Research at NC State: Current Status and Future Directions

Board of Visitors
Friday, October 7th
Alan Rebar, Vice Chancellor for Research, Innovation and Economic Development (ORIED)
Research Productivity & Comparative Data

Partnerships & Economic Development

Technology Commercialization & New Ventures

Moving Ahead
Research Productivity & Comparative Data
FY2016 Research Activity in Review

$349 million in new research awards

34% proposal success rate in dollars

$1.03 billion in research proposals submitted

32 large-scale proposal submissions
NSF R&D Expenditures by Sponsor

In Millions

FY05 FY06 FY07 FY08 FY09 FY10 FY11 FY12 FY13 FY14 FY15

In Millions

$0 $50 $100 $150 $200 $250 $300 $350 $400 $450 $500

5% Growth Rate

Reported to NSF

Institution
Industry
State
Federal
FY14: Federal Expenditures by Agency

$181.4M

Most recent Higher Education Research and Development (HERD) Survey, FY2014
NSF Total R&D Expenditures of Select Peers
Identified by Office of Institutional Research

<table>
<thead>
<tr>
<th>Institution</th>
<th>FY10</th>
<th>FY11</th>
<th>FY12</th>
<th>FY13</th>
<th>FY14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Texas A&amp;M U.</td>
<td>$689.6M</td>
<td>$705.7M</td>
<td>$693.4M</td>
<td>$820.0M</td>
<td>$854.2M</td>
</tr>
<tr>
<td>Georgia Tech</td>
<td>$615.8M</td>
<td>$655.4M</td>
<td>$688.9M</td>
<td>$730.5M</td>
<td>$725.6M</td>
</tr>
<tr>
<td>U. Florida</td>
<td>$681.5M</td>
<td>$739.9M</td>
<td>$697.0M</td>
<td>$695.1M</td>
<td>$708.5M</td>
</tr>
<tr>
<td>U. Illinois</td>
<td>$515.1M</td>
<td>$545.7M</td>
<td>$583.8M</td>
<td>$743.5M</td>
<td>$621.7M</td>
</tr>
<tr>
<td>Purdue U.</td>
<td>$549.0M</td>
<td>$578.2M</td>
<td>$602.5M</td>
<td>$595.7M</td>
<td>$564.9M</td>
</tr>
<tr>
<td>Michigan State U.</td>
<td>$431.4M</td>
<td>$454.2M</td>
<td>$507.1M</td>
<td>$515.7M</td>
<td>$526.9M</td>
</tr>
<tr>
<td>Virginia Tech</td>
<td>$398.2M</td>
<td>$450.1M</td>
<td>$454.4M</td>
<td>$496.2M</td>
<td>$513.1M</td>
</tr>
<tr>
<td>U. Maryland</td>
<td>$451.4M</td>
<td>$495.4M</td>
<td>$502.4M</td>
<td>$492.0M</td>
<td>$485.0M</td>
</tr>
<tr>
<td><strong>NC State U.</strong></td>
<td><strong>$360.8M</strong></td>
<td><strong>$378.1M</strong></td>
<td><strong>$404.2M</strong></td>
<td><strong>$417.5M</strong></td>
<td><strong>$446.1M</strong></td>
</tr>
<tr>
<td>Iowa State U.</td>
<td>$250.1M</td>
<td>$267.6M</td>
<td>$261.0M</td>
<td>$266.6M</td>
<td>$313.3M</td>
</tr>
<tr>
<td>Colorado State</td>
<td>$302.9M</td>
<td>$330.8M</td>
<td>$376.0M</td>
<td>$313.2M</td>
<td>$308.0M</td>
</tr>
</tbody>
</table>

Table created using the most recent HERD Survey, FY2014  
Dollars in millions
# Research Per FTE FY2014: Select Peer Comparison

Identified by Office of Institutional Research

<table>
<thead>
<tr>
<th>Institution</th>
<th>TT Faculty</th>
<th>Research Expenditures (Millions)</th>
<th>Research Expenditures Per FTE</th>
<th>National Academy Members³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Georgia Tech</td>
<td>942</td>
<td>$725.6M</td>
<td>$770,223</td>
<td>26</td>
</tr>
<tr>
<td>U. Florida</td>
<td>1637</td>
<td>$708.5M</td>
<td>$432,820</td>
<td>24</td>
</tr>
<tr>
<td>Texas A&amp;M</td>
<td>2029</td>
<td>$854.2M</td>
<td>$421,002</td>
<td>22</td>
</tr>
<tr>
<td><strong>NC State</strong></td>
<td>1123</td>
<td><strong>$446.1M</strong></td>
<td><strong>$397,250</strong></td>
<td><strong>18</strong></td>
</tr>
<tr>
<td>Virginia Tech</td>
<td>1535</td>
<td>$513.1M</td>
<td>$334,299</td>
<td>15</td>
</tr>
<tr>
<td>U. Illinois</td>
<td>1875</td>
<td>$621.7M</td>
<td>$331,591</td>
<td>57</td>
</tr>
<tr>
<td>Purdue U.</td>
<td>1743</td>
<td>$564.9M</td>
<td>$324,110</td>
<td>25</td>
</tr>
<tr>
<td>U. Maryland</td>
<td>1585</td>
<td>$485.1M</td>
<td>$306,026</td>
<td>9</td>
</tr>
<tr>
<td>Colorado State</td>
<td>1093</td>
<td>$308.0M</td>
<td>$281,773</td>
<td>5</td>
</tr>
<tr>
<td>Michigan State</td>
<td>2027</td>
<td>$526.9M</td>
<td>$259,944</td>
<td>10</td>
</tr>
<tr>
<td>Iowa State</td>
<td>1251</td>
<td>$313.2M</td>
<td>$250,410</td>
<td>7</td>
</tr>
</tbody>
</table>

---

1. Integrated Postsecondary Education Data Systems (IPEDS) Data Center, 2015
3. The Top American Research Universities 2014 Annual Report
# NSF Ranking

**# 7 in Total R&D Expenditures**

among all public universities without a medical school

<table>
<thead>
<tr>
<th>Rank</th>
<th>Institution</th>
<th>$ Millions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>U. California, Berkeley</td>
<td>$744.3M</td>
</tr>
<tr>
<td>2</td>
<td>Georgia Institute of Technology</td>
<td>$725.6M</td>
</tr>
<tr>
<td>3</td>
<td>U. Illinois, Urbana-Champaign</td>
<td>$621.7M</td>
</tr>
<tr>
<td>4</td>
<td>Purdue U., West Lafayette</td>
<td>$564.9M</td>
</tr>
<tr>
<td>5</td>
<td>Virginia Polytechnic Institute and State U.</td>
<td>$513.1M</td>
</tr>
<tr>
<td>6</td>
<td>U. Maryland, College Park</td>
<td>$485.0M</td>
</tr>
<tr>
<td>7</td>
<td>North Carolina State U.</td>
<td>$446.1M</td>
</tr>
</tbody>
</table>

Table created using most recent HERD Survey, FY2014
### NSF Ranking

**# 3 in Industry Expenditures**

among all public universities without a medical school

<table>
<thead>
<tr>
<th>Institution</th>
<th>$ Millions</th>
<th>% of Total Expenditures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 SUNY, Polytechnic Institute</td>
<td>$170.1M</td>
<td>41%</td>
</tr>
<tr>
<td>2 U. California, Berkeley</td>
<td>$83.5M</td>
<td>11%</td>
</tr>
<tr>
<td>3 North Carolina State U.</td>
<td>$49.9M</td>
<td>11%</td>
</tr>
<tr>
<td>4 Georgia Institute of Technology</td>
<td>$41.6M</td>
<td>6%</td>
</tr>
<tr>
<td>5 U. Illinois, Urbana-Champaign</td>
<td>$41.0M</td>
<td>7%</td>
</tr>
<tr>
<td>6 Purdue U., West Lafayette</td>
<td>$38.9M</td>
<td>7%</td>
</tr>
<tr>
<td>7 Wichita State U.</td>
<td>$30.9M</td>
<td>53%</td>
</tr>
<tr>
<td>8 Virginia Tech</td>
<td>$28.7M</td>
<td>6%</td>
</tr>
<tr>
<td>9 Rutgers, State U.</td>
<td>$24.3M</td>
<td>86%</td>
</tr>
</tbody>
</table>

Table created using the most recent HERD Survey, FY2014
FY2016 Research Awards by Sponsor

In Millions

FY12 | FY13 | FY14 | FY15 | FY16

- Other
- State Government
- Industry and Trade Associations

12.5% Growth Rate

RADAR Data 08/24/16
FY2016 Proposal Development in Review

32 Large-scale proposal submissions

$327 million in funds were requested

$10.3 million in awards to date ($197.1 million still pending)

11 workshops/site visits were held to support NSF proposals

517 faculty/staff were involved in PDU-supported proposals
# Proposal Development Activity

<table>
<thead>
<tr>
<th>Activity</th>
<th>FY16</th>
<th>5 Year Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Proposals Assisted</td>
<td>32</td>
<td>116</td>
</tr>
<tr>
<td><strong>Total $ Amount Assisted</strong></td>
<td>$327.1M</td>
<td>$835.7M</td>
</tr>
<tr>
<td><strong>Total $ Amount Awarded</strong></td>
<td>$10.3M*</td>
<td>$151.1M</td>
</tr>
<tr>
<td># of People Served Through Training Programs</td>
<td>220</td>
<td>695</td>
</tr>
</tbody>
</table>

** $ Amounts include subawards to partners
* $197.1 million still pending
Federally Funded Collaborative Centers & Institutes

One of only two universities leading 2 National Science Foundation Engineering Research Centers

$30.1M  The FREEDM Systems Center
$15.5M  The ASSIST Center

Leading 4 federally funded collaborative institutes

$146M, PowerAmerica
$63M, Laboratory for Analytic Sciences
$25M, Consortium for Nonproliferation Enabling Capabilities
$25M, Norovirus Collaborative for Outreach, Research, and Education (NoroCORE)
FY16-17
Manufacturing Innovation Institutes (MII)

Advanced Tissue Biofabrication, RegenerateUSA - $80M, US Department of Defense

Biopharmaceutical Manufacturing, NIIMBL - $75M, NIST

Smart Charge- $75M, NIST

Home to Southeast Regional Manufacturing Center as part of the Smart Manufacturing - $75M, DOE

In negotiations with MIT to be part of Fibers & Textiles
Partnerships & Economic Development
FY2016 Partnership & Economic Development in Review

17 Total new partners on Centennial Campus and off campus

87 Current partners, 73 partners on Centennial Campus

3200+ partner employees are on Centennial Campus

6 New Master Research Agreements (MRA) signed

50 economic development projects
Centennial Campus Corporate Innovation Hub

Corporation Innovation Centers are established to facilitate interactions between Corporate Partners and NC State.

This year Merck and IBM established hubs on Centennial Campus bringing the total number of centers to 6.

ABB, Mann+Hummel, HanesBrands and Eastman
Eastman Partnership 2013-2016

In Sept 2012, Eastman signed an MRA worth $10M in research funding over 6 years and in early 2013 established its Innovation Center on Centennial Campus

- $8.5M invested to date
- $134M value of investment to Eastman
- 68 funded projects
  - 26 active
  - 42 completed
- 23 presentations/posters
- 19 manuscripts published
- 33 co-op students at Eastman
- 10 NCSU hires to Eastman
  - 6 B.S., 4 Ph.D.
- 32 invention disclosures
- 1 patent issued
  - 11 patents pending
- 8.5M invested to date
- 134M value of investment to Eastman
- 68 funded projects
- 26 active
- 42 completed
- 23 presentations/posters
- 19 manuscripts published
- 33 co-op students at Eastman
- 10 NCSU hires to Eastman
  - 6 B.S., 4 Ph.D.
- 32 invention disclosures
- 1 patent issued
  - 11 patents pending
Technology Commercialization & New Ventures
FY2016 Technology Commercialization & New Ventures in Review

- 291 new invention disclosures filed
- 56 new patents awarded
- 164 commercialization agreements signed
- 914 Material Transfer Agreements (MTAs), Confidential Disclosure Agreements (CDA)s and other agreements
- $3.8 million in royalties
Association of University Technology Managers (AUTM) Rankings
Among all universities without a medical school

#1 in Licenses & Options Executed
#5 in Startup Companies
#6 in Invention Disclosures
#6 in License Income
#7 in US Patents Issued
#9 in Total Patents Filed
Startup Companies

<table>
<thead>
<tr>
<th>Year</th>
<th>FY12</th>
<th>FY13</th>
<th>FY14</th>
<th>FY15</th>
<th>FY16</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY12</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FY13</td>
<td></td>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FY14</td>
<td></td>
<td></td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FY15</td>
<td></td>
<td></td>
<td></td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>FY16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12</td>
</tr>
</tbody>
</table>
Chancellor’s Innovation Fund

Approaching its 6th year, the Chancellor’s Innovation Fund has awarded $1.9M to 28 projects

- 10 startup companies launched
- 14 license and option agreements
- $9.9M in follow on funding
- $983K in licensing revenue
Wolfpack Investor Network (WIN)

• Creating a network for alumni angel investors to facilitate investments in promising NC State startups

• WIN members will make investments directly in the startup companies

• WIN will work collaboratively with the Duke Angel Network (DAN) and the proposed Carolina Angel Network (CAN) to establish the new Triangle Venture Alliance (TVA)
Moving Forward
Building Research Excellence

Maintaining and building our excellence in the disciplines

Increasing visibility, presence and reputation in interdisciplinary research

*With our Centennial Campus and Think and Do philosophy, we are uniquely positioned to be an international leader in interdisciplinary and translational research*
Building Research Excellence

- Improving Infrastructure & Processes
- Faculty Development in Research
- Fostering Partnerships & Collaborations
Improving Infrastructure & Processes

Electronic Research Administration (eRA) system

- Steering Team established June 2016
- RFP planned for Jan 2017
- Training & education launched Nov 2017
- New system launch early 2018

Streamlining Organization

- Restructure and new hires
- Working towards a more seamless transition between pre-award & post-award
- Looking at compliance needs
Improving Infrastructure & Processes

Identifying and Developing Core Facilities
• Shared Core Facilities
• Faculty Startup & Retention Packages

Developing Standardized Management Approaches for Centers & Institutes

Enhancing Communication
• Developing Strategic Plan for Research Communication (internal & external)
• New Faculty Orientation – Oct. 12th
• Increased Interaction and Feedback with Advisory Groups (URC, ROC, RSC, RLA)
Faculty Development in Research

Research Leadership Academy (RLA)
Inaugural class 2016

- Created by the URC to establish programs and initiatives to support the research development of faculty

Support Faculty at All Stages in Research Career

- Entry/early career
- Tenured/mid-career
  - Develop leadership skills where appropriate
  - Re-energize mid-career faculty as needed
- Senior Faculty
Faculty Development in Research

Ongoing Programs

• OTT workshops (14 companies, 15 faculty)
  • Investor Ready Business Plan
  • Startup Boot Camp and Lunch & Learn Program

• PDU workshops (254 faculty)
  • 5 webinars on Participant Support, Broader Impacts, and Equipment and Facilities proposals.
  • NSF CAREER award panel with 7 previous winners

Future Programs

• Promotion for Career Awards/Honor Recognition
• Grant Writing Programs
Fostering Partnerships & Collaboration

Ongoing Initiatives in Partnership Development

- Multi-institutional grant proposals
- Centennial Campus Partner Program
- Industry Alliances Partner Program
- Economic Development Programs with State and City
Fostering Partnerships & Collaboration

New Initiatives: Game-Changing Research Incentive Program (GRIP)

$2.3MM to be distributed over 3 years to incentivize visionary research projects that will result in more extramural funding, superior interdisciplinary graduate education and training, and have a greater societal impact.

- 59 Preliminary Proposals Submitted
- 300 Faculty Members Participated
- ½ of the Teams included RTI Researchers
- 52 Departments were Represented
GRIP Participation

Lead PI by College

- COE: 40%
- CALS: 12%
- CED: 3%
- CHASS: 7%
- CNR: 7%
- COD: 2%

Participating Faculty by College

- COE: 31%
- CALS: 14%
- CED: 2%
- CHASS: 5%
- CNR: 10%
- COD: 4%

Other: 3%
New Initiatives: Refocus Federal Relations Activity

• Greater emphasis on interactions with individual agencies (DOD, DOE, NIH)
• Initial Focus: DOD
  • Working with faculty to advise them in pursuing Department of Defense (DOD) research
  • Hosted Defense Advanced Research Projects Agency (DARPA) and Office of Naval Research (ONR) Science Advisors
  • Connect faculty with program managers at Army Research Office (ARO), ONR and DARPA.
Building Research Excellence

- Improving Infrastructure & Processes
- Faculty Development in Research
- Fostering Partnerships & Collaborations
Thank You