Research development at NC State took a big leap forward in 2005-06, with new broadly based research institutes and centers of excellence proposed and initiated by faculty throughout the University. “Institutes and centers play a pivotal role in enhancing our position as a leading research university for the 21st century,” said Chancellor James Oblinger. “Through key partnerships, our centers and institutes help leverage NC State’s strengths to generate new knowledge, create innovative technology, contribute to economic development and improve services and products. They also help to develop the educational experiences of our students through undergraduate and graduate research opportunities.”

Institutes and centers also played an important role in generating the 5.6% increase in research awards received by NC State in 2005-06. Joining the list of 55 existing centers and institutes at NC State (see www.ncsu.edu/sparcs/centers/), one institute and six multidisciplinary centers of excellence were initiated in 2005-06. These include:

- The Institute of Maintenance Science and Technology
- The Center for Comparative Medicine and Translational Research
- The Semiconductor Power Electronic Center
- The Forest Biomaterials and Biotechnology Research and Education Center
- The Cooperative Tourism Center
- The Center for Research of the Nano/Bio Material Interface
- The North Carolina Coastal Resources Law, Planning and Policy Center

“Centers and institutes employ highly competent faculty and students, offering partners a critical mass of talent that surpasses the capabilities of individual organizations,” explains Dr. John Gilligan, Vice Chancellor for Research and Graduate Studies. “They are usually very successful in attracting research funding from government and industry, and each supports a substantial educational component, especially at the graduate level.”

Working with Dr. Steven Lommel, Assistant Vice Chancellor for Research Development, faculty focus groups have been engaged in planning for other institutes and centers in nanotechnology, nonwoven textiles, systems biology, energy and biofuels, and neutron sciences—all areas where NC State has substantial interdisciplinary strength. These focus groups are gauging available funding at the federal or state level as well as industry partnership interest.

In general, an institute has a much larger scale mission than a center and some are made up of several centers, each with a smaller and more specific scope of work. All institutes and centers involve faculty and students in more than one department. In addition, they often include the participation of other institutions, agencies, or organizations such as hospitals, industry, foundations, or governmental bodies. “It takes a real expertise and time commitment to create a research institute or center,” says Lommel. “The faculty behind these initiatives are our best, brightest, and most committed to breaking into emerging fields of research, education and service.”
### Awards by Sponsor

<table>
<thead>
<tr>
<th>Sponsor</th>
<th>Dollars</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal Government</td>
<td>$148.3M</td>
<td>72%</td>
</tr>
<tr>
<td>Private Foundations</td>
<td>$7.4M</td>
<td>4%</td>
</tr>
<tr>
<td>State Government</td>
<td>$27.2M</td>
<td>13%</td>
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<tr>
<td>Industry</td>
<td>$21.3M</td>
<td>10%</td>
</tr>
<tr>
<td>Other</td>
<td>$2.8M</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$207.0M</td>
<td>100%</td>
</tr>
</tbody>
</table>

### Federal/Non-Federal Awards Ten-Year Comparison

#### Summary of Sponsored Programs Activity
- Proposals Submitted: 1,559
- Awards Received: 1,940
- Grant and Contract Dollars Requested: $616.3M
- Grant and Contract Dollars Awarded: $207.0M
- Grant and Contract Direct Expenditures: $201.6M
- Recovered Indirect Cost Expenditures: $30.4M

#### Federal Awards by Agency

- **Total $148.3M**
  - National Science Foundation: $31.0M
  - Department of Agriculture: $27.1M
  - Department of Health & Human Services: $22.5M
  - Department of Commerce: $15.4M
  - Department of Defense: $15.2M
  - Department of Energy: $13.6M
  - Department of Education: $9.8M
  - National Aeronautics & Space Agency: $4.7M
  - Environmental Protection Agency: $2.7M
  - Department of the Interior: $1.9M
  - Department of Homeland Security: $0.2M
  - Other: $4.2M

#### Non-Federal*
- $58.8 M

* 03-04 non-federal awards include $33.5M grant from Golden LEAF Foundation.

### Research Highlights

Our faculty and students are working on thousands of projects that will ultimately benefit North Carolina and the nation. To the right are just a few examples of cutting-edge research results from the past year.

**Associate professor of civil, construction, and environmental engineering, Dr. Joel Ducoste** is researching ways to prevent sanitary sewer overflows caused by accumulation of fat, roots, oil, and grease in collection systems. Using computer simulations and pilot-scale tests, Ducoste and his team are analyzing the surface chemistry of pipe materials as well as pretreatment methodologies.

**Dr. Maysam Ghovanloo**, assistant professor of electrical and computer engineering, has developed the Tongue Drive system—an innovative assistive device to enable people with severe disabilities such as spinal cord injuries or degenerative diseases to access computers using their tongues. A prototype, which communicates wirelessly with a basic PDA to control a computer, wheelchair, telephone, TV, or other device, will be tested at WakeMed Rehab Hospital in Raleigh.
Dr. Gail Jones, professor of mathematics, science and technology education, and her UNC colleague have received a $700,000 grant to study what types of experiences improve students’ ability to conceptualize size and scale. The results will lead to better student understanding of technological developments such as the telescope and the atomic force microscope, as well as future advancements in astrophysics, biotechnology, nanoscale science, and geography.

Dr. Gregg Dean, professor of immunopathology and an expert on feline and human lentiviruses, is developing novel vaccine strategies for the prevention of human and feline immunodeficiency (HIV/FIV) virus infection. Dean’s lab is investigating the potential of Lactobacillus bacteria, a safe organism used in food processing, as an inexpensive, easy to manufacture, orally delivered vaccine vector.
Funded by the National Institute of Allergy and Infectious Disease, mathematics professor Tom Banks, statistics professor Marie Davidian, and their colleagues are developing mathematical and statistical models that will aid in designing new treatment strategies for HIV patients. The research could lead to new approaches for treating acutely infected patients based on their personal variables.

With support from NIH, NSF, and DOE, Professors Alex Smirnov and Tatiana Smirnova are developing novel approaches to studying drug molecular mechanisms. Dr. Smirnov is using his newly discovered lipid nanotube technology to develop a new generation of robust and efficient hybrid nanoscale devices and membrane protein biochips. Dr. Smirnova is using advanced spectroscopic tools to study bonding interactions in membrane proteins and principles governing assembly of transmembrane domains of enveloped viruses to assist in developing novel vaccines.

College of Textiles professors Alan Tonelli and Richard Kotek have developed a super-strong aliphatic nylon fiber to be used in ropes, loading straps, parachutes, and automotive tires, or to create composite materials suitable for high-temperature applications. Tonelli says these fibers are as much as 10 times stronger than typical aliphatic nylons and will probably be more economical to produce than high-strength nylons like Kevlar.
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Textiles professor Stephen Michielsen and collaborators at Emory University have developed a novel, permanent nano-coating for filters to kill or inactivate most viruses and bacteria when exposed to visible light. Early tests have shown that the coating kills 99.9% of influenza and vaccinia viruses. Potential uses will include hospital areas and waiting rooms, airplanes, businesses, and anti-viral masks for first responders and the military.
**Graduate Applicants**
**Fall 1996-2005**

**Graduate Enrollment**
**Fall 1996-2005**

**Research Highlights**

Microbiology Professor Scott Laster, working with Erimos Pharmaceuticals, has discovered that a small molecule named EM-1421—currently in clinical trials for treatment of malignant tumors—also reduces the often fatal complications of multiple flu strains, possibly including avian flu. An R&D facility for Houston-based Erimos is located on NC State’s Centennial Campus.

**Degrees Awarded 1997-2006**

**College of Agriculture and Life Sciences**

With funding from NIH and the National Academies, assistant professor of genetics Dr. Philip Awadalla and his research team are resequencing the *Plasmodium falciparum* genome from parasites around the world to discover novel vaccine and drug targets. *Plasmodium falciparum* is the most lethal agent of malaria, which kills two to four million people each year.

**College of Design**

Architecture professor Georgia Bizios oversees a partnership with the Lumbee Tribe of North Carolina to promote quality home designs and an increase in home ownership among members. Architecture graduate students work with Bizios and tribe members to generate design guidelines and prototypes for affordable, energy-efficient, culturally appropriate homes and neighborhoods. Lumbee Home Designs is part of the College of Design’s Home Environments Design Initiative—a vehicle for helping improve the quality of residential architecture in North Carolina.
Wood and Paper Science professors Hasan Jameel, Hou-min Chang, and Richard Venditti have developed a process to recover and recycle 60% of the enzymes required during various phases of producing ethanol from wood and other waste paper. This process has the potential to significantly decrease the cost of ethanol production.
NC State in Top Ranks of U.S. Public Universities

2nd in Best Overall Public University Value
3rd in Life Sciences Patent Pipeline Power
5th in Best Overall Public University Value
6th in Total Research Expenditures among Public Universities without Medical Schools
6th in Industry-Funded Research
9th in Total Patent Pipeline Power
15th in Undergraduate Engineering Programs
16th in Public University Libraries
19th in Graduate Students in Science and Engineering Fields in Doctorate-Granting Institutions
20th in Overall Commercialization Index among U.S. and Canadian Universities
27th in Overall Lombardi Center Ranking of Public Universities
36th in Total Research Expenditures among Public Universities
4th among all U.S. Engineering Colleges in Number of B.S. Degrees Awarded
4th among all U.S. Engineering Colleges in Number of B.S. Degrees Awarded to Women
5th among all U.S. Engineering Colleges in Number of B.S. Degrees Awarded to African Americans
Tier 1 ranking among “Top 100 Entrepreneurial Colleges” for NC State’s Entrepreneurship Education Initiative

Rankings of Graduate Programs among Public Universities

- Aerospace Engineering (21)
- Agricultural Engineering (6)
- Applied Mathematics (11)
- Business (30)
- Chemical and Biomolecular Engineering (11)
- City Management and Urban Policy (14)
- Civil Engineering (16)
- Computer Engineering (17)
- Computer Science (27)
- Economics (26)

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