>Fall 13</td>
<td>Contact engineering faculty to recruit additional participants</td>
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<td>Recruit enrolled participants</td>
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<td>Start data collection</td>
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<td><strong>Year 2</strong></td>
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<tr>
<td>Summer 13</td>
<td>Continue data collection (complete 75 interviews &amp; verbal protocols with senior engineering students)</td>
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<td>Data preparation, editing, and coding</td>
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<td>Data analysis (coding)</td>
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<td>Develop case studies</td>
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<td>Present findings at ACE</td>
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<td>Present findings at PIES</td>
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<td>Present findings at INEED</td>
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<td></td>
<td>Data analysis (frequency calculations)</td>
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<td>Present findings at INEED</td>
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<td>Submit conference proposals on preliminary findings</td>
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<td>Submit findings at INEED</td>
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<td>Develop an innovation-focused teacher professional development module for PBIS Teacher Line</td>
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<td>Fall 13</td>
<td>Continue data collection (complete 75 interviews &amp; verbal protocols)</td>
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<td>Submit conference proposals on preliminary findings</td>
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<td></td>
<td>Present findings at INED</td>
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<td>Data analysis (next semester)</td>
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<td>Submit a final manuscript to IEEE</td>
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**Senay Purzer, 2012 Purdue CAREER Awardee**

Assistant Professor of Engineering Education

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### Integrating Education and Research

If interested, contact **sbond@purdue.edu** for help with timeline graphic.
## Plan of Action

### Proposal Preparation Timeline

<table>
<thead>
<tr>
<th>WEEK</th>
<th>MONDAY</th>
<th>TUESDAY</th>
<th>WEDNESDAY</th>
<th>THURSDAY</th>
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**Notes:**
- **Red:** High priority tasks.
- **Yellow:** Medium priority tasks.
- **Green:** Low priority tasks.
- **Gray:** Not applicable or needs further clarification.
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. Senay Purzer, Assistant Professor of Engineering Education

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 Awarded
Storyline is Basis for PO Discussion

Create a one-page brief

**One-page** project description sent to program officer that 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

- Develop one-page document
  - review draft internally
  - email to PO to request conversation
- RFP has link for contact list
- Read CAREER summaries on [www.nsf.gov](http://www.nsf.gov)
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? (Don’t ask if NSF is interested in your topic)
2. Is this the right scope?
3. What is the typical award size in this program?
4. What type of review? Ad Hoc and/or Panel?

Outline before Writing

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

Possible Outline for CAREER Project Description

- Title 4-5 pages
  - Use “I” instead of “we” or “one” because this is about YOUR path. (However, one-page summary is requested to be third-person)
  - 1 page summary

- 1st paragraph
  - Answer: 1-2 pages
  - Focus: 1 page

- Maximum of 6 pages
  - Make your proposal easy to read: Use high-quality, legible type on white or light-colored paper.

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

Significance and Rationale (1-4 pages)

- Compelling narrative that motivates 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 pursuing novel work, rather than incremental
  - State both research and educational goals
  - Concisely state what will be the impact on the field when you are successful with your proposed CAREER

Background (1-4 pages)

- This is not a literature review for your dissertation. This is a key reference of what has been done already to address this problem
- Can include your relevant preliminary studies within this section or leave separate section

Preliminary Data

- Can include your preliminary data within this section or leave separate section

Research Plan

- Complete step-by-step (including major milestones)

- Be clear about your research plan:
  - What are your major milestones?
  - What is your timeline?
  - What are your expected outcomes?
Compliance Check
Read NSF Grant Proposal Guide as well as RFP

NSF returns many CAREERs without Review
  • Submit within window
  • Include all required items, e.g. department chair letter
  • Font, margin, page count meet GPG
  • Budget in allowable range
  • No Co-PIs
  • No unauthorized documents, e.g. support letters

NSF Top Ten Mistakes
NSF CISE CAREER Workshop 2015 http://cst.seas.gwu.edu/nsf-cise-career/?page_id=23

  10. Fonts are too small
  9. Figures are illegible
  8. Acronyms are ugly and make text hard to read
  7. Dissing the competition
  6. Poor distinction between preliminary results and proposed work
5. Lackluster education plan
4. Lack of clarity in writing and long-winded
3. Dull broader impacts
2. Confining yourself to your PhD work

1. Research plan lacking cohesion
   • Do not staple together unrelated ideas
   • Do not offer a laundry list with no prioritization
   • Do not make everything look like a nail to your hammer
   • *Tell a story with your narrative*
Internal Review
Because sometimes what is obvious to you is not obvious to others

Key Online Resources
Self-help tool series

- Management Plan Self-Assessment
- Letters of Individual or Institutional Commitment
- Postdoctoral Mentoring Plan Template
- Tips for Major Research Instrumentation Proposals
Key Online Resources

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

http://docs.lib.purdue.edu/ovpr/

The Office of the Executive Vice President for Research and Partnerships (EVPRP)

The Office of the Executive Vice President for Research and Partnerships (EVPRP) supports faculty in all aspects of research, including finding access to research grants, data, and translation facilities, and, in collaboration with schools and departments, to support research. Our mission is to attract research funds and support research at Purdue University. Research funds support research at Purdue University. EVPRP supports research at Purdue University.
Key Online Resources

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

![Image of Key Online Resources](image1)

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**Tools for understanding broader impacts**

**Funding Agency Requirements for Broader Impacts**

![Image of Key Online Resources](image2)
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
Questions?