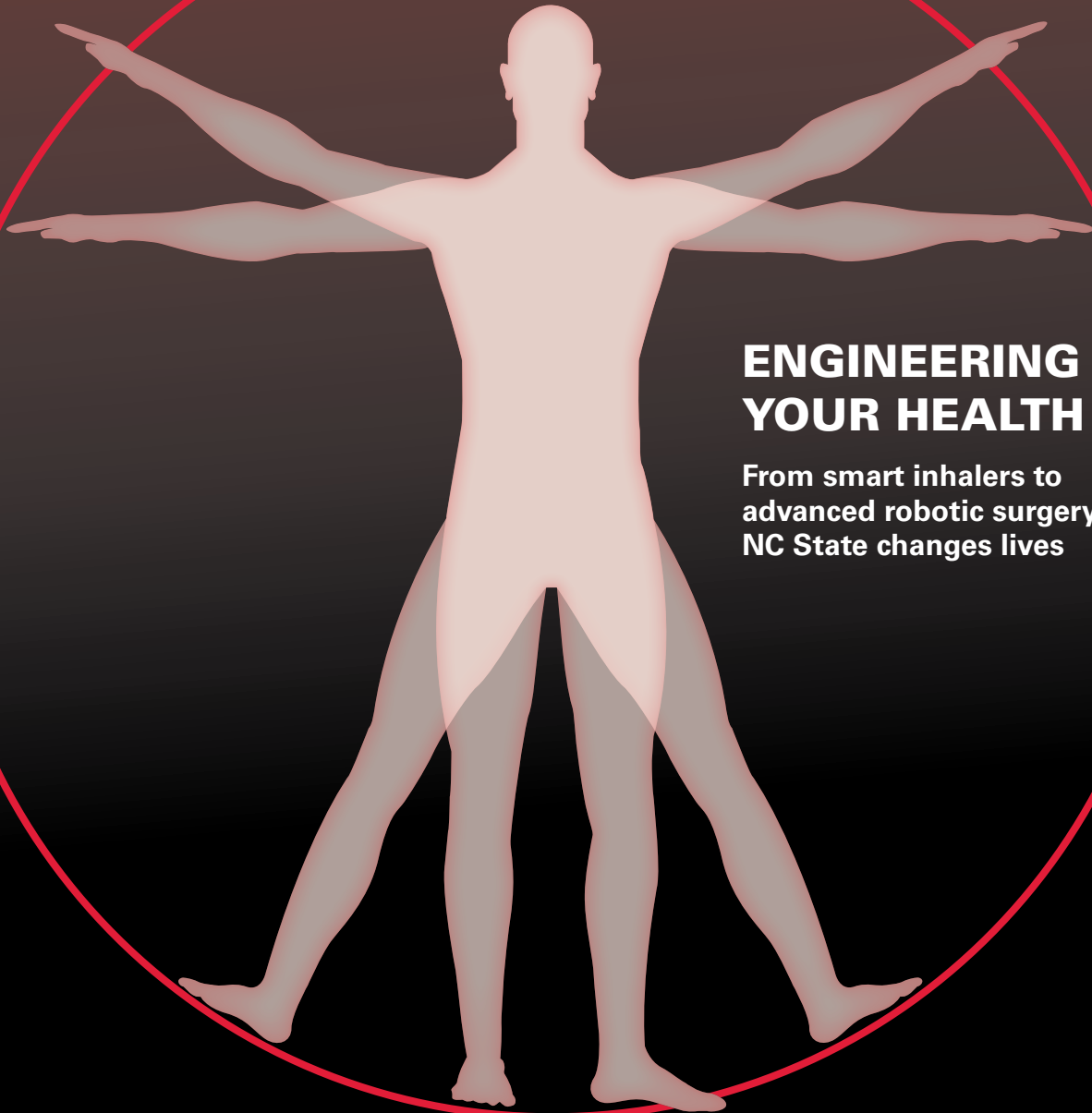


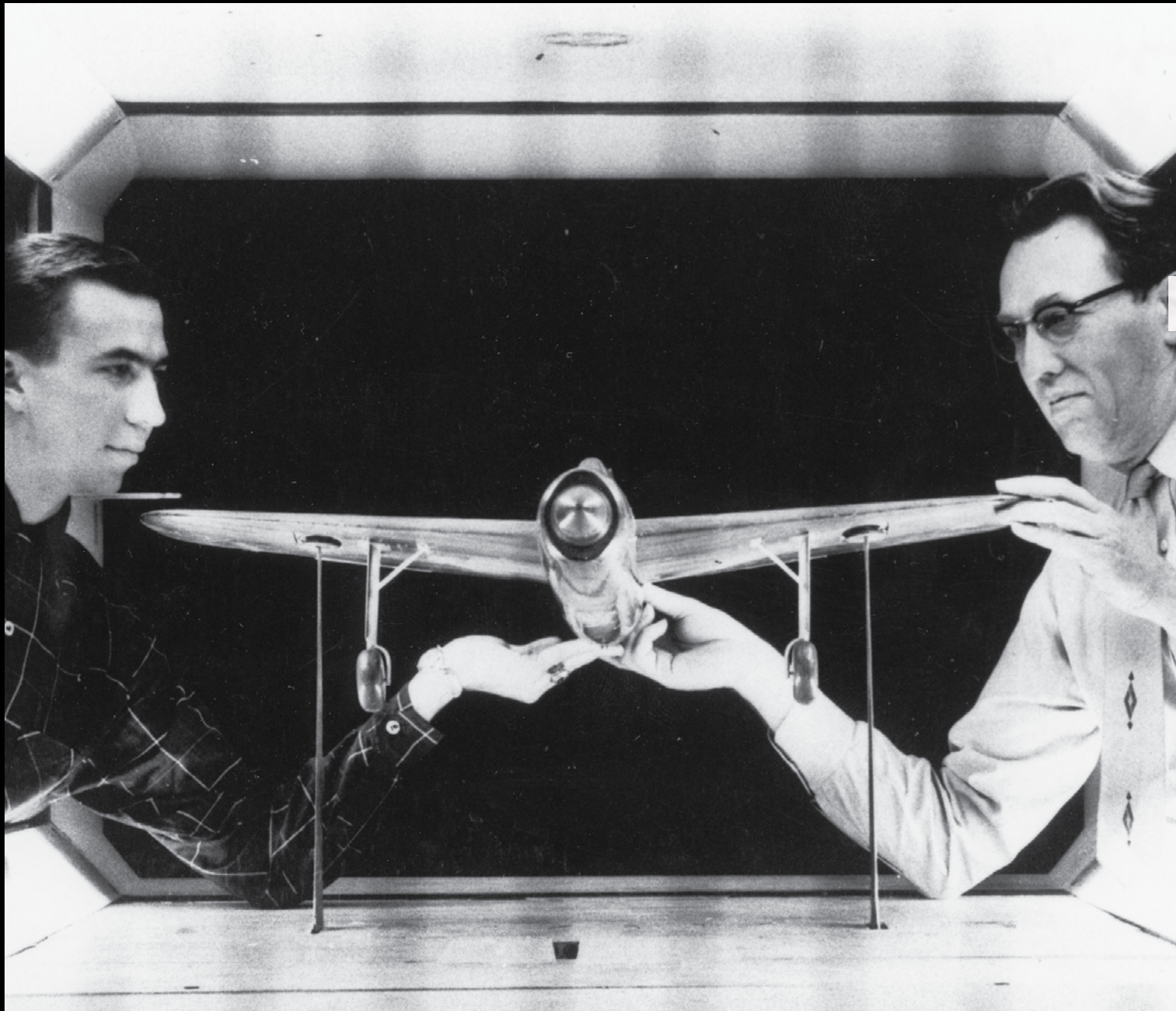
# nc state

## ENGINEERING



### ENGINEERING YOUR HEALTH

From smart inhalers to  
advanced robotic surgery,  
NC State changes lives



### **"WINDS SWOOSH AT NC STATE"**

Back in 1955, when the wind tunnel in Broughton Hall was just four years old, the *Charlotte Observer* ran this photo in a story titled, "Winds Swoosh at NC State College." The story documented how researchers were using the tunnel to study hurricane winds a few months after Hurricane Hazel struck the coastal Carolinas.

Fast-forward to 2010. The new Engineering Building III (right), which will house the departments of Mechanical and Aerospace Engineering and Biomedical Engineering when it opens this summer, will feature a new, state-of-the-art wind tunnel for teaching and research. A new generation of swooshers is born.

Robert M. Pinkerton (right), who is in charge of the aeronautical option, points out to Al Pruden, senior from Rolesville, a feature of the model plane mounted in the wind tunnel.

— From the *Charlotte Observer*, January 30, 1955.



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**ON THE COVER:** Leonardo da Vinci created the original Vitruvian Man around the year 1487 based on the work of the engineer and architect Marcus Vitruvius Pollio. The drawing has since become a contemporary symbol of health and medicine. The related illustration on page 16 shows just some of the ways NC State engineers are improving health and health care.



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**ASSOCIATE EDITOR Nate DeGraff**

**GRAPHIC DESIGN DIRECTOR Mark Ransom**

**MAGAZINE DESIGN DIRECTOR Natalie Scott Brown**

**CONTRIBUTING WRITERS**

Caroline Barnhill, Martin Baucom, Mick Kulikowski, Brandi McElveen,  
Matt Shipman, Laura White

**IMAGES**

Cree, Inc., Nate DeGraff, Rebecca Kirkland, Selwyn Sherrill, Jonathan  
Stephens, Jennifer Weston, Roger Winstead, iStockphoto.com, Skanska

**OFFICE OF THE DEAN**

College of Engineering  
Campus Box 7901, NC State University  
Raleigh, NC 27695-7901  
919.515.2311  
[www.engr.ncsu.edu](http://www.engr.ncsu.edu)

**NC STATE ENGINEERING FOUNDATION INC.**

Campus Box 7901, NC State University  
Raleigh, NC 27695-7901  
919.515.7458  
[www.engr.ncsu.edu/foundation](http://www.engr.ncsu.edu/foundation)

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***Did you know?***

Did you know that the FREEDM Systems Center headquartered  
at NC State is the first National Science Foundation Engineering  
Research Center focused on finding technical solutions for the  
nation's energy problems? The center aims to develop the "Energy  
Internet" that revolutionizes the nation's power grid and speeds  
renewable electric-energy generation and storage technologies  
into homes, businesses and vehicles. Plug-in hybrid vehicles, such  
as the school bus shown here, are part of the solution.

# FROM THE DEAN



Louis A. Martin-Vega

This spring at NC State, we are welcoming a new  
chancellor, saying goodbye to an excellent interim  
leader, and celebrating many successes in the College  
of Engineering.

Chancellor Randy Woodson arrived at NC State in early  
April. He has already won the admiration of many across  
the campus, and we are looking forward to working with  
him to move the College and the University forward.  
With his arrival, we also said goodbye to Chancellor Jim

Woodward, who has provided excellent leadership for the University since his arrival  
last year. The NC State community will be forever grateful for his strength, integrity  
and grace during a very difficult time.

We are also celebrating many successes in the College. We joined forces with  
the Pratt School of Engineering at Duke University to host a National Academy of  
Engineering Grand Challenges Summit here in Raleigh. The summit brought together  
more than 500 academics, researchers, students and leaders in government and  
industry to examine the challenges we face in energy and health care and discuss  
our nation's ability to compete in all areas internationally. This spring, good news  
arrived with the publication of the latest *US News & World Report* graduate engineer-  
ing rankings, which placed our College 30th overall and 18th among public colleges  
of engineering, both up one spot from last year.

In this issue you will read about many of our other achievements. We talked with  
Senate Pro Tem Marc Basnight about how the College and the North Carolina  
General Assembly have worked together to create jobs and build North Carolina's  
reputation as a worldwide leader in innovation and high-tech industry. We are fortu-  
nate that our state leaders have long supported higher education, and with their sup-  
port the College will continue to play an important role in establishing North Carolina  
as an innovation hot spot.

You will also read about our efforts to make the new open source cyber world more  
secure, research that improves your health and well-being, and some of our future  
engineers who are already making an impact. And we talk with Bob Greenberg of  
IBM about the long-term relationship between his company and the College, exam-  
ine how several of our graduates created the internationally successful company  
Cree, Inc., and explore the benefits of the Edward P. Fitts endowment.

We are grateful for your ongoing support, and I sincerely hope you enjoy this spring  
issue of *NC State Engineering*. As always, I look forward to a continued dialogue  
with you on our shared future.

Louis A. Martin-Vega, Dean

## The new chancellor



William R. Woodson

Dr. William R.  
"Randy" Woodson  
began his duties as NC  
State's 14th chancellor  
in April and has made  
boosting the univer-  
sity's national and  
international reputa-  
tion one of his primary  
goals.

Woodson comes to  
NC State from Purdue

University, where he served as executive vice  
president for academic affairs and provost.  
He took on the role of provost at Purdue in  
May 2008 after serving nearly four years as  
the Glenn W. Sample Dean of Agriculture.  
Prior to that, Woodson was the associate dean  
of agriculture and director of the Office of  
Agricultural Research Programs at Purdue  
from 1998 to 2004.

Woodson replaces Dr. Jim Woodward, who  
had been serving as interim chancellor since  
June 2009.

"The grand challenges of society  
now — water, climate, energy — have science  
and technology issues that have to be resolved,  
and NC State is in a tremendous position to be  
among the leading institutions in the country  
that address those challenges. But we can't  
do that if we're not strong in engineering, the  
physical sciences and mathematics," Woodson  
told the *Raleigh News & Observer* in March.

Woodson received a bachelor's degree in  
horticulture and chemistry from the University  
of Arkansas and a master's degree in horti-  
culture and a doctorate in horticulture/plant  
physiology from Cornell University. ■





# Q & A

## Questions for **NANCY ALLBRITTON**

Dr. Nancy Allbritton became the new head of the Joint UNC-NC State Department of Biomedical Engineering in August 2009. She talks about her background, her plans for the department and the fast-growing field of biomedical engineering.

**What role does engineering play in health care, which has made so much national news recently?** When I think of engineers, I think of people who improve the quality and function of our lives. That may be building bridges, but it also may be building a better artificial knee. A big part of life's quality is your ability to carry out your daily activities and do things that excite you. Engineering helps us to do those things as long as possible.

**What attracted you to this position?** The potential to build a first-rate department is here. You have a great medical school at UNC and a great College of Engineering at NC State. You have dynamic faculty. And nearby you have Research Triangle Park, which is important because biomedical engineering is closely tied to industry, commercialization and biotechnology. It just doesn't get any better than that.

**Your background seems to suit the job well. Tell us about it.** I interweaved work on a Ph.D. in medical engineering and medical physics at MIT with work on a medical degree at Johns Hopkins. After doing postdoc work at Stanford, I became a faculty member at UC-Irvine, where I helped found their department of biomedical engineering. I came to this position from the chemistry department at UNC, where I continue my biomedical microtechnologies research.

**NC State has made improving health and well-being a key focus area.**

**How does your department fit in with that initiative?** It's a very forward-looking idea on NC State's part, and we see ourselves being a key player. The National Institutes of Health and other funding agencies like to see groups of researchers from different fields working together, and between the colleges of engineering and veterinary medicine, as well as other entities at NC State, there are huge opportunities for our researchers to partner with others here.

**Where do you want to take the department?** We've laid out three primary research directions: rehabilitation engineering, imaging engineering and biomedical microtechnologies. All three capitalize on the strengths of both NC State and UNC and reflect North Carolina's interest in bolstering its leadership role in cancer research, diagnostics and therapeutics.

**Why is biomedical engineering such a fast-growing field?** One reason is the growing trend among the biological and medical sciences to become more quantitative. We also recognize that technology is really what spurs leaps in biomedical research, and biomedical engineering is one of the natural suppliers of that technology. With federal funding agencies showing great interest in these areas, it's a very good time to be an engineer or a physical scientist in a biomedical field. ●

## IN THE NEWS

### Honeyfied: IES helps bee company grow

*Business North Carolina* magazine named its 2009 Small Business of the Year in December.

The winner? A northwestern North Carolina beekeeping company that received assistance from the Industrial Extension Service, which is part of the College of Engineering.

The Brushy Mountain Bee Farm, located in Moravian Falls, NC, doubled its sales and workforce over the course of two years, thanks in part to lean manufacturing principles taught by IES specialists.



With the IES assistance, the company reported more than \$2 million in increased sales and doubled its workforce to 50 employees. Sales are 81 percent higher than in 2007, and more than 24,000 customers have shopped at the company in person, through mail order, or online over the past two years, according to the magazine. ■

### Crime time coverage

*Reuters*, the international news service, brought up the hit TV series "CSI: Crime Scene Investigation" in a November story, noting that the criminologists on the show use the latest technology to solve crimes.

"Soon," the story continued, "real criminal investigation teams will be using videogame technology to help forensic scientists collaborate virtually to recreate what happened at the scene of the crime."

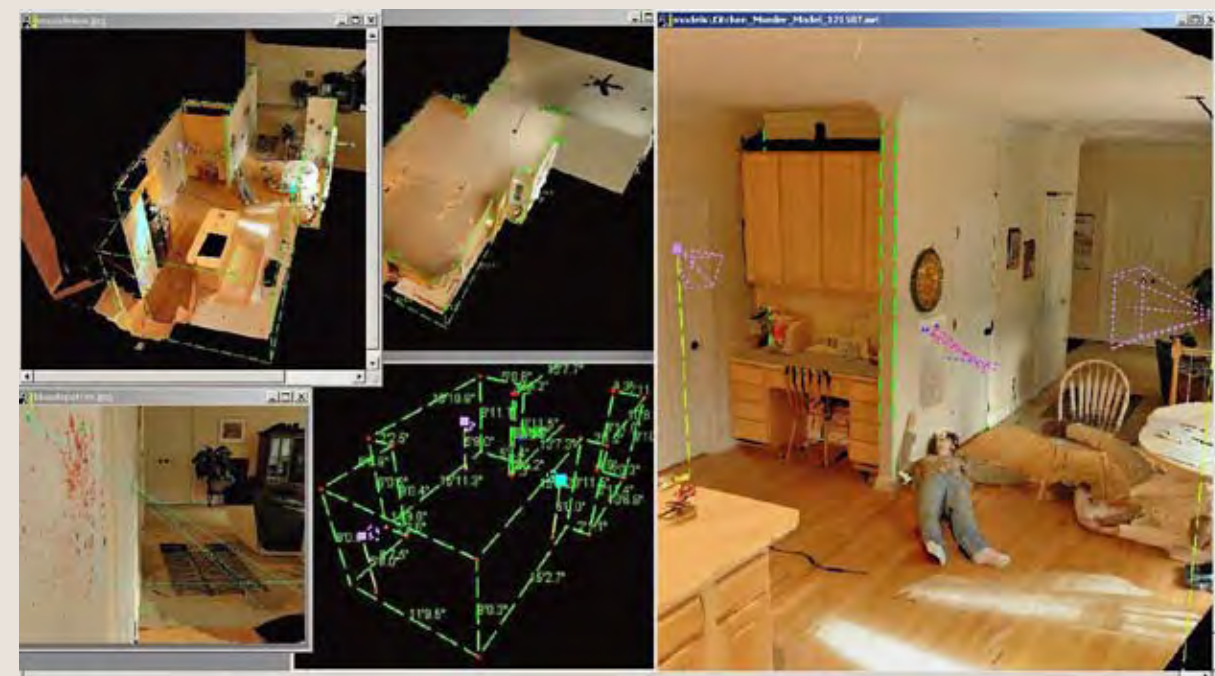
That's because Dr. Michael Young, associate professor of computer science, and

other NC State researchers landed a \$1.4 million grant from the National Science Foundation to help lay a foundation that promotes greater collaboration in the field of forensic science.

Their work will develop a framework for multi-agency CSI collaboration by creating an unprecedented cyber infrastructure — a virtual environment that provides data resources, simulation tools, expert access and unique collaboration capabilities.

"We'll be building an easy-to-use interface on top of the game environment that will allow CSIs and other investigators to link locations in the crime scene to external sources of data, such as hair and fiber databases, finger print images and investigator notes," Young told *Reuters*.

The *New York Times*, *Washington Post* and *Forbes* were among the news outlets that picked up the story. ■







## Groundbreaking moment

The James B. Hunt Jr. Library will house the University's engineering collections and will be located near the completed Engineering Buildings I, II and III along a patch of green space known as "the oval."

The growing engineering community on Centennial Campus is another step closer toward getting a state-of-the-art library within a short walk from many of its buildings.

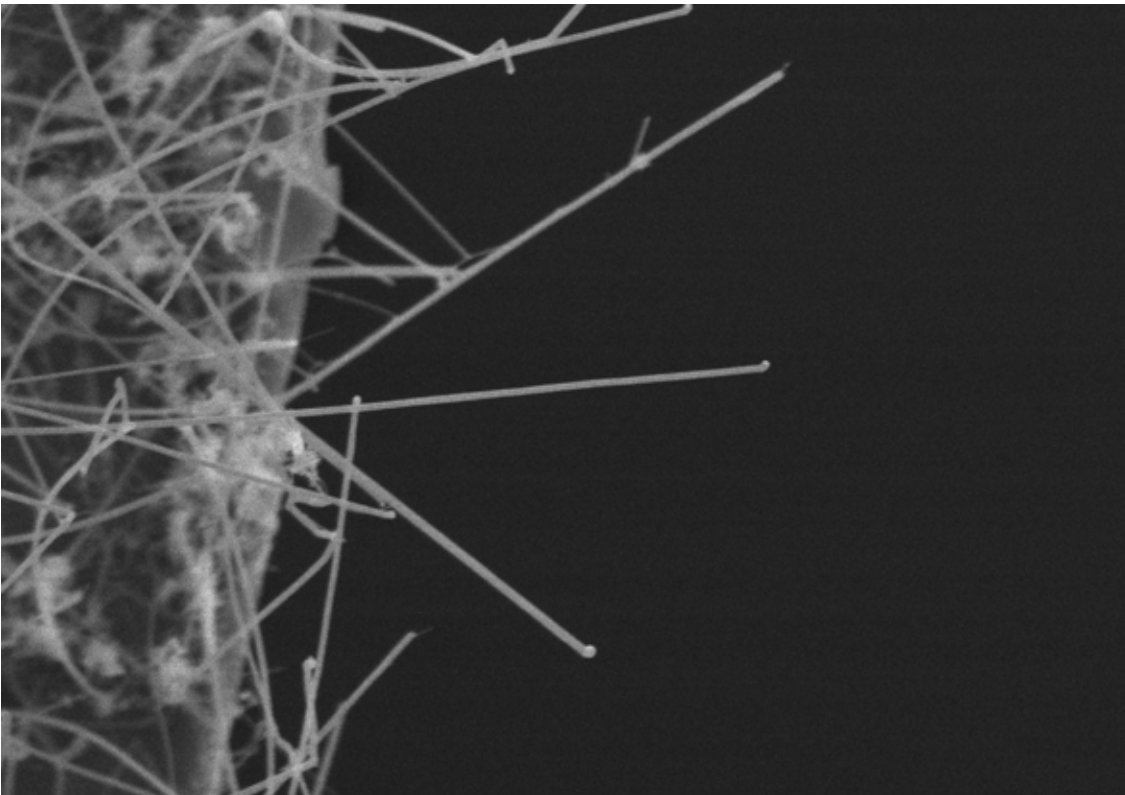
The ceremonial groundbreaking of the James B. Hunt Jr. Library occurred Oct. 23 and coincided with the campus' 25th anniversary celebration. The event drew 400 guests and featured addresses by several notable North Carolina figures including Hunt, who was the state's governor for 16 years and holds two degrees from NC State.

The library, which will feature a state-of-the-art automated storage and retrieval system, is scheduled to be completed in 2012. It will house the University's engineering collections and will be located near the completed Engineering Buildings I, II and III along a patch of green space known

as "the oval." When built, Engineering Buildings IV and V will stand nearby.

"This building will mark the beginning of a new era in learning and collaboration on campus," said Susan Nutter, vice provost and director of libraries at NC State. "We're absolutely thrilled that the university is going to have one of the finest academic and research libraries anywhere in the world."

The 200,000-square-foot library will also help alleviate overcrowded conditions in university library spaces. And it will house the Institute for Emerging Issues, a public-policy "think-and-do" tank that brings together leaders from businesses, non-profit organizations, government and higher education to tackle some of the biggest issues facing North Carolina's future growth and prosperity. ■



## Wired for action

"These wires are the building blocks for future nanoelectronics."

Silicon nanowires are attracting significant attention from the electronics industry due to the drive for ever-smaller electronic devices, from cell phones to computers. The operation of these future devices, and a wide array of additional applications, will depend on the mechanical properties of these nanowires.

New NC State research shows that silicon nanowires are far more resilient than their larger "bulk" counterparts, a finding that could pave the way for smaller, sturdier nanoelectronics, nanosensors, light-emitting diodes and other applications.

"The mainstream semiconductor industry is built on silicon," says Dr. Yong Zhu, assistant professor of mechanical engineering and lead researcher on this project.

"These wires are the building blocks for future nanoelectronics."

The researchers set out to determine how much abuse these silicon nanowires can take. How do they deform — meaning how much can you stretch or warp the material before it breaks? And how much force can they withstand before they fracture or crack?

As it turns out, silicon nanowires deform in a very different way from bulk silicon, which is brittle and can't be stretched or warped very much without breaking.

"The silicon nanowires are more resilient and can sustain much larger deformation," said Feng Xu, a Ph.D. student in mechanical engineering. "Other properties of silicon nanowires include increasing fracture strength and decreasing elastic modulus as the nanowire gets smaller and smaller."

The fact that silicon nanowires have more deformability and strength is a big deal, said the researchers, who also include Ph.D. student Qingquan Qin and researchers at the University of Michigan.

"The insights gained from this study not only advance fundamental understanding about size effects on mechanical properties of nanostructures," Zhu said, "but also give designers more options in designing nanodevices ranging from nanosensors to nanoelectronics to nanostructured solar cells." ■





Framing the forecast

By using climate forecasts for short-term planning, water managers can better plan for potential shortages due to drought.

With much of the Southeast finally recovering from a major drought, many state and local governments are looking for ways to improve water resource management in anticipation of the next extended dry period. Fortunately, continued improvement of climate forecasts is resulting in better information about what rainfall and streamflow may look like months in advance. An NC State engineer has developed an innovative water management framework that would take advantage of these forecasts to plan for droughts or excess rain in order to make the most efficient use of an area’s water resources. By using climate forecasts for short-term planning, water managers can better plan

for potential shortages due to drought, says Dr. Sankar Arumugam, an assistant professor of civil, construction and environmental engineering. The research “proposes a framework that would use forecast data to improve water management, allowing water managers to be proactive with their planning rather than reacting to events after the fact,” Arumugam says. According to Arumugam, advances in the understanding of how changes in ocean temperature affect the atmosphere and, ultimately, precipitation and temperature, make seasonal or longer-term climate forecasts increasingly reliable. At the same time, Arumugam says, water management is becoming more important due to increasing global population — which

means greater water demand — and global climate change, which could stress both humid and arid regions with the former getting wetter and the latter becoming drier. As part of the research, Arumugam and other researchers performed a case study looking at the state of Ceara in Brazil, which is an arid region that receives little or no rainfall from June through the following January. “We found there would be significant benefits for the region, primarily in alleviating the vulnerability of poor farming communities if this framework was implemented,” says Arumugam. ■



Robertson’s design was credited with allowing thousands of people to escape the towers before they collapsed following the terrorist attacks of Sept. 11, 2001.

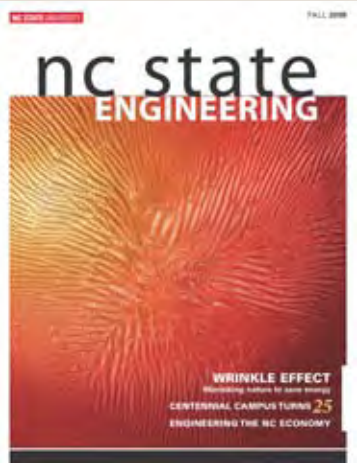
Towering figure

Leslie E. Robertson, who led the structural design of the former World Trade Center, delivered the annual Paul Zia Distinguished Lecture in Civil Engineering and Construction in September, packing the Raleigh Little Theatre near the NC State campus. Dubbed the “Skyscraper Superstar” for his groundbreaking work on the World Trade Center and other towers, Robertson has redefined the upper limits of high-rise engineering and design. In his address, Robertson used his innovative designs to discuss how the complicated relationship between structural engineers and architects can produce brilliant results. Robertson first gained worldwide attention in the 1960s for directing the structural design of the World Trade Center’s twin towers in New York. His design was credited with allowing thousands of people to escape the towers before they collapsed following the terrorist attacks of Sept. 11, 2001. Robertson and his New

York-based firm, Leslie E. Robertson and Associates, are also responsible for the structural design of the 1,614-foot Shanghai World Financial Center, the world’s second-tallest completed building at the time of his address, and hundreds of other skyscrapers and structures around the world. Robertson’s wife, SawTeen See, who joined him for his trip to Raleigh, is also an accomplished structural engineer. The Zia lecture series was established in 2002 to honor the accomplishments of Dr. Paul Zia, Distinguished University Professor Emeritus of Civil Engineering at NC State. Zia is a leading figure in the fields of concrete and structural engineering and served as head of the Department of Civil, Construction, and Environmental Engineering for nine years. The series is presented by NC State’s Constructed Facilities Laboratory and the Department of Civil, Construction, and Environmental Engineering. ■

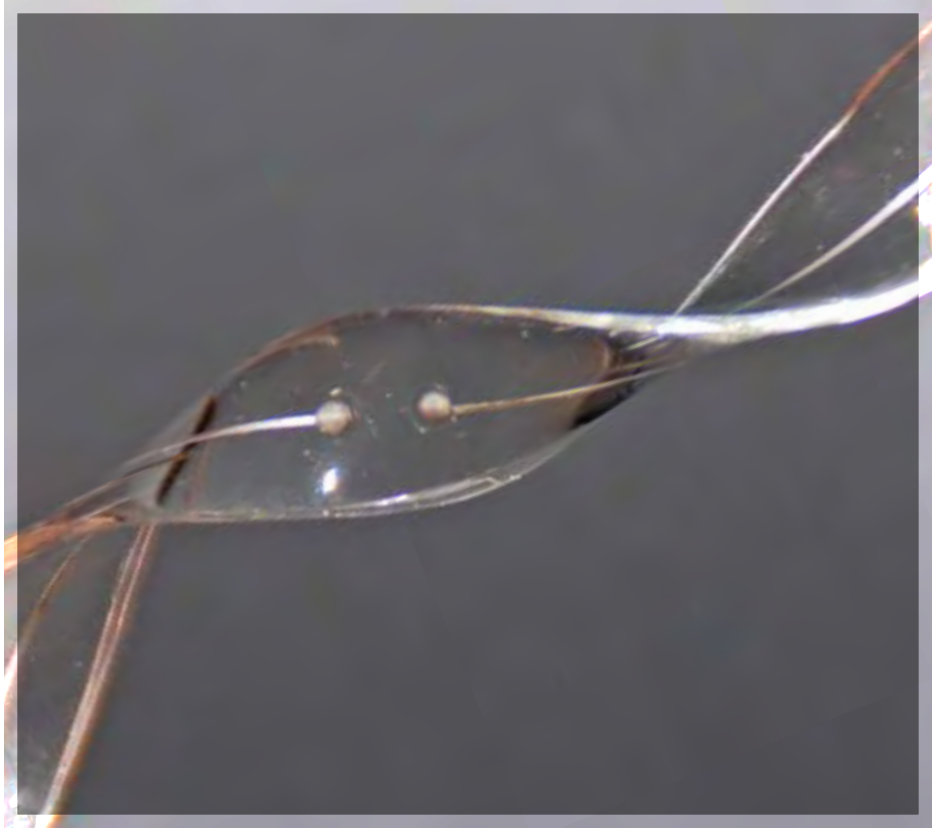
Award-winning magazine design

We redesigned this magazine for the Fall 2009 edition to better communicate all the great things that make the College of Engineering at NC State one of the nation’s leading public engineering schools. Our goal was to come up with content and a design that featured our accomplishments as well as issues of larger significance to the College, such as its impact on the North Carolina economy and its leadership role on NC State’s groundbreaking Centennial Campus. We are pleased to announce that we met these goals and were able to save money on production costs as well. Our success was recognized with two awards from the Council for Advancement and Support of Education (CASE) at its 2009 District III Advancement Awards Competition. The magazine was honored with an Award of Excellence in the category of “Magazine Publishing Improvement” and a Special Merit Award in the category of “Alumni Magazines II” for magazines published for institutions or colleges with an enrollment of 5,000 to 10,000. In addition, the feedback from readers like you has been overwhelmingly positive, and we thank you for your support. Happy reading! ■





## Shape shifters: Creating a new breed of antennas



Antennas aren't just for listening to the radio anymore. They're used in everything from cell phones to GPS devices.

NC State research is revolutionizing the field of antenna design — creating shape-shifting antennas that open the door to a host of new uses in fields ranging from

public safety to military deployment. Modern antennas made from copper or other metals are limited as to how far they can be bent — and how often — before they break completely. NC State engineers have created antennas using an alloy that “can be bent, stretched, cut and twisted — and will return to its original shape,” said Dr. Michael

The alloy in the antennas “can be bent, stretched, cut and twisted — and will return to its original shape.”

Dickey, assistant professor of chemical and biomolecular engineering and co-author of the research.

The researchers make the new antennas by injecting an alloy made of the metals gallium and indium, which remains in liquid form at room temperature, into very small channels the width of a human hair. The channels are hollow, like a straw, with openings at either end — but can be any shape. Once the alloy has filled the channel, the surface of the alloy oxidizes, creating a “skin” that holds the alloy in place while allowing it to retain its liquid properties.

The alloy makes an effective antenna that could be used in a variety of existing electronic devices, but its applications could also include monitoring bridge construction and uses in military equipment.

Others involved in the research include NC State doctoral students Ju-Hee So, Amit Qusba and Gerard Hayes, undergraduate student Jacob Thelen, and University of Utah professor Dr. Gianluca Lazzi, who participated in the research while a professor at NC State. ■

## Series of successes

During the Fall 2009 and Spring 2010 semesters the College and the North Carolina Dept. of Commerce hosted a series of four seminars designed to motivate and enhance collaboration among researchers and industry.

The series was based on manufacturing research and development across a number of industry areas. Each seminar was a conversation between attendees and faculty on how the College and industry

can work better together to address the state's economic-development challenges and opportunities. In addition to presentations by top researchers, the seminars offered participants direct access to engineering faculty.

The first seminar, held in November, focused on advanced materials and manufacturing and was attended by industry representatives as well as several members of the NC General Assembly. The second seminar, which focused on aerospace and

manufacturing, was held in February.

The two seminars held in April and May focused on energy, green manufacturing and biomanufacturing.

The seminars were organized in part by NC State's Industrial Extension Service (IES), which is part of the College. IES helps companies stay abreast of the latest technologies and best practices in both engineering and business management to increase productivity, efficiency, quality and, as a result, profits. ■

## Nothing but net

Pay attention, Shaq: Two NC State engineers have figured out the best way to shoot a free throw — a frequently underappreciated skill that gets more important as the game clock winds down.

To get a swish rather than a brick, you need the best possible conditions for releasing the basketball from your hand, say Drs. Chau Tran and Larry Silverberg, mechanical and aerospace engineers and co-authors of a peer-reviewed study.

The engineers used hundreds of thousands of three-dimensional computer simulations of basketball free-throw trajectories to arrive at their conclusions. After running the simulations, Tran and Silverberg formed recommendations to improve free-throw shooting.

First, the engineers say that shooters should launch the shot with about three hertz of back spin. That translates to the ball making three complete backspinning revolutions before reaching the hoop. Back spin deadens the ball when it bounces off the rim or backboard, the engineers assert, giving the ball a better chance of settling through the net.

Shooters should aim for the back of the rim, leaving close to 5 centimeters — about 2 inches — between the ball and the back of the rim, the engineers say. According to the simulations, aiming for the center of the basket decreases the probabilities of a successful shot by almost 3 percent.

Other recommendations concern the height and launch angle of the release.

“Our recommendations might make even the worst free-throw shooters — you know who you are, Shaquille O’Neal and Ben Wallace — break 60 percent from the free-throw line,” Silverberg says with tongue firmly in cheek. “A little bit of physics and a lot of practice can make everyone a better shooter from the free-throw line.” ■



To get a swish rather than a brick, you need the best possible conditions for releasing the basketball from your hand.





A Sanitary Solution

In impoverished and developing countries, monthly periods are a major cause for concern among women. The lack of affordable, quality sanitary pads results in women missing up to 50 days of school annually — thereby compromising their educational and professional potential. Researchers at NC State are helping to combat the problem by designing affordable pads made from natural, available materials that will allow for local production and sale. “This project is just one of many examples of how a university without a medical school like NC State can have a major impact on global health,” said Dr. Marian McCord, associate professor of biomedical

engineering and textile engineering, chemistry and science. McCord was contacted by Sustainable Health Enterprises (SHE), a social enterprise dedicated to developing a franchise model led by young women to manufacture and distribute affordable, high-quality and environmentally friendly sanitary pads in underserved parts of the world. Former President Bill Clinton named the SHE project one of the “commitments to action” at the Clinton Global Initiative’s annual meeting in September. McCord and other NC State researchers are using their knowledge in areas such as nonwovens, wood and paper science, and medical textiles to develop a sanitary pad from materials readily available in local areas — such as the fiber from banana

“This project is just one of many examples of how a university without a medical school like NC State can have a major impact on global health.”

stems in Rwanda. The pads will be sold by community health workers for 30 percent less than the available brand. Others involved in the project include Drs. Lucian Lucia, Medwick Byrd and Hasan Jameel in the Department of Wood and Paper Science and Dr. Russell Gorga in the Department of Textile Engineering, Chemistry and Science. The final prototype was produced by David W. Allen, a senior in textile engineering. ■

Meeting the Challenges

The College of Engineering at NC State is among the leaders in the national conversation on the grand challenges facing the world in the 21st century. In partnership with Duke University’s Pratt School of Engineering, the College hosted a summit on the National Academy of Engineering (NAE) Grand Challenges in Raleigh in early March. The event, one of five national summits scheduled around the country in 2010, focused on engineering better medicines, preventing nuclear terror and providing energy from fusion. These challenges were among 14 identified by NAE as needing solutions in the 21st century.

The Raleigh event drew hundreds of leaders from a variety of fields and included tours of NC State’s nuclear reactor, Biomanufacturing Training and Education Center and new engineering buildings on Centennial Campus. Speakers included U.S. Sen. Edward E. “Ted” Kaufman of Delaware, who holds a mechanical engineering degree from Duke; John T. Chambers, the chairman and CEO of Cisco; Dr. Kristina M. Johnson, the U.S. Under Secretary for Energy; and Jeffrey R. Immelt, chairman and CEO of GE.

The NAE Grand Challenge Summit Series represents a commitment to sustain critical dialogue and engagement with grand challenge problems and to change the way students are educated to better prepare them for the challenges ahead. ■



More on the Grand Challenges is available at [www.engineeringchallenges.org](http://www.engineeringchallenges.org).



Baugh named Japan Center director

Dr. John Baugh (left), professor of civil engineering and operations research, has been named director of the North Carolina Japan Center at NC State. Founded in July 1980 by Gov. James B. Hunt, the Japan Center continues to strengthen the state’s academic, economic, scientific and cultural ties with Japan. It functions as a statewide resource, promoting business and trade with Japan, fostering academic collaboration and student exchange, and serving the general public by offering language classes for pre-college students and adults, hosting a variety of cultural events, and working with Japan-related community groups. Baugh’s scientific and technical areas of interest overlap with issues of national importance to the country of Japan in areas such as computational and decision support for natural hazard mitigation and active seismic protection of building structures. He has traveled throughout Japan’s cities and more remote areas. ■

Brenner receives R.J. Reynolds Award

Dr. Donald W. Brenner (right), Kobe Steel Distinguished Professor and associate department head in the Department of Materials Science and Engineering, was named the 25th recipient of the R.J. Reynolds Tobacco Company Award for Excellence in Teaching, Research and Extension in November. The award was established in 1981 within the College of Engineering to honor a member of the engineering faculty who has demonstrated superiority in several areas of activity that relate to the University’s three-fold mission of teaching, research and extension. The annual award is supported by the R.J. Reynolds Tobacco Company through the North Carolina Engineering Foundation Inc. to bring recognition to scientific and educational achievements in fields of engineering. The recipient is given a \$25,000 prize distributed over five years. Brenner has been one of the world’s leading innovators in research and education in computational materials science for more than 20 years. ■





# THINKING BIG

A strong relationship with the North Carolina General Assembly has kept the College moving.

Marc Basnight surveyed the landscape. Two gleaming engineering buildings stood behind him, and another, nearly finished, stood to his left. One of the state’s most influential political figures liked what he saw at the College’s new home on Centennial Campus.

“Society is enriched because of what is created here — the opportunity to do something that no one’s ever done for the betterment of mankind,” Basnight said a little later in a conference room overlooking the scene. “If you don’t think big, you’ll get caught up in the mainstream of mediocrity.”

Basnight, the president pro tempore of the state Senate, and other members of the North Carolina General Assembly have been key players in the College’s quest to become the top public engineering school in the country. Over the past decade, state legislators — with

help from voters — have authorized funding for three new engineering buildings on NC State’s landmark Centennial Campus. Two are open, and the third will open its doors this summer.

That legislative support has helped propel the College to elite status among the nation’s engineering institutions. The College has the nation’s fourth-largest undergraduate engineering enrollment and produces 63 percent of all engineering degrees awarded by North Carolina colleges and universities. Its graduate program is ranked No. 1 in North Carolina and 18th nationally among public engineering schools, according to *US News & World Report*.

Now the College has turned its focus to engineering buildings IV and V, which will house industrial and systems engineering; engineering administration; civil, construction, and environmental engineering; and nuclear engineering. Legislators approved funding for designing the buildings, but the money has been held up as the state struggles with the fallout from the recent recession.

The economic troubles notwithstanding, Basnight believes it’s important that the College get the money for the new buildings. He told Dr. Louis Martin-Vega, dean of the College, that the facilities represent an investment in the state’s economic future.

“I don’t believe you back up in the design and the planning and the actual appropriating for IV and V,” Basnight said. “I believe it’s critical that we do it.”

Basnight, who represents constituents in eight counties on the state’s northeastern edge, has a history of political and legislative successes. He joined the Senate in 1984 and became its president pro tem in 1993. He has held that leadership post for a record eight terms, during that time creating the state’s Clean Water Management Trust Fund and helping pass \$3.1 billion in bonds for state colleges and universities that provided funds for engineering buildings I and II.

He’s also been a strong supporter of the College and of the engineering profession. For Basnight, building a workforce of trained engineers is critical to the state’s long-term success. He often speaks with industry leaders from around the state who tell him they need more engineers, so he sees the value in a strong engineering college at the state’s largest public university.

“The ultimate goal,” Martin-Vega said, “is the creation of more economic opportunities.”



Sen. Marc Basnight, right, tours the engineering complex on Centennial Campus with Dean Louis Martin-Vega, center, and Kevin Howell, assistant to the chancellor for external affairs.

Basnight lives in Dare County, where Orville and Wilbur Wright made their historic flight in 1903. He wondered aloud what the Wright Brothers could have done with formal training, and what the state’s leaders can offer a child who wants to be the next Orville or Wilbur.

“Why shouldn’t we want to lead the world in the development of the way we live? And how we move people. How we communicate. How we provide food for the world,” Basnight said. “It is in places like this that this will occur.” ■

Support from the General Assembly has helped the College rise in national rankings, add students, conduct dynamic research, build new facilities and hire new faculty.

**NATIONAL RANKING\***

2007	2010
34	30

\*Graduate school rankings published in *US News & World Report*.

**RESEARCH EXPENDITURES**

2006	2009
\$92 million	\$128 million

**STUDENTS**

2006	2009
7,467	8,769

**NEW FACILITIES**

3 new engineering buildings on Centennial Campus with 615,000 square feet  
198 laboratories  
23 classrooms

**NEW FACULTY (2007-2009)**

\$32.8 million grants secured  
7 NSF CAREER Awards  
50 Patents or patents pending  
8 Professional Society Fellows  
3 Editors-in-chief of professional journals





# ENGINEERING YOUR HEALTH

NC State engineers are finding new ways to help all of us enjoy longer, healthier and more productive lives. This graphic shows just some of the ways NC State Engineering is improving health and health care.



## Blood filtering

NC State chemical engineers developed a filter that removes the human form of "mad cow disease," a fatal brain disorder, from blood. The device filters the blood prior to transfusions into patients.



## Charging implants

Tiny retinal prosthetics and cochlear implants help people see and hear, but they can't store enough energy in a battery. NC State electrical engineers are designing more efficient wireless power transfer circuits to keep these devices running longer.



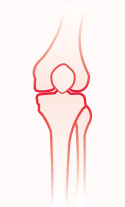
## A smarter inhaler

A new "Smart Inhaler" developed by NC State mechanical engineers targets drugs onto diseased tissue without affecting healthy areas of the respiratory system, signaling a breakthrough for treating diseases like lung cancer.



## Heart surgery

As doctors increasingly rely on robotics for minimally invasive heart surgeries, NC State mechanical, industrial and biomedical engineers have made advancements that allow the robots to work even more efficiently and inexpensively.



## Attacking Arthritis

NC State biomedical engineers use pig joints to study the effects of impact collisions on bones and cartilage. The research could help scientists find the cause of osteoarthritis.

## Particle project

NC State civil, construction, and environmental engineers are studying how tiny airborne particles inhaled by humans affect rates of asthma and heart disease. The results could help lead to better air-quality standards.

## Watching cancer

Biomedical engineers at NC State have developed a noninvasive way to monitor metabolism in malignant tumors, such as those associated with breast cancer. This information can help doctors plan further treatments.

## Modeling radiation dose

CT scans produce images that help doctors diagnose and treat disease, but they also expose the patient to potentially harmful radiation. NC State nuclear engineers modeled the radiation dose to human embryos in the womb to learn more about these effects.

## Groundbreaking Prosthetics

NC State industrial and systems engineers are working with veterinary surgeons on prosthetic implants that are attached to bone, giving patients who have lost an arm or leg a stable, permanent limb. The implants have been tested in cats and dogs.



## Protecting Privacy

As confidential patient information travels across computer networks, it becomes vulnerable to hackers. NC State computer scientists are leaders in the ongoing effort to keep health care records secure.



## Nanostructures

Researchers in chemical engineering and materials science and engineering at NC State are designing tiny structures to deliver drugs to specific areas in the body, a process that also helps researchers learn more about how these structures work.

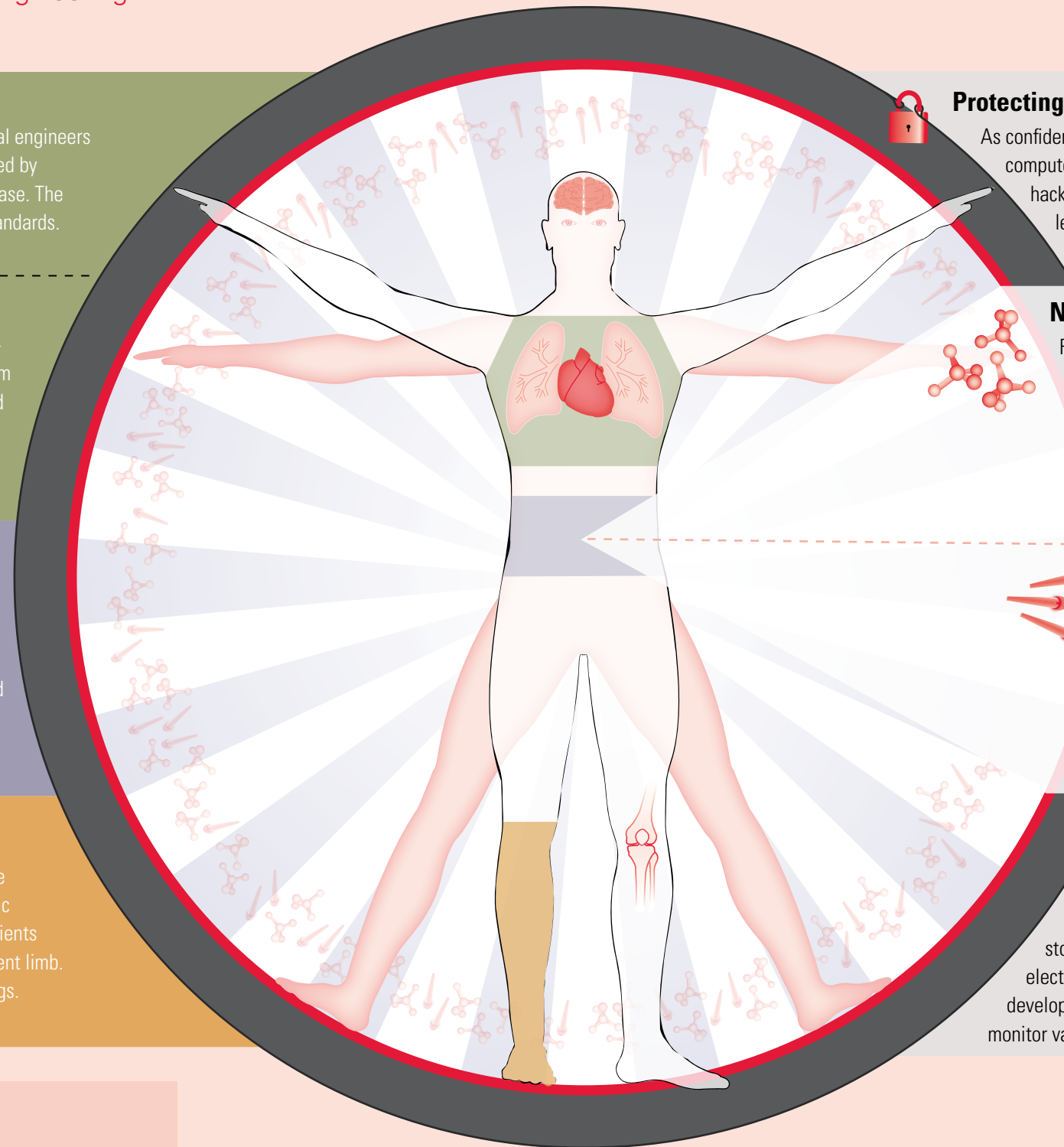


## Microneedles

NC State biomedical engineers are developing tiny hypodermic needles that could one day deliver glucose to diabetics. The new system would provide controlled and painless drug delivery in response to blood-sugar fluctuations.

## Vascular Sensors

Patients suffering from aching legs, lymphedema and other vascular conditions often wear compression stockings to aid circulation. NC State electrical and biomedical engineers are developing sensors for the stockings that can monitor vascular system health.



## Improving the system

NC State is a leader in health systems engineering, filling a growing national need to improve the organization, delivery and cost-effectiveness of health care.





# CYBER WARRIORS

Computer scientists and engineers at NC State are winning the battle against hackers.

*“Companies Fight Endless War Against Computer Attacks”  
– The New York Times*

*“Federal Web sites knocked out by cyber attack”  
– Associated Press*

*“Electricity Grid in U.S. Penetrated by Spies”  
– The Wall Street Journal*

The headlines are ominous — and numerous. There are many more just like them — warnings that personal data may be stolen, national security may be compromised, corporate information may fall into the wrong hands.

It’s the state of the world we live in today, and it’s for these reasons that NC State computer scientists and engineers are at the forefront of efforts to combat cyber-security threats. Through initiatives with government organizations, the military, health care providers and other industry partners, NC State works to keep us safe from hackers and train the next generation of computer security experts.

“This is a growth industry,” said Dennis Kekas, executive director of NC State’s Institute for Next Generation IT Systems. “There are going to be a lot of new jobs created in this new environment.”

To some degree, everyone who works with computers is involved with security. Even the most casual user has account passwords and firewall protection. And since the advent of networking, computer

scientists and engineers have made huge efforts to prevent enormous amounts of information — much of it confidential — from being stolen, deleted or used maliciously.

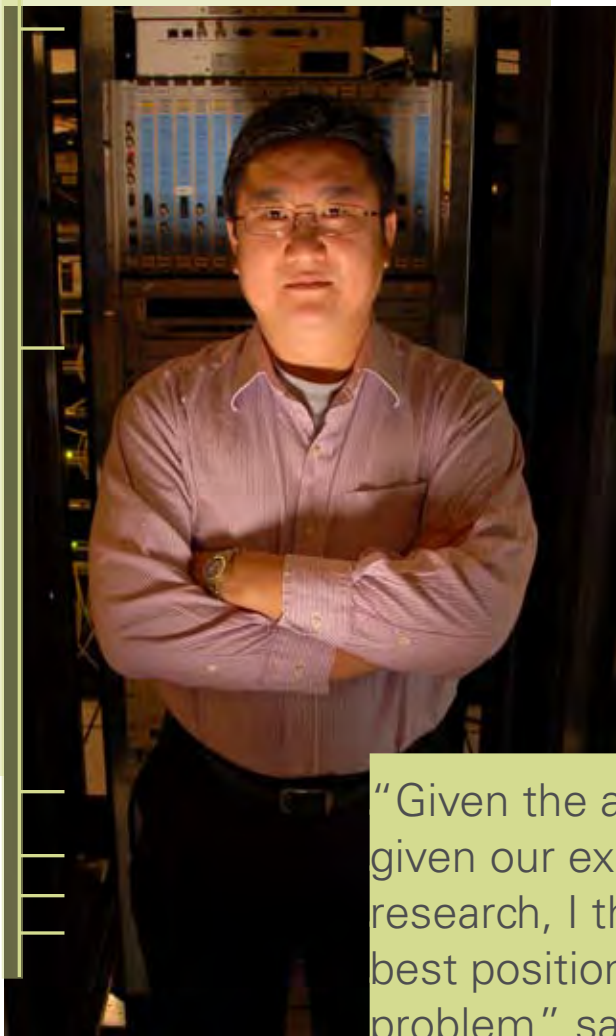
But computers and the networks connecting them have become more omnipresent and advanced. Now, many systems use open source technology, which allows outsiders to improve the software or change it to fit different needs.

A pattern has emerged: Computer scientists develop a new system. Hackers find ways to compromise it. Computer scientists work to defeat those attacks and develop better security measures. Hackers find ways to defeat them. The cycle continues.

“This is an arms race,” said Dr. Douglas Reeves, professor of computer science.

Cyber attackers can take many forms, but the threats many people in the field are most worried about are called “botnets.” These attackers break into a computer, or a group of thousands of computers, and use the machines to commit a crime, all without





"Given the access to VCL and given our experience in security research, I think we are in the best position to tackle this problem," said Dr. Peng Ning.

Dr. Peng Ning is the technical director for the Secure Open Systems Initiative, which envisions a future where all network and software systems are trustworthy and protected from attacks.

the computer's owner knowing what's happened. It's as if someone used a stolen vehicle as a getaway car after robbing a store. A botnet called Zeus, for example, has been getting plenty of national media attention because it is used to steal bank account usernames and passwords.

But as botnets and other attack programs gain attention, Reeves and others at NC State are working to fight them. Among Reeves' projects is an effort to help systems recognize when they're being attacked and build better defenses that don't inhibit the computer's performance. Likewise, Dr. Xuxian Jiang, an assistant professor of computer science, is working to better understand how botnets communicate with each other, which could help researchers design systems to stop them.

Much of the security work at NC State is done with the help of the Virtual Computing Laboratory (VCL). When it was introduced at NC State in 2004, the VCL was one of the first large-scale examples of "cloud computing" operating in an educational setting.

The technology lets users run software on high-powered servers accessed through their personal computers. This lowers hardware and software costs because it shares resources among its users and readapts itself when new users want to use different sets of applications.

The VCL is an extremely secure system, but NC State computer scientists want to push its boundaries further. Through the new Secure Open Systems Initiative (SOSI), which is supported by the U.S. Army Research Office, researchers are working to develop a hyper-secure version of the VCL that conforms to strict military and governmental regulations.

The VCL's security research can also serve the private sector. SOSI develops techniques and tools to secure open systems and helps industry collaborators assess these systems, including trustworthy deployment testbeds. The results, researchers say, will foster economic growth. Partners in the venture include Cisco, IBM, MC Dean, Red Hat and Tekelec.

"Given the access to VCL and given our experience in security research, I think we are in the best position to tackle this problem," said Dr. Peng Ning, associate professor of computer science and technical director of SOSI.

The work is done with the help of students, who get a chance to work in a state-of-the-art computing lab that prepares them for careers in the burgeoning cybersecurity fields. The U.S. government and private companies will need about 60,000 cybersecurity workers over the next three years, according to a Boeing technical director recently quoted in *Business Week*.

"This provides a perfect environment for us to do our work and observe real-world problems," said Ahmed Azab, a graduate student who works in Ning's lab.

The researchers also see great needs for security in health care systems. Health care now accounts for 16 percent of the U.S. gross domestic product, and increasingly complex and interconnected computer systems are needed to manage that hulking pile of information. Dr. Laurie Williams, associate professor of computer science, worries that without proper security measures whole databases could be deleted, or a doctor anywhere in the world could uncover health care information for any patient.

One of Williams' projects involves studying whether a virtualized, open-source health care computing system could be securely

used in rural areas that lack access to centralized servers and maintenance service.

"It's kind of a dangerous thing because health care is one of the few domains where involuntarily all of our records can be sent all over the place," said Williams, who leads NC State's Center for Open Software Engineering. "So it's very important that the software be very secure."

Health care is also a field to which students can easily relate, so much of Williams' coursework involves health-care applications. She has also organized a series of health care information technology forums that have brought together health care researchers, academics and practitioners to foster partnerships and collaboration.

Bringing people together is also a responsibility that Dr. Annie Anton has assumed. Anton, a professor of computer science, works on ways to make the often-convoluted language of privacy policy more understandable for non-computer scientists. She directs the Privacy Place, a privacy research center that aims to disseminate privacy information to the public, software developers and lawmakers.

Anton says that software engineers, for example, aren't trained to analyze law so they can ensure that the software they write follows the law. She works to bridge those gaps, which includes testifying before Congress on privacy issues.

"Unless we make sure that we are disseminating that knowledge to the lawmakers, we're never going to improve things for our nation," Anton said. "Things change, and it's all about making sure Congress is informed."

Keeping computer networks secure is the focus of researchers in the Department of Electrical and Computer Engineering. Dr. Wenye Wang, an associate professor, leads a laboratory that is working on a host of network security projects, including assessing the security of power grids and designing self-healing networking architecture that can withstand the havoc caused by a weapons of mass destruction attack.

The lab is also working on the first networking communications backbone of the FREEDM Systems Center, a National Science Foundation Engineering Research Center headquartered at NC State that's working on ways to bring the "smart grid" into homes, vehicles and businesses nationwide.

The nature of cybersecurity work means researchers are constantly adapting to more complicated systems — and more complicated attacks. The arms race continues.

"To work in this area," said Dr. Mladen Vouk, head of the Department of Computer Science, "you can't really relax."

## VCL ACROSS THE STATE

A big part of NC State's cybersecurity efforts is the Virtual Computing Laboratory (VCL), which lets users run software on high-powered servers accessed through their personal computers.

But the VCL serves much more than just the NC State community. Colleges and universities around the state use VCL, and the technology will eventually make its way into the state's public K-12 school systems.

### A list of current academic partners:

- Duke University
- East Carolina University
- Johnston Community College
- NC Central University
- NC Community College System
- UNC-Chapel Hill
- UNC-Greensboro
- Wake Technical Community College
- Western Carolina University



### TYRIK HICKS

**Class:** Junior  
**Major:** Chemical Engineering  
**Hometown:** Rocky Point, NC

**Fun fact**  
I like to salsa dance.

### ANAHID BEHROUZI

**Class:** Junior  
**Majors:** Civil Engineering and Spanish Language and Literature  
**Hometown:** Chapel Hill, NC

**Fun fact**  
I race competitively in downhill skiing.

### STEPHANE HENRION

**Class:** Senior  
**Major:** Electrical Engineering  
**Hometown:** Raleigh, NC

**Fun fact**  
I dabble in French cooking.

### MARK MENESSES

**Class:** Junior  
**Major:** Nuclear Engineering  
**Hometown:** New Orleans, LA

**Fun fact**  
I've donated blood every eight weeks on the dot for the past three years. A friend of mine had a brother with leukemia, so I've seen first-hand how donated blood can affect someone's life.

### JESSICA ROGERS

**Class:** Junior  
**Majors:** Chemical Engineering and Paper Science and Engineering  
**Hometown:** Greensboro, NC

**Fun fact**  
I lived in Japan for three years as a child.

### KALIE PORTERFIELD

**Class:** Junior  
**Major:** Mechanical Engineering  
**Hometown:** Carroll, Ohio

**Fun fact**  
I've run several half-marathons and will run a full one this spring.

**W**hen the time came to look at colleges, Kalie Porterfield had her pick. The Carroll, Ohio, high schooler was valedictorian of her class and the most valuable player and captain of her soccer team. Her record of leadership and scholarship meant she was highly sought after by many colleges, and she wanted a place where she could continue to lead, serve and excel academically. But she also wanted to learn and grow in a caring and dynamic college environment.

"I chose to come to NC State because of the people," she said. "Everyone was warm and welcoming, and there seemed to be a lot of opportunity here."

Porterfield, now a junior mechanical engineering major at NC State, wants other students to have the same experiences she's had. Along with more than 30 other students, she is part of the Engineering Ambassadors program, an initiative that puts top engineering students at the forefront of the College's recruiting, mentoring and marketing efforts.

"They're basically an army," said Brian Koehler, the staff leader of the ambassadors. "It's a huge benefit to the College to have these talented student leaders reaching out to spread the word about NC State engineering."

The list of activities that ambassadors participate in reads like a timeline of an NC State engineering student's career. Ambassadors are there before the start, dispensing advice to top high school students at open houses and recruiting events across the state. Ambassadors are there in the middle, serving as teaching assistants for an introductory engineering course and helping run a freshman engineering design competition. And ambassadors are there at the end, coordinating a ceremony that introduces seniors to the profession and assisting with the College's massive Engineering Career Fair that helps many NC State students land jobs.

Fulfilling those duties takes a lot of time, especially for students who already stack their schedules with difficult courses and lots of extracurricular activities. But the ambassadors say the experience, which comes with a small stipend, is well worth the effort for the leadership and service opportunities it provides.

"It's changed me," said ambassador Jessica Rogers, a junior majoring in chemical engineering and paper science and engineering. "It's helped me become more outgoing and more of a leader and see the strong points in the things that I'm doing."

The ambassadors program, which informally dates to 2006 but officially began two years ago, has attracted some of the College's finest students. The current crop includes five high school valedictorians, nine recipients of prestigious University scholarships, 28 dean's list members, and several students who hold leadership positions on the Engineers' Council and other student groups.

# AMBASSADORS

## FOR ENGINEERING



“...one of the ways I think I can help the College grow is to help it recruit other talented students from around the state, the nation and the world.”

–Stephane Henrion

Having these top performers serve as the faces of the College has helped it compete for the next generation of outstanding students. Last fall, for example, nearly 400 high school students and their parents sampled desserts, chatted with ambassadors and College alumni, and learned about succeeding in the College during five recruiting events held across the state.

The ambassadors serve as sounding boards during these sessions as the prospective students pepper them with questions about NC State. Several ambassadors talked about the confidence they gained from speaking at events like these, skills that will serve them well after they graduate.

“If you have stage fright,” Porterfield said, “you lose it pretty quickly.”

These efforts are working, as 80 percent of students attending the recruiting events eventually apply to the College. This results in top freshman classes. In 2009, for example, the average high school GPA of the new freshmen was 4.34, and 53 percent of new students were in the top 10 percent of their high school graduating class.

“You always have to think about the future,” said another ambassador, Stephane Henrion, a senior electrical engineering major. “And one of the ways I think I can help the College grow is to help it recruit other talented students from around the state, the nation and the world.”

Once new students arrive on campus, they see even more of the ambassadors. Every engineering student must take an introductory engineering course that teaches students the teamwork, problem solving and verbal communication skills that become the foundation of a successful engineering career. Ambassadors serve as teaching assistants for these courses, mentoring students through an important time.

“I let them know the little secrets and nuggets of what’s going on and what’s coming up,” Rogers said.

Ambassadors are also stalwarts at large events such as the Freshman Engineering Design Day, in which hundreds of first-year students team up and test their design skills against their peers, and the NC State Engineering Career Fair, one of the largest events of its kind in the country.

“They’re a huge help,” said Koehler, who directs several College of Engineering events. “The ambassadors bring lots of energy and organization to those events.”

Ambassadors also take questions from prospective students during weekly information sessions, hang out with prospective students during “Spend-a-Day” at NC State events and help run the ceremony in which students graduate to the profession. For alumni returning to campus, ambassadors are available to give tours and answer questions about life at NC State.

On top of all this, the ambassadors gather in a classroom each Thursday afternoon to discuss their work and talk about leadership. This past semester, the class read a book that explores ways people can lead regardless of their rank in the organization.

During their final meeting of the fall semester, Dr. Louis A. Martin-Vega, dean of the College of Engineering, spoke to the students. He told them about his vision to make the College the top public engineering school in the country, and how leaders like them were helping to make that possible through their work for the College.

“There’s an awful lot that one can derive from serving others,” Martin-Vega said. “And basically, that’s what leadership is.” ■

Who will represent the next generation of ambassadors? In many ways, **it’s up to you**. Your scholarship gift to the College of Engineering helps NC State compete for the best and brightest undergraduate students.

For more information on scholarship gifts, visit [www.engr.ncsu.edu/foundation](http://www.engr.ncsu.edu/foundation) or call (919) 515-7458.



TYRIK HICKS

#### Leadership activities

Region II pre-college initiative chairperson, National Society of Black Engineers; Upperclassman mentor for peer mentor program through the Student Mentor Association; Tutor/mentor for middle school students, Saturday Program for Academic and Cultural Enrichment (SPACE)

#### Last internship

I worked with ExxonMobil in Baton Rouge, La., monitoring a ketone dewaxing unit.

#### Undergraduate research

I worked with Dr. George Roberts on measuring and modeling the viscosity of different polymers.

#### Life after NC State

I’d like to get an MBA and further develop my business skills.

#### Role model

Barack Obama. I like his message and his story.



ANAHID BEHROUZI

#### Leadership activities

Co-president and former community outreach chair, NC State Chapter of the Society of Women Engineers; Team captain, Relay for Life; Volunteer site liaison, Service Raleigh

#### Last internship

I was a structural engineering intern with Jacobs Engineering in Dallas, Texas. I calculated bridge quantities for a design-build bid and reviewed subcontractor shop drawings for precast bridge components.

#### Life after NC State

I plan to attend graduate school in structural engineering and focus on green building techniques.

#### Role model

Santiago Calatrava, the visionary civil engineer, architect and sculptor.



STEPHANE HENRION

#### Leadership activities

President and former vice president, academic committee chair, and electrical and computer engineering representative of the Engineers’ Council; Chancellor’s aide

#### Last internship

I interned with ExxonMobil in Fairfax, Va., and created a best practice work process for integrating data from smart devices into existing programs and processes.

#### Undergraduate research

I’m working with Dr. Jay Baliga in the NSF FREEDM Systems Center at NC State on analyzing the incorporation of new materials into power semiconductors.

#### Life after NC State

I plan to attend graduate school in electrical engineering, focusing on energy and the smart grid.

#### Role models

My parents, for teaching me the importance of education, to always strive to do my best, and to give back to the community.



MARK MENESSES

#### Leadership activities

Publicity chair, Engineers’ Council; Vice president, The Order of 30 and 3

#### Last internship

I interned with Entergy Operations, a power company, in New Orleans, La., providing research and support on the planning of the replacement of in-core instrumentation thimbles and other activities.

#### Life after NC State

I’ll likely pursue nuclear engineering research in graduate school focusing on advancing nuclear reactor technology so it’s cleaner and more efficient.

#### Role model

Don Marpe, my supervisor during my first summer with Entergy. He was someone everyone respected.



JESSICA ROGERS

#### Leadership activities

Pre-college initiative chairperson, National Society of Black Engineers; Treasurer, Life Changers Campus Ministries

#### Last internship

I was a co-op engineer with Packaging Corp. of America, in Valdosta, Ga., where I worked to solve the problem of high dissolved oxygen levels within the steam process.

#### Life after NC State

I’m leaning toward pursuing a graduate degree in chemical engineering and then pursuing a career in the environmental side of the field.

#### Role model

My father, who has had a successful engineering career with the U.S. military and Call Henry, Inc.



KALIE PORTERFIELD

#### Leadership activities

Co-chair and financial manager, 2010 Krispy Kreme Challenge Charity Race; Company check-in coordinator, NC State Engineering Career Fair; Mechanical engineering representative, NC State Engineers’ Council

#### Last internship

I was a quality-control intern with Boehringer Ingelheim pharmaceuticals in Columbus, Ohio.

#### Undergraduate research

I’m working with Dr. Greg Buckner on fabricating a controlled syringe pump that will be used as part of an effort to improve the effectiveness of radioactive microsphere therapy for liver cancer patients.

#### Life after NC State

I want to work in industry and then possibly pursue an MBA specializing in engineering project management.

#### Role model

Dr. Jerome Lavelle, associate dean of academic affairs. He’s been really great when I have questions about professional matters and always refers me to the right people.



Cree's LED lighting technology is found in installations all over the world, including these high-definition video screens at the American Airlines Center in Dallas, Texas.

# CREATING CREE

Co-founders of the groundbreaking LED lighting company still pal around like brothers — just like they did at NC State.

They remembered. They joked. They ate. And they cheered.

For many of the founders of Cree, Inc., this year's Distinguished Engineering Alumni dinner gave them a chance to do what they've been doing since their graduate school days: have fun. The alumni — Calvin Carter Jr., John Edmond, Neal Hunter and John Palmour — have been trading laughs, giving each other grief, and enjoying business success for more than a quarter century.

"To have a team stick together that long is actually incredibly unusual in a start-up situation," Palmour said. "We've all been able to fight vehemently and then go out and have a beer."

By working together, the group has helped build a powerhouse in the growing LED lighting industry. Cree, headquartered at the edge of the Research Triangle Park in Durham, NC, employs 4,000 workers globally and is among the world's top manufacturers of LEDs, or light-emitting diodes.

LEDs, which come in many forms, are semiconductor devices that turn electricity into light. Bulbs featuring the technology are gaining popularity because they use less energy than traditional incandescent bulbs, which haven't changed much since the days of Thomas Edison.

After more than two decades of steady growth for Cree, the NC State alumni can look back on a string of successes for themselves and the company. The group attended the dinner to celebrate the accomplishments of Palmour, who is the third Cree founder, along with Carter and Hunter, to receive the College's top alumni award.

"NC State set the basis for all of it," Carter said. "We're all very proud of our university degrees."

Cree's roots date to 1983 in an NC State materials science and engineering lab. Edmond, Palmour and Hunter's brother, Eric, were students of legendary researcher Dr. Robert Davis, and Carter was a research assistant professor in the lab. The group was investigating the properties of silicon carbide, a rare, naturally occurring material that researchers thought would be able to operate at higher temperature and power levels than materials found in traditional semiconductors.

Eric Hunter eventually left the group and teamed up with his brother, Neal, an NC State mechanical engineering graduate student, to launch a start-up technology company. But when the Hunter brothers saw the advances the materials group was making, they scrapped their initial idea and offered to help the group bring

the silicon carbide research to market instead. Thomas Coleman, a sixth founder who was from outside NC State, was also part of the team.

By 1987, when the company was formally founded, the researchers had devised a way to grow silicon carbide crystals and use them in ways that could be used for lighting. These promising results helped them scrape together enough money through family connections, credit accounts and sheer determination to start paying themselves and find lab and office facilities.

"We were too young and stupid to know it couldn't be done," Palmour said, laughing.

From there, the company grew steadily, making many notable technological achievements along the way. In 1989, Cree introduced the world's first blue light-emitting diode, a landmark that paved the way for billboards and large video screens to produce full-color displays. Two years later, the company released the

world's first commercial silicon carbide wafers. In 1993, it made its initial public offering, and by the middle of 2001 it had amassed nearly 1,000 employees.

Today, the company's LED chips are found in digital camera flashes, traffic signals, cell phone backlighting and many other applications. Cree's lights and lighting components brighten spaces in businesses and homes all over the world.

Along the way, most of the group has remained close, and they take great pride in hiring others who share their non-political, no-nonsense approach to business. Eric Hunter left Cree in the 1990s, but the other NC State

alumni remain in influential positions with the company. They credit much of their success to their relationships with each other.

"We definitely consider ourselves brothers. We love like brothers and fight like brothers and laugh like brothers," Carter said. "We have a good time." ■

**"We definitely consider ourselves brothers. We love like brothers and fight like brothers and laugh like brothers...We have a good time!"**



(From left to right) Calvin Carter Jr., John Palmour, Neal Hunter and John Edmond attended the Distinguished Engineering Alumni banquet in January.



## FITTS GIFT HAS DEPARTMENT *ON THE MOVE*

Five years after his historic gift, alumnus Edward P. Fitts urges others to keep the momentum going.

In 2005, when Edward P. Fitts gave \$10 million to industrial and systems engineering at NC State, a key condition was that it be used to help an already highly regarded department rise in national rankings. The gift would accomplish this, in part, through endowed professorships and fellowships to help NC State compete for the best faculty and graduate students.

In just five years, the Fitts gift has made a significant impact on the department and the College. Professorships set up under the endowment brought outstanding faculty from other schools and helped keep other top performers at NC State. Ten graduate students held full or partial Fitts fellowships this past year. And in national undergraduate rankings by *US News & World Report*, the department rose from No. 18 in 2007 to No. 12 in 2009. The graduate rankings score also improved in 2009.

These successes notwithstanding, Fitts isn't resting. The 1961 industrial engineering alumnus is pushing forward and inviting others to join in the excitement.

"We've only scratched the surface," Fitts said. "Success breeds success. Our faculty is doing an outstanding job and that enables us to attract more top professors and students to our programs. We must continue

to welcome the best talent at NC State and provide new ways to develop and retain it."

Fitts is accustomed to building top-tier organizations. He spent 27 years as chairman and CEO of the global packaging company Dopaco, which he grew from a small company of 115 employees to a company of 1,500 employees spread across nine plants with sales of more than \$400 million annually.

To continue the department's momentum, Fitts said, "we need help from alumni and other individuals and corporations to move us to the next level and beyond."

Dr. Paul Cohen, the department head and holder of one of the professorships the gift established, has seen how hard Fitts works to make sure the department keeps improving.

With the gift came the establishment of an independent advisory board, led by Fitts, that meets with Cohen periodically to provide direction and advice.

"Ed and the rest of the board ask great questions," Cohen said. "They challenge us and force us to think very carefully about the direction we're taking."

Fitts lists three reasons to invest in the department. First, the initial transformational investment has been successful,

providing a strong foundation for new donors to build on. Second, there is no better way to invest in the nation's future than by producing great engineers who can drive its economic growth.

Third, "and perhaps most satisfying for me," Fitts said, "is the chance to meet and work with the students who receive our scholarships and support. They are full of ideas, energy, inspiration and optimism. They are ready to solve problems with fresh eyes and create things we've never dreamed of."

Fitts, a Watauga Medal recipient and Distinguished Engineering Alumnus, offers high praise for the drive and vision of Dr. Louis Martin-Vega, dean of the College of Engineering. Fitts is also quick to credit NC State for his business success and wants to build that sense of pride in the department among its alumni and other supporters.

"It's gratifying to realize that one's gift can have such an immediate and productive impact," he said. ■

For more information about giving to the Edward P. Fitts Department of Industrial and Systems Engineering, please contact Lori Richards at 919.513.1338 or [lori\\_richards@ncsu.edu](mailto:lori_richards@ncsu.edu).

## Rewarding Relationship

The longstanding bond between IBM and NC State helps the College and the company.

Why do so many NC State students end up at IBM?

"You start off with a good pool of talent," said Bob Greenberg, IBM's senior state executive for North Carolina. "And then, I think, it's the education students get inside the school, the way the programs are run, the way the faculty structures the education. That all seems to marry very well with what IBM is looking for."

The strong working relationship between IBM, one of the world's largest computer and technology companies, and NC State goes back decades. Today, NC State ranks among the top three schools from which IBM hires graduates, and most of those come from the College of Engineering. Since 2002, the company has hired more than 1,000 NC State graduates, and many of them have gone on to work at the company's Research Triangle Park campus.

But the partnership goes well beyond the personnel office. NC State and IBM have been working for years on hi-tech projects that are revolutionizing education and computer security. Most notably, IBM teamed with the College and NC State's Office of Information Technology in 2004 to establish the Virtual Computing Laboratory, or VCL, a remote access service that allows users to access powerful computing resources and software from anywhere at any time.

The technology, which has received national media attention, has already been extended to other North Carolina universities and community colleges and will eventually wind up in K-12 classrooms. Researchers are also using it as part of an initiative to make computer systems more secure and trustworthy.

IBM is also a longstanding supporter of NC State people and programs. The company has provided millions of dollars through the years to support students, outstanding faculty achievements and hardware enhancements and upgrades. And company representatives are often on campus to meet with faculty, talk with students and recruit new employees.

"IBM has been an outstanding partner and huge help to NC State and our department," said Dr. Mladen Vouk, head of the Department of Computer Science and associate vice provost for information technology. "Its generous contributions have helped NC State faculty make dynamic, world-class discoveries and advances. We very much appreciate IBM's interest in our students and the opportunities IBM has been offering our students and faculty. We are very proud of our joint contributions to the education and economic development of North Carolina."

Many alumni who go on to work for IBM spread the word about their college

experience. Rene Johnson, a mechanical engineering graduate who as part of her job coordinates regional EWeek events for the company, sees recruiting for NC State as an important way to give back to the university.

"You get to tell students about forming those lifetime friendships," Johnson said. "And that's important, because you're away from home. You're away from your mom and dad. And those friendships are going to be there for life."

Greenberg says he's proud of IBM's bond with NC State and impressed by the insight and vision of its leadership. With all the research, education and social interactions that take place between the two organizations, a precedent has been set for successful collaboration in the years to come.

"NC State has great people to work with as well as excellent students," Greenberg said. "We look forward to continuing the relationship well into the future." ■



NC State is one of the top schools from which IBM hires engineering graduates. Among them are (from left to right) Kevin Bell, Bob Callaway, Jean Normandy, Rene Johnson, Ken Vu, Tintin Sukawati and David George.



Build a brighter future

Private support helps the College compete for the best and brightest.

Dean Louis A. Martin-Vega has set an ambitious long-term goal for the College: To become the nation's leading public college of engineering.

To get there, the College must attract and retain top faculty and students. The ability to offer endowed scholarships, fellowships and professorships is the best way to convince these top performers to pursue their academic careers here.

Endowments can be established for a variety of purposes and may be designated to suit the donor's desires. With all such gifts, the principal remains invested while only the annual income is used for the donor's chosen purpose.

**Endowed professorships** are the most important vehicle for recruiting and retaining outstanding research faculty. These funds are used for salary support and research activities, including graduate assistants, equipment and course development. The North Carolina General Assembly has a matching grant program that makes each endowed professorship gift go farther. For example, for the minimum professorship gift of \$333,000, the state contributes an additional \$167,000.

Along with faculty, graduate students are primary agents of innovation within a research-intensive school such as the College of Engineering. **Fellowship endowments**, which provide financial support for graduate students, are extremely important for attracting and retaining the best graduate students. The minimum level to endow a graduate fellowship is \$300,000.

And while an NC State engineering degree remains one of the best bargains in higher education, the cost of tuition is still a barrier for many students. There is formidable competition among top engineering colleges for the best undergraduates, so **endowed**

**scholarships** are crucial to NC State's ability to bring them here. An endowment of \$150,000 generates annual income roughly equivalent to a full year of tuition and fees. Endowments can be established for a minimum of \$25,000.

Donors can also establish endowments that **create or enhance academic programs**, providing students with a wealth of opportunities to broaden their experiences. Donors can build new opportunities or greatly enhance existing programs to foster collaboration and team building and expose students and faculty to new and important ideas.

Donors who want to make annual sustaining contributions can join the **Dean's Circle** with a gift of \$1,000 or more annually. As the leadership annual giving program, the Dean's Circle is crucial to our student recruiting strategy. It is unique among annual fundraising efforts in that 100 percent of each donor's gift goes to support student scholarships and fellowships within the College.

All gift categories provide the College the opportunity to recognize donors who have made a difference in the College and in the lives of those it serves. Such recognition, through annual dinners and other special events, reminds students and faculty of the generosity that enabled their many academic and research opportunities. This recognition also sets a clear example for other alumni and friends by highlighting the lasting impact their own potential contributions can have on the College.

Donors can also take satisfaction in knowing that their gifts not only build a stronger faculty and student body; they also help boost the College's national ranking, bringing the College closer to realizing Martin-Vega's ambitious goal. ■



Michael Steer

A gift that saves lives

*"The support provided by the Lampe professorship gives me the freedom to pursue ideas that could never be supported by traditional means. There is more research I want to pursue that will help protect our soldiers and Marines, and this professorship gives me the opportunity to test out crazy ideas. Once they are worked out, then it is easy to get external support. I am very grateful to the Lampe Family for their generous support."*

– Dr. Michael Steer, Lampe Professor of Electrical and Computer Engineering

Steer recently received the U.S. Army Commander's Award for Public Service, among the Army's highest civilian honors.

His research has helped American forces remotely counter roadside bombs, which has saved hundreds of soldiers' lives in Iraq and Afghanistan. The Lampe family, longtime supporters of the College, established the professorship in 2005. ■

New Engineering Foundation and alumni websites



How can you get involved and make a difference at the College of Engineering? What impact does philanthropy have on the people who pursue their dreams in the College?

The NC State Engineering Foundation has launched a newly redesigned website to answer those questions for alumni, friends and corporate partners.

You'll find information on the College's greatest opportunities for donor impact, ways to give, the importance of endowment and recognition of donors — as well as stories of students and professors who benefit from donor support. You can also make a gift online.

Visit the new site at [www.engr.ncsu.edu/foundation](http://www.engr.ncsu.edu/foundation).

In addition, the College's new alumni portal pulls together information on how to get involved with student recruiting and other events. The site also provides a searchable database of the College's Distinguished Engineering Alumni and links to Facebook and LinkedIn sites.

The alumni pages are at [www.engr.ncsu.edu/alumni](http://www.engr.ncsu.edu/alumni). ■

FROM THE FOUNDATION BOARD PRESIDENT



Ed White

Spring is a time for new beginnings, and that feels particularly true here at NC State this year.

This April, NC State welcomed the leadership of Dr. William Randolph "Randy" Woodson as the university's 14th chancellor. Chancellor Woodson comes to us from Purdue University, where he most recently served as provost, the university's chief academic officer. He is very familiar with the vital, solution-oriented role that a land-grant College of Engineering like ours at NC State plays in our society.

He also shares with Dean Martin-Vega a desire to boost the national and international reputation of the College of Engineering and to increase the value of the diploma hanging on your wall and mine. As I know you agree, we have a lot to be proud of — and plenty more to accomplish in driving our College to new heights!

One of Chancellor Woodson's primary goals is to build the university's endowment, the long-term investments made by alumni and friends that provide the margin of excellence in higher education. As readers of this publication know, the NC State Engineering Foundation shares this commitment, recognizing that endowment gifts are unique in their capacity to make an impact on the lives of many students and faculty. In Engineering, endowment was the focus of the *Achieve!* fundraising campaign, through which we increased the number of endowed scholarships by 65, more than doubled the number of endowed professorships, and tripled the number of endowed fellowships, unrestricted funds and programmatic funds.

As we all take pride in this achievement, we are especially grateful for the loyal and passionate donors whose generosity opened up so much opportunity for students and faculty here in the College. But there still remains much to accomplish in our effort to be the very best. The overall endowment in support of the College of Engineering, as well as the endowment per student, lags that of many of our regional and national peer institutions like Georgia Tech, Virginia Tech, Purdue and Penn State. These are the schools we compete with for the people who will make a difference in our society today and tomorrow. Endowment is the key to building the opportunities those students and faculty seek.

I hope that you will take a moment to visit the Engineering Foundation's new website ([www.engr.ncsu.edu/foundation](http://www.engr.ncsu.edu/foundation)), which provides further information about our efforts to build the endowment, and recognizes the growing number of alumni and friends who are building the future of our College.

**Ed White** (BS EO '78)  
*President, NC State Engineering Foundation Board of Directors*



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## College honors outstanding alumni



Johnny F. Norris, Jr.



Dr. John W. Palmour



B.D. Rodgers

The Distinguished Engineering Alumnus award honors alumni whose accomplishments further their field and reflect favorably on the university.

The College named Johnny F. Norris, Jr., president and chief executive officer of Fuel Tech, Inc; Dr. John W. Palmour, chief technology officer of advanced devices for Cree, Inc.; and B.D. Rodgers, chairman of Rodgers Builders, Inc. as its Distinguished Engineering Alumnus award winners for 2009.

The awards were presented by Dean Louis A. Martin-Vega at a banquet held Jan. 28 on NC State's Centennial Campus. The award honors alumni whose accomplishments further their field and reflect favorably on the university.

Norris graduated from NC State in 1971 with a bachelor's degree in nuclear engineering. After serving a decade in the U.S. Air Force, he advanced rapidly to top executive positions with several organizations, including Duke Energy, before joining Fuel Tech. Under his leadership, Fuel Tech experienced record-setting growth in revenue and profit in 2006 and 2007. He has also mentored NC State students, provided summer internships and been a generous supporter of the College.

Palmour received his bachelor's and doctoral degrees in materials science and engineering from NC State in 1982 and 1988, respectively. He co-founded what became Cree, a leading LED lighting company that now has 4,000 employees worldwide. With NC State, he has helped drive research collaborations with faculty and students and endowed the Hayne Palmour III Scholarship in honor of his father, a longtime NC State ceramic engineering professor.

Rodgers received his bachelor's degree in civil engineering from NC State in 1949. Beginning in 1963, he built Rodgers Builders into a highly successful construction company that was named the 2007 Carolinas AGC "Best of the Best in the Carolinas Construction Industry." His support for NC State includes endowing the B.D. and Patricia Rodgers Scholarship and the Rodgers Builders Student Travel Fund for the Department of Civil, Construction, and Environmental Engineering. ■





# BY THE NUMBERS

A look at some of the figures that shape the College of Engineering

## 8,769

Fall 2009 graduate and undergraduate student enrollment, the most in the College's history and the fourth largest engineering enrollment in the nation. The College expects to reach 10,000 students, football fans among them, by the end of the decade.

## 3

Raleigh's national ranking among metropolitan areas best for young adults, according to Portfolio.com.

## \$1 billion

Statewide economic impact created by NC State's Industrial Extension Service, which is part of the College, from 2006 to 2009.

## 88

Faculty members who have received Presidential and National Science Foundation recognitions for achievement, including 62 NSF CAREER Awards.

## 4

NC State's rank on a list of greenest schools in the Southeast published by *Blue Ridge Outdoors* magazine. The university was lauded for its campus-wide energy efficiency achievements and free alternative transportation options.



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