Diversity at the Forefront of Science:
One View from NSF

F. Fleming Crim
Assistant Director for
Mathematical and Physical Sciences
April 2013
Diversity at the Forefront of Science: One View from NSF

A Learning Curve

Knowledge

Time

Jan 14, 2013

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NSF Vision and Goals

Empowering the Nation Through Discovery and Innovation

NSF Strategic Plan for Fiscal Years (FY) 2011-2016

National Science Foundation

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Directorate for Mathematical and Physical Sciences

NSF Strategic Goals

- Transform the Scientific Frontiers
- Innovate for Society
- Perform as a Model Organization

- Advancing Discovery
- Building Blocks for Innovation
- Forefront Facilities
- Educating the Next Generation

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$1 basic research

$40 – $140 GDP

50 – 75\% of economic growth from fruits of basic research
$1 basic research

$40 – $140 GDP

50 – 75 % of economic growth from fruits of basic research
Mathematical and Physical Sciences (MPS)
Chemistry (CHE)
Mathematical and Physical Sciences (MPS)
Office of Multidisciplinary Activities (OMA)
Astronomy (AST)
Chemistry (CHE)
Materials Research (DMR)
Mathematical Sciences (DMS)
Physics (PHY)

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NSF Supports Basic Research

Fraction of Federal Support

All Science and Engineering Fields: 21%
Physical Sciences: 41%
Mathematics: 60%

MPS supports 50%
NSF Supports Basic Research

Fraction of Federal Support

MPS supports 50%

<table>
<thead>
<tr>
<th>Field</th>
<th>Support</th>
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<tbody>
<tr>
<td>All Science and Engineering Fields</td>
<td>21%</td>
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<tr>
<td>Physical Sciences</td>
<td>41%</td>
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<tr>
<td>Engineering</td>
<td>41%</td>
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<tr>
<td>Environmental Sciences</td>
<td>49%</td>
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<tr>
<td>Social Sciences</td>
<td>52%</td>
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<tr>
<td>Mathematics</td>
<td>60%</td>
</tr>
<tr>
<td>Biology*</td>
<td>67%</td>
</tr>
<tr>
<td>Computer Science</td>
<td>86%</td>
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</tbody>
</table>

*Excludes the National Institutes of Health.
Source: NSF Survey of Federal Funds for Research and Development.
MPS FY 2014 Budget Request

$ 1309 M

FY 2012 Enacted

Amount ( Millions )

AST  CHE  DMR  DMS  PHY

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MPS FY 2014 Budget Request

$ 1309 M → $ 1386 M  5.9% ↑

<table>
<thead>
<tr>
<th></th>
<th>FY 2012</th>
<th>FY 2014</th>
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<tr>
<td>MPS Enacted</td>
<td>$ 1309 M</td>
<td>$ 1386 M</td>
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<tr>
<td>MPS Request</td>
<td>5.9%</td>
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<th>CHE</th>
<th>DMR</th>
<th>DMS</th>
<th>PHY</th>
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<tr>
<td>Amount (Millions)</td>
<td>1386 M</td>
<td>1309 M</td>
<td>5.9%</td>
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</tbody>
</table>

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Mathematical and Physical Sciences (MPS)

Infrastructure (facilities, centers, instrumentation)

- Education: $50M
- Research: $895M
- Research (core, cross-cutting, CAREER): $440M

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The Excitement of Advancing Discovery

...extending our view of galaxy formation nearly to the Big Bang...

MPS supported 8 of 12 recipients of the National Medal of Science

Bard
Faber
Gates
Golomb
Goodenough
Hawthorne
Hood
Mazur

...differential topology, number theory, and arithmetic algebraic geometry...

National Medal of Science
Barry Mazur (DMS)

National Medal of Science
Sandra Faber (AST)
The excitement of advancing discovery.

...extending our view of galaxy formation nearly to the Big Bang...

The Higgs Particle in the CMS detector at the LHC

...differential topology, number theory, and arithmetic algebraic geometry...

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33,000 People in MPS Activities*

- Undergraduates: 21%
- Graduate Students: 27%
- Senior Researchers: 35%
- Postdoctoral Researchers: 7%
- Other Professionals: 10%

*Estimated for FY 2014
• Demographics

• Renew the workforce

• Invigorate science
• Demographics
  The US will be “majority minority” by 2042*

• Renew the workforce
  The biological imperative

• Invigorate science
  Culture and style matter

* US Census estimate

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Milestones - Ethnicity and Gender - 2010

**Freshmen – science, engineering**
- Non-minority women: 15%
- Minority women: 16%
- Non-minority men: 41%
- Minority men: 29%
- Total: 1,232,000

**Bachelors – science, engineering**
- Non-minority women: 7%
- Minority women: 11%
- Non-minority men: 42%
- Minority men: 40%
- Total: 525,000

**Advanced Degrees science, engineering**
- Non-minority women: 37%
- Minority women: 5%
- Non-minority men: 51%
- Minority men: 7%
- Total: 173,000

F. Crim at NDEW 2013
Female Fraction of Full-Time Science and Engineering Faculty at Four-year Institutions

<table>
<thead>
<tr>
<th>Field</th>
<th>1997</th>
<th>2008</th>
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<tbody>
<tr>
<td>Computer Science</td>
<td>25%</td>
<td>50%</td>
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<tr>
<td>Mathematics</td>
<td>25%</td>
<td>50%</td>
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<tr>
<td>Physical Sciences</td>
<td>25%</td>
<td>50%</td>
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<tr>
<td>Life Sciences</td>
<td>25%</td>
<td>50%</td>
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<tr>
<td>Psychology</td>
<td>25%</td>
<td>50%</td>
</tr>
<tr>
<td>Social Sciences</td>
<td>25%</td>
<td>50%</td>
</tr>
<tr>
<td>Engineering</td>
<td>25%</td>
<td>50%</td>
</tr>
</tbody>
</table>

Source: National Science Foundation, Survey of Doctorate Recipients

F. Crim at NDEW 2013 | www.oxide.gatech.edu
“The Leaky Pipeline”

US Bachelors Degrees

- African American
- Hispanic or Latino
- American Indian
- Alaskan Native
- Female*

National Center for Science and Engineering Statistics, 2010

*Physical Science Degrees

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The NSF Role
Facilitate and Foster Community Responses

Workshops

Policies

Programs

Balancing the Scale:
NSF’s Career-Life Balance Initiative

National Science Foundation (NSF) Policies Aim to Bolster Development of STEM Workforce

Fisk-Vanderbilt Masters-to-PhD Bridge Program

you can
Reach for the Ph.D.
tú puedes

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Finding the Policies and Programs

Google search for "nsf broadening participation"

Scholarly articles for nsf broadening participation
Making a case for BPC [Broadening Participation in ... - Gilbert - Cited by 10
Broadening participation through scalable game ... - Repenning - Cited by 28
Running participation in computing, issues and ... - Peckham - Cited by 21

US NSF - Office of the Director - Broadening Participation
www.nsf.gov/od/broadeningparticipation/bp.jsp
Broadening Participation. Background on NSF Broadening Participation. NSF's commitment to broadening participation is embedded in its Strategic Plan ...

US NSF - MPS - DMR - Broadening Participation
www.nsf.gov/mps/dmr/diversity.jsp
The links below provide a sampling of information that may help Principal Investigators and others in broadening participation in their activities. This list is not ...

US NSF - Office of the Director - Broadening Participation - Portfolio
www.nsf.gov/od/broadeningparticipation/bp_portfolio_dynamic.jsp
The portfolio represented below is divided into three categories: (1) programs that are primarily focused on broadening participation, (2) programs that have ...
NSF Broadening Participation Portfolio

Background

NSF has taken a variety of approaches to broaden participation across its many programs. While broadening participation is included in the NSF review criteria, some program announcements and solicitations go beyond the standard criteria. They range from encouraging language to specific requirements. Investments range from capacity building, research centers, partnerships, and alliances to the use of co-funding or supplements to existing awards in the core research programs.

The portfolio represented below is divided into three categories: (1) programs that are primarily focused on broadening participation, (2) programs that have broadening participation as one of several emphases, and (3) Dear Colleague Letters expressing interest in specific aspects of broadening participation.

(1) Programs focused on broadening participation
(2) Programs with broadening participation as one part
(3) Dear colleague letters expressing interest
<table>
<thead>
<tr>
<th>Program</th>
<th>Code</th>
<th>Code for</th>
<th>Code for</th>
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<tr>
<td>ADVANCE: Increasing the Participation and Advancement of Women in</td>
<td>12-584</td>
<td>All</td>
<td>All</td>
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<tr>
<td>Academic Science and Engineering Careers</td>
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<tr>
<td>Alliances for Graduate Education and the Professoriate</td>
<td>12-554</td>
<td>EHR, MPS</td>
<td>HRD</td>
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<td>Broadening Participation Research Initiation Grants in Engineering 2013</td>
<td>13-534</td>
<td>ENG</td>
<td>CBET, CMMI, ECCS, EEC, IIP</td>
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<tr>
<td>Centers of Research Excellence in Science and Technology (CREST) and</td>
<td>13-533</td>
<td>EHR</td>
<td>HRD</td>
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<tr>
<td>HBCU Research Infrastructure for Science and Engineering (RISE)</td>
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<tr>
<td>EPSCoR Research Infrastructure Improvement Program Track-3: Building</td>
<td>13-553</td>
<td>OIA</td>
<td>EPSC</td>
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<tr>
<td>Diverse Communities</td>
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<tr>
<td>EPSCoR Research Infrastructure Improvement Program: Inter-Campus and</td>
<td>10-598</td>
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<tr>
<td>Intra-Campus Cyber Connectivity</td>
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<td>Experimental Program to Stimulate Competitive Research: Workshop</td>
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<td>Opportunities (EPS-WO)</td>
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<td>General &amp; Age-Related Disabilities Engineering (GARDE)</td>
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<td>CBET</td>
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<td>Historically Black Colleges and Universities Undergraduate Program</td>
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<td>HRD</td>
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<td>Louis Stokes Alliances for Minority Participation (LSAMP)</td>
<td>12-564</td>
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<td>HRD</td>
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<td>NSF Scholarships in Science, Technology, Engineering, and Mathematics</td>
<td>12-529</td>
<td>EHR</td>
<td>DUE</td>
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<td>Ocean Sciences Postdoctoral Research Fellowships</td>
<td>13-504</td>
<td>GEO</td>
<td>OCE</td>
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<td>Ocean Sciences Research Initiation Grants</td>
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<td>Opportunities for Enhancing Diversity in the Geosciences (OEDG)</td>
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<td>GEO</td>
<td>AGS, EAR, OCE</td>
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<td>Partnerships for Research and Education in Materials</td>
<td>11-562</td>
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<td>Partnerships in Astronomy &amp; Astrophysics Research and Education</td>
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<td>MPS</td>
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<td>Postdoctoral Research Fellowships in Biology</td>
<td>12-497</td>
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<td>Research in Disabilities Education</td>
<td>12-542</td>
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<td>DRL, HRD</td>
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<td>Research on Gender in Science and Engineering</td>
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<td>SBE Postdoctoral Research Fellowships</td>
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<td>SBE</td>
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<td>Advancing Informal STEM Learning</td>
<td>12-560</td>
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<td>American Competitiveness in Chemistry-Fellowship</td>
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<td>3</td>
<td>Centers for Chemical Innovation</td>
<td>12-572</td>
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<td>4</td>
<td>Computing Education for the 21st Century</td>
<td>12-609</td>
<td>CISE, EHR, OCI</td>
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<td>EMERGING FRONTIERS IN RESEARCH AND INNOVATION 2013</td>
<td>12-583</td>
<td>BIO, ENG, MPS</td>
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<td>Engineering Research Centers</td>
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<td>Graduate Research Fellowship Program</td>
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<td>8</td>
<td>Innovative Technology Experiences for Students and Teachers</td>
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<td>Integrative Graduate Education and Research Traineeship Program</td>
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<td>Integrative Graduate Education and Research Traineeship Program-CIF21 Track</td>
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<td>BIO, CISE, EHR, ENG, GEO, MPS, OCI, OIA, OISE, OPP, SBE</td>
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<td>International Research Experiences for Students</td>
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<td>Major Research Instrumentation Program:</td>
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<td>Materials Research Centers and Teams</td>
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<td>Math and Science Partnership</td>
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<td>Mentoring Through Critical Transition Points in the Mathematical Sciences</td>
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<td>NSF Earth Sciences Postdoctoral Fellowships</td>
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<td>17</td>
<td>Postdoctoral Fellowships in Polar Regions Research</td>
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<td>18</td>
<td>Research Experiences for Undergraduates</td>
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<td>19</td>
<td>Research Training Groups in the Mathematical Sciences</td>
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<td>MPS</td>
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<td>20</td>
<td>Science and Technology Centers: Integrative Partnerships</td>
<td>11-522</td>
<td>All</td>
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<td>21</td>
<td>Science of Learning Centers</td>
<td>07-7278</td>
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<td>No.</td>
<td>Dear Colleague Letters</td>
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<td>Research Assistantships for High School Students (RAHSS) - SBIR/STTR Phase II Supplements</td>
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<td>SBIR/STTR Supplemental Funding for Community College Research Teams</td>
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<td>Supplemental Opportunity for SBIR/STTR Mentoring</td>
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<td>Broadening Participation in Computing Alliance Program (BPC-A)</td>
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<td>MPS Alliances for Graduate Education and the Professoriate - Graduate Research Supplements</td>
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<td>Stimulating Research Related to the Science of Broadening Participation</td>
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<td>Prepare, Engage, and Motivate a Diverse STEM Workforce</td>
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<td>EHR</td>
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<td>9</td>
<td>Balancing the Scale: NSF’s Career-Life Balance (CLB) Initiative</td>
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<td>Research Experiences for Veterans/Teachers</td>
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<td>Engineering Research Experiences for Veterans</td>
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<td>Research Experience for Teachers (RET): Funding Opportunity in the Biological Sciences</td>
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<td>Research Assistantships for High School Students (RAHSS): Funding to Broaden Participation in the Biological Sciences</td>
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<td>Announcement of Efforts to Increase Hispanic Participation in STEM Fields</td>
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<td>Alliances for Graduate Education and the Professoriate (AGEP) Program</td>
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<td>18</td>
<td>Broadening Participation in Engineering (BPE)</td>
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</table>
Partnerships in Astronomy and Astrophysics Research and Education (PAARE)

Enhance diversity in astronomy and astrophysics through long term collaborative research partnerships among minority serving institutions and partners at research institutions

Solar, Stellar, and Exoplanets at NMSU

NSO

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Partnerships in Astronomy and Astrophysics Research and Education (PAARE)

Enhance diversity in astronomy and astrophysics through long term collaborative research partnerships among minority serving institutions and partners at research institutions.

AstroCom NYC

Improve access by urban minority students to research opportunities.

GO-FAAR

Fisk-Vanderbilt Masters-to-PhD Bridge Program
29 URM students - 97% retention
Alliances for Graduate Education and the Professoriate (AGEP)

Supplements to existing MPS grants to support under-represented minority graduate students

Partnership of MPS with Directorate for Education and Human Resources (EHR)
Transitions to Graduate Study

Fisk-Vanderbilt
Master’s-to-Ph.D. Bridge Program

FISK-VANDERBILT
Master’s-to-PhD Bridge Program
a joint program in astronomy, biology, chemistry, physics, and materials science

LOOKING FOR STUDENTS WITH:
Persistence, Passion, Self-motivation, Strong work ethics

AREAS OF STUDY:
Astronomy, Biology, Chemistry, Physics, Materials Science

WE PROVIDE:
Tuition & fees, Medical Insurance, $1800 Monthly

YOU WILL FIND:
Support through school and thereafter, Student & alum network, Assistance with presentations/thesis & defense/job placement

F. Crim at NDEW 2013
www.oxide.gatech.edu
Career Life Balance

Balancing the Scale:
NSF’s Career-Life Balance Initiative

National Science Foundation (NSF) Policies Aim to Bolster Development of STEM
Career Life Balance

“Balancing the Scale”

- Flexibility in timing grants
- No-cost extensions
- Supplements for personnel
- CAREER
- Plans for ADVANCE, Graduate Fellows, post-docs
Directorate for Mathematical and Physical Sciences (MPS)

- Advancing Discovery
- Building Blocks for Innovation
- Forefront Facilities
- Educating the Next Generation