NSF Research Traineeship (NRT) Program
Innovative Interdisciplinary Graduate Training

Division of Graduate Education
Directorate For Education and Human Resources
National Science Foundation
NSF Research Traineeship (NRT) Program

• A Foundation-wide program launched in 2014 as the successor to IGERT

• Goals:
  • Advance cutting-edge interdisciplinary research in high-priority areas
  • Increase the capacity of graduate programs to produce STEM professionals with professional skills for a range of careers
  • Develop innovative approaches that will promote transformative improvements in graduate education.
NSF Research Traineeship (NRT) Program

NRT

Traineeship

- Comprehensive training
- Interdisciplinary theme
- MS and/or PhD
- 5 years, up to $3M total
- Limit 2 submission/institution

Innovations in Graduate Education

- Test-bed/pilot projects
- No student support
- MS and/or PhD
- 3 years, up to $500K
- Limit 2 submission/institution
FY 2016 Traineeship Priority Areas

- **Data-Enabled Science & Engineering (DESE)**
- **Innovations at the Nexus of Food, Energy and Water Systems (INFEWS)**
- **Understanding the Brain (UtB)**
- Other Crosscutting, Interdisciplinary Themes
"T-Shaped" Student

Breadth of Knowledge

Depth of Knowledge

Domain Specialty

NSF Research Traineeship Program (NRT)

Directorate for Education and Human Resources/Division of Graduate Education
“π-Shaped” Student

Breadth of Knowledge

Domain Speciality

Computational/Stats

Depth of Knowledge

NSF Research Traineeship Program (NRT)
Data Enabled Science & Engineering Priority Area

New interdisciplinary advances
  • Mathematical, computational, and statistical algorithms
  • Prediction techniques
  • Simulation and modeling methodologies

New approaches to data
  • Collection
  • Analysis and visualization
  • Integration
  • Stewardship
Types of DESE Projects

• Partnerships between computational and mathematical and other STEM disciplines to manage and exploit data sources.

• Research focused on the development of novel data-driven approaches and tools that
  • Advance scientific and engineering discovery
  • Integrate and leverage major cyberinfrastructure investments

• Novel programs that integrate educational and training opportunities with major facilities and infrastructure investments.
NRT: DESE Numbers

Number of Projects: 12
Average Budget: $2.97M
Total NSF Support: $35.6M
Trainees Supported: 439 (36.6/awd)
Total Projected Trainees: 867 (72.2/awd)
% Budget for Participant Support: 61%
2014-2015 Proposals and Awards

Proposals

- **DESE** (274: 61%)
- **Other** (175: 39%)

Awards

- **DESE** (12: 66%)
- **Other** (6: 33%)
2014-2015 NRT DESE Awards

Directorate for Education and Human Resources/Division of Graduate Education
Common Features of NRT DESE Projects

- Intensive training (boot camps) in computational and analytical techniques.
- Vertically-integrated training (faculty and post-docs).
- Entrepreneurial training coupled with industrial internships.
- New interdisciplinary courses in model-based analysis, data storage and management, analytics, and visualization.
- Team Science: opportunities for domain scientists to work with computer and data scientists to develop and pilot novel applications.
Data-Enabled Discovery and Design of Energy Materials (D$^3$EM)

- PI: Raymundo Arroyave  
  *Dept. Materials Science & Engineering*  
  *Texas A&M University*
- 80+ Trainees (MS and PhD), 6 Departments
- Students and faculty from materials science, informatics, engineering design
- Emphasis on employer-desired professional and technical skills
Data-Enabled Discovery and Design of Energy Materials (D³EM)

**Six Departments • Three Disciplines • One Vision**

Building a collaborative framework for the accelerated development of materials through materials science, informatics, and engineering design.

### Transcend Disciplines
- Materials Science
- Design
- Informatics

### Launch Successful Careers
- Industry
- Entrepreneurship
- Academia

**D³EM Trainees**

### Impact Energy Technology & Systems
- Energy Storage
- Energy Conversion
- Sustainability
- Energy Efficiency

### Key Features:
- Employer-driven Learning Outcomes
  - See survey results: Table 2, Page 9
- Disciplinary Grounding followed by Interdisciplinary Learning
- Reflection through e-Portfolio
- Learning Community
- Faculty Community of Scholars
- Summer School on Computational Materials Science
- Capstone Materials Design Studio
- Energy and Entrepreneurship Research
- Pedagogical Impact and Dissemination in Scholarly Literature

### Timeline

<table>
<thead>
<tr>
<th>Timeframe</th>
<th>PhD Qualified</th>
<th>MS Graduates</th>
<th>PhD Graduates</th>
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<tbody>
<tr>
<td>1st Year</td>
<td>Skilled</td>
<td>Interdisciplinary Integration</td>
<td>Research Theses Proposal</td>
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<tr>
<td>2nd Year</td>
<td>Bldg.:</td>
<td>Intern Research</td>
<td>Research Theses Defense</td>
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<tr>
<td></td>
<td>Disciplinary</td>
<td>Reflection</td>
<td>YR 3</td>
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<tr>
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<td>Grounding</td>
<td>Learning Community</td>
<td>YR 5</td>
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<tr>
<td></td>
<td>YR 1</td>
<td>Development of Technical Knowledge, Professional Skills, Career</td>
<td>YR 4</td>
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<tr>
<td></td>
<td>YR 2</td>
<td>Reflection</td>
<td>YR 4+</td>
</tr>
</tbody>
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### Leadership Trainees Inclusion
- 9 NRT Faculty • 10+ Affiliated • External Advisory Board • Internal Admin. Council
- 41 NRT-funded MS, PhD Students • 40+ Additional Participants • 2 Education PhDs
- Broad Recruitment Strategies • Partnership w/ URM Schools • Targeted Fellowships Learning Community • Faculty/Peer Mentoring • Individual Development Plan

### Education Pedagogical Model
- Emphasis on Developing Employer-desired Professional and Technical Skills

### Research
- Impact of Pedagogical Methods
- Goal Oriented Materials Design
- Data-Enabled Materials Discovery

### Partners
- Texas A&M University (Center for New Ventures and Entrepreneurship, Energy Institute, Center for Teaching Excellence, Office of Graduate and Professional Studies; Other Academic Institutions; Industry; National Laboratories)