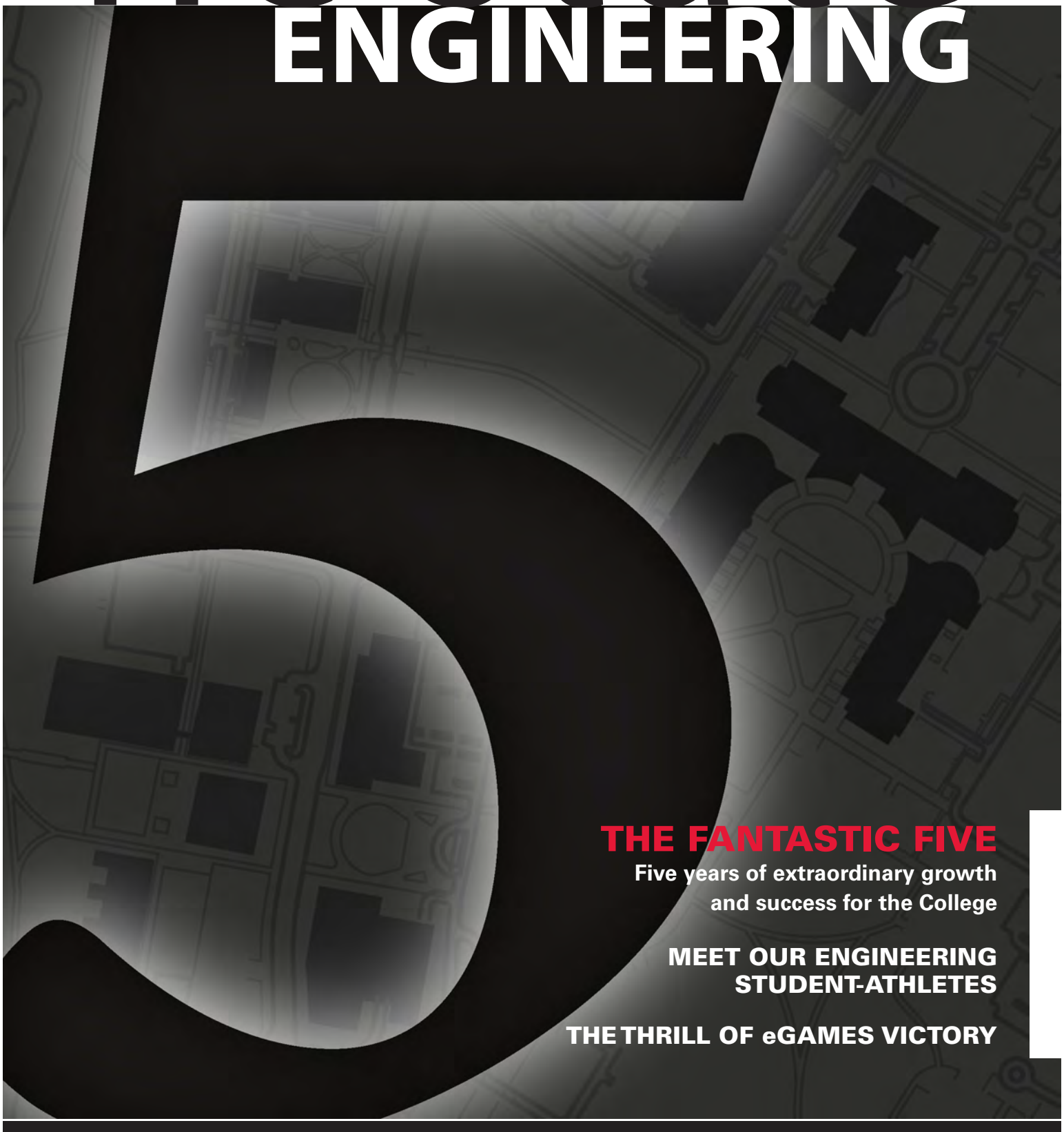
NC STATE UNIVERSITY

FALL 2011

nc state ENGINEERING



THE FANTASTIC FIVE

Five years of extraordinary growth and success for the College

MEET OUR ENGINEERING STUDENT-ATHLETES

THE THRILL OF eGAMES VICTORY

RENAISSANCE RIDDICK

Wallace Carl Riddick held lots of titles during the early years of NC State. Dean of Engineering. President. Football coach.

Football coach?

Yes, Riddick was the university's first football coach, a position he held in 1898 and 1899 after learning the game as a student at Lehigh University. He was such a strong influence on NC State athletics (for many years he was a member of the university's Athletics Council) that Riddick Stadium was named in his honor. The photo above shows a 1910 baseball game at the old stadium.

At right is Riddick in 1940, using the instrument on which he took his first surveying lesson nearly six decades earlier. He joined what was then the NC College of Agriculture and Mechanic Arts in 1892 as a professor of mechanics and applied mathematics before beginning his rise to the very top levels of the university administration.

He became known as the "Father of Engineering in North Carolina," but with his many talents in academics, administration and athletics, "Renaissance Riddick" would fit just as well.

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ON THE COVER: Thanks to strong leadership, robust outside support and the amazing work of our faculty and students over the past five years, the College is even more admired and serves more people than at any time in its history.

DEAN **Dr. Louis A. Martin-Vega**

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Did you know?

Did you know that a group of NC State engineering students are using their skills to help a rural Bolivian community maintain a steady supply of clean drinking water?

The mountain town of Asanquiri gets precious little rainfall during its dry season, and the only source of water for its community center, an on-and-off spring, contains bacteria that make people sick. Two years ago, the NC State chapter of Engineers Without Borders built a rain harvesting system at the center to improve water quality and quantity. Students from the chapter, including Benjamin Lord (right), returned to the town in May to survey the terrain and see what else could be done to keep the clean water flowing.

FROM THE DEAN

Louis A. Martin-Vega

The NC State campus is reinvigorated each fall with the arrival of both new and returning students. These young engineers and computer scientists will be key drivers of future economic growth, and the College plays an important role in ensuring that they are prepared to join—and start—the businesses and industries that propel our economy forward.

Our efforts are part of an international trend. Around the world, governments and industries are calling for more well-trained engineers, sentiments echoed by President Obama's Council on Jobs and Competitiveness during a recent meeting held at NC State as well as in studies released by the US National Academy of Engineering. I was recently in Argentina and found that its government wants to triple the number of engineering graduates produced by its universities.

Here in our College, we have continued to work hard to produce top-flight engineering graduates while absorbing a significant budget cut. I want to assure you that our budget decisions have protected academic programs as much as possible. Fortunately, funding for our research programs has grown significantly, bringing in millions of dollars that support many of our graduate students, centers and laboratories.

This issue of our alumni magazine celebrates those research accomplishments, and many more. The centerfold shows the many ways our college has grown and improved over the past five years. Another article outlines the economic impact of our alumni, who are responsible for creating tens of thousands of jobs statewide and around the country.

You will also read about the on-and-off-the-field heroics—and incredible time-management skills—of our engineering student-athletes. And you will learn how our faculty shape state and national policy as advisors to some of the world's most influential people and organizations.

We are also happy to report that the solid-state transformers developed by our National Science Foundation Engineering Research Center, the FREEDM Systems Center, were named to MIT T*echnology Review's* 2011 list of the world's 10 most important emerging technologies.

While these accomplishments are impressive, we are not standing still. The College continues to move closer to our goal of becoming one of the world's premier colleges of engineering.

I hope you will enjoy this issue of *NC State Engineering* and come away with a renewed sense of pride in your college.

Louis A. Martin-Vega, Dean

Welcoming 31 new faculty

NC State engineering students noticed lots of new names in their course listings this fall.

That's because the College has welcomed 31 new faculty members for 2011-12, one of the largest new faculty classes in the College's history.

The 2011-12 class boasts new arrivals in 10 of the College's academic departments and includes both senior and junior faculty. It continues a torrid pace of hiring that has seen the College add dozens of faculty over the past several years.

The College has made bringing in new faculty members a top priority due to enrollment growth and additional emphasis on research. Generous gifts from alumni have added more distinguished professorships for senior faculty, and the university is committed to boosting faculty resources.

These efforts are paying off. The talent and experience new faculty bring to the College invigorates research efforts and curricula and creates a more meaningful educational experience for undergraduate and graduate students. Groups across campus benefit from what these extraordinary people have to offer.

In short, these new faculty members make the College better. On behalf of the College, welcome! ▪

Q & A

Questions for TONY MITCHELL

Dr. Tony Mitchell, assistant dean for engineering student services, director of Minority Engineering Programs (MEP) and associate professor of electrical and computer engineering at NC State, talks about helping some of the nation's brightest minority engineering students succeed. Mitchell is retiring this fall after a 21-year career with the College. He will continue to serve the College as assistant dean emeritus.

Why is it so important for the College to have programs for underrepresented minority students?
Engineering schools everywhere want gifted minority students, and industry wants them, too. Our job is to beat the competition and get them to NC State. Our programs have helped the College rank in the top five and top six nationally in bachelor's degrees awarded to African Americans and Native Americans, respectively. Other schools often contact us to learn how we do it.

It starts with recruiting, right?
That's right. We have a spring minority recruiting weekend for admitted high school seniors. Many of them have been admitted elsewhere as well, so our job is to show them and their parents that NC State is the right place. Many choose NC State, and for them we have our Summer Transition Program in which they can start college a little early and adapt to it.

What happens when the fall semester starts?
We have START — Student Advancement and Retention Teams — led by upper-class students who act as big brothers and big sisters for the first-year students. We also offer a first-year professional development course sequence. The fall course focuses on college strategies and survival skills, while the spring course features mock job interviews.

How does industry get involved?
We have a national advisory board made up of industry members. They often conduct those mock interviews I just mentioned, and they hire our students for jobs and internships. Many board members also offer student scholarships and financial support for our programs.

Tell us about your external work promoting MEP and NC State.
We submit papers on our programs to national and international conferences so others can learn from our experiences. We've written about our Summer Transition Program and landing and administering a large National Science Foundation grant, among others. I also do program evaluations for ABET and serve on NSF and NASA review panels. I learn a lot from these experiences, and they open doors for our program and the College.

What other relationships has MEP built outside NC State?
Two of our deepest relationships are with the National Action Council for Minorities in Engineering (NACME) and the National GEM Consortium. Dean Martin-Vega is secretary on GEM's Executive Committee. Both groups want to enhance the success of minorities in engineering and other technical disciplines. Building these national relationships helps us get minority students in top jobs, and it helps employers get the students they want. It's a win-win.

Mice in space

When Atlantis made the space shuttle program's final flight in July, it hosted 30 tiny passengers. They were mice, and the knowledge gained from their adventure may one day help humans travel far beyond the moon.

The mice are integral to the research of Dr. Ted Bateman, associate professor of biomedical engineering, who is studying ways to protect future astronauts from bone loss during extended exposure to the microgravity environment of space.

NBC News, United Press International (UPI) and the *Charlotte Observer* were among the outlets that picked up the story. ▪

Hearing the hockey puck

The *News & Observer* and WRAL were among the outlets that picked up on NC State engineering students' work developing a hockey puck for blind players.

Several students taught by Dr. Russell Gorga, associate professor of textile engineering and the textile engineering program director, worked on designs for the puck after Gorga met a blind Canadian hockey player who runs a group trying to get more visually impaired people out on the ice.

The puck needs to make noise when it moves across the ice so players can hear it and react, but it needs to be tough enough to withstand slap shots. Students came up with designs that fit those criteria, hoping the pucks might one day replace the ones currently used in Canada's leagues for visually impaired players. ▪

After Japan

NC State nuclear engineers continue to help the public understand what happened, what's still happening, and what's yet to come at the Fukushima Daiichi nuclear power plant that was hit with an earthquake and tsunami in March.

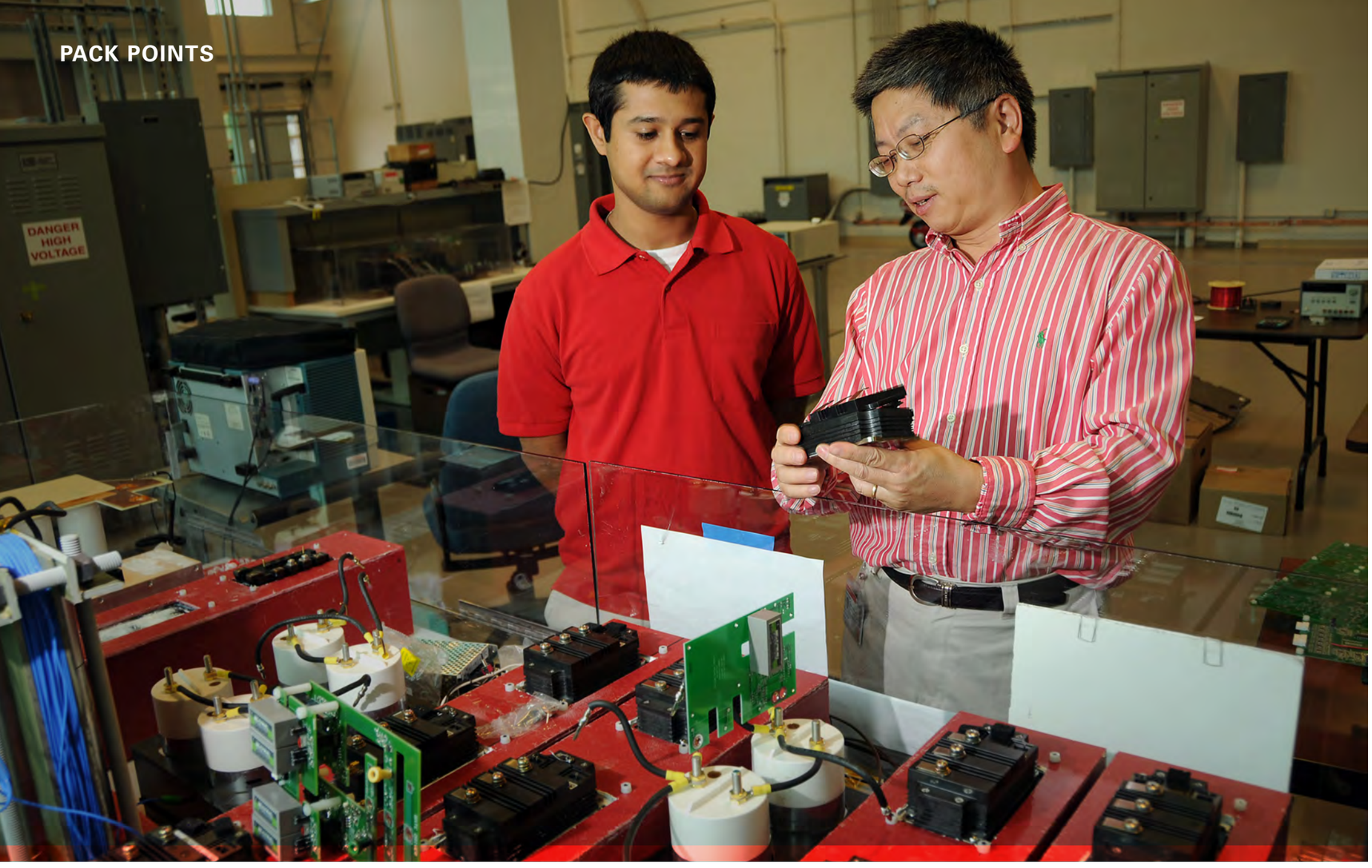
Among them is Dr. John Gilligan, professor of nuclear engineering and director of Nuclear Energy University Programs for the US Dept. of Energy, who helped provide context on the future of nuclear energy for WUNC radio's "The State of Things" this spring. ▪

Aiming at Android attackers

If you're a piece of Android malware, you might not be long for this world. Dr. Xuxian Jiang is working hard to hunt you down.

Jiang, assistant professor of computer science, and his research team have identified more than a dozen pieces of malware and data-stealing applications available for Google's Android smartphones. Some apps were available on Google's official Android Market; they have since been pulled down.

Jiang's team also developed software that helps Android users prevent their personal information from being stolen by hackers. *The Wall Street Journal, Wired,* the *Boston Globe, PC World* and *Computerworld* were among the media outlets that covered Jiang's work. ▪



A Top 10 for FREEDM

The smart solid-state transformers being developed by the NSF FREEDM Systems Center at NC State were named to MIT *Technology Review*'s 2011 list of the world's 10 most important emerging technologies.

Smart transformers, which are more efficient and adaptive than transformers commonly used on the power grid today, are cited as devices that will soon have a profound impact on how we live and work.

"Smart grid technology could make electrical power more reliable and make it easier to integrate renewables such as solar and wind. The smart transformer being developed at the NSF FREEDM Systems Center at NC State represents a major advance for smart grids, allowing the flow of electricity to be controlled and rerouted in a manner similar to how data is routed around the Internet," said Stephen Cass, special projects editor for the *Technology Review*, the world's oldest technology magazine.

Today's power grid only lets power flow in one direction — from the power company to the consumer — and the transformers on today's grid simply transfer electrical energy from one circuit to another and transform it to a more usable voltage.

But the smart transformers under development at FREEDM (above) are more flexible and have components that are built to handle high power levels and quickly change power voltage and frequency as they communicate with the rest of the grid. The devices could allow electric vehicles to be charged more quickly and utilities to incorporate large amounts of solar and wind power into the grid without blackouts or power surges.

Formed in 2008 by a five-year, $18.5 million Engineering Research Center grant from the National Science Foundation (NSF), the Future Renewable Electric Energy Delivery and Management (FREEDM) Systems Center is headquartered at NC State and includes faculty and facilities at seven universities in the US and Europe. Its goal is to revolutionize the nation's power grid and speed renewable energy technologies into every home and business. ▪

The breakdown on biodegradables

They may do more harm than good in landfills.

NC State research shows that so-called biodegradable products are likely doing more harm than good in landfills because they are releasing a powerful greenhouse gas as they break down.

"Biodegradable materials, such as disposable cups and utensils, are broken down in landfills by microorganisms that then produce methane," said Dr. Morton Barlaz, co-author of a paper, along with PhD student James Lewis, describing the research. "Methane can be a valuable energy source when captured, but it is a potent greenhouse gas when released into the atmosphere."

And the US Environmental Protection Agency (EPA) estimates that only about 35 percent of municipal solid waste goes to landfills that capture methane for energy use. EPA estimates that another 34 percent of landfills capture methane and burn it off on-site, while 31 percent allow the methane to escape.

"In other words, biodegradable products are not necessarily more environmentally friendly when disposed in landfills," said Barlaz, professor and head of NC State's Department of Civil, Construction, and Environmental Engineering.

This problem may be exacerbated by the rate at which these man-made biodegradable materials break down. Federal Trade Commission (FTC) guidelines call for products marked as "biodegradable" to decompose within "a reasonably short period of time" after disposal. But such rapid degradation may actually be environmentally harmful because federal regulations do not require landfills that collect methane to install gas collection systems for at least two years after the waste is buried. If materials break down and release methane quickly, much of that methane will likely be emitted before the collection technology is installed. This means less potential fuel for energy use and more greenhouse gas emissions.

As a result, the researchers found that a slower rate of biodegradation is actually more environmentally friendly because the bulk of the methane production will occur after the methane collection system is in place. Some specific biodegradable products such as bags that hold yard waste and are always sent to composting or anaerobic digestion facilities were not included in the study. ▪

Going global with former NSF director

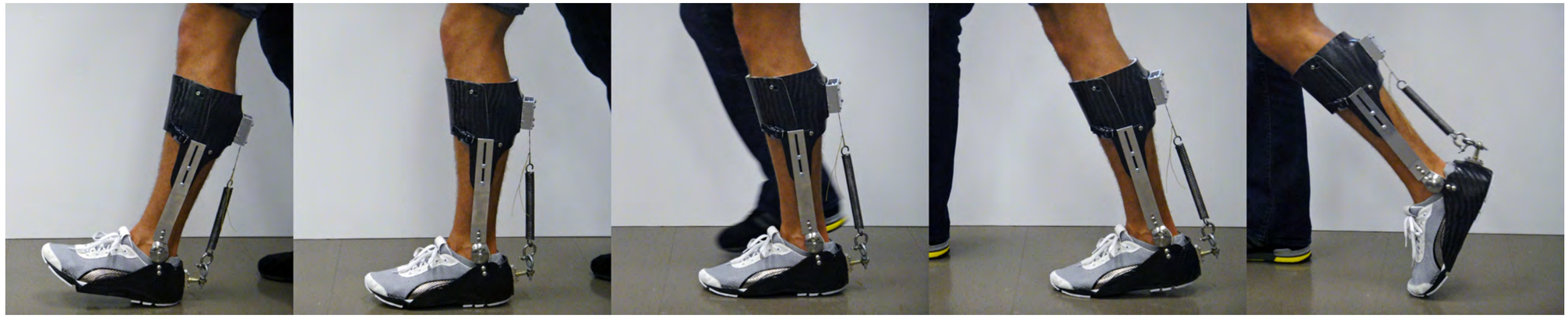
Dr. Arden L. Bement Jr., the inaugural director of Purdue University's Global Policy Research Institute and the David A. Ross Distinguished Professor of Nuclear Engineering at Purdue, delivered the second annual Robert F. Davis Distinguished Lecture in April.

The series is organized and hosted by the Department of Materials Science and Engineering at NC State.

Bement previously served as director of the National Science Foundation (NSF) for six years. In his address, he discussed global policy issues in our "shrinking" world, a dynamic resulting from continued advancements in information and communications technologies and the increasing use of social networking and virtual action groups for addressing and redressing dysfunctional governance and leadership.

Before joining NSF, Bement served as director of the National Institute of Standards and Technology (NIST) of the Department of Commerce, a position he began in 2001. He joined NIST from Purdue, where he was head of the School of Nuclear Engineering.

The Davis Lecture Series was created in 2010 to honor the accomplishments of Dr. Robert F. Davis, an internationally recognized semiconductor researcher who spent more than three decades as a faculty member in the Department of Materials Science and Engineering at NC State. ▪



The power of walking – and running

In a first-of-its-kind study comparing human walking and running motions, engineers at NC State showed that ankles and hips equally contribute to power generation when people walk, but the ankles generate more of the power when humans run. Knees provide approximately one-fifth or less of walking or running power.

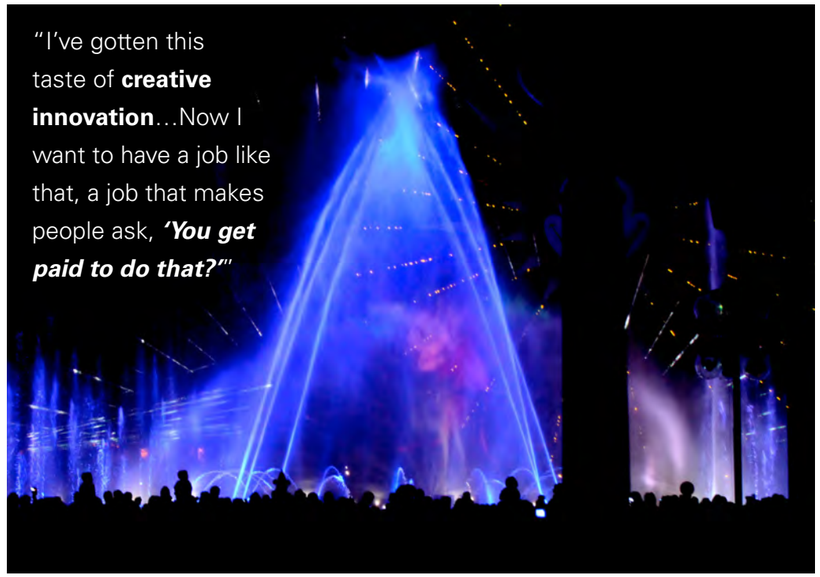
The research could help inform the best ways of building assistive or prosthetic devices for humans or constructing next-generation robotics, said NC State biomedical engineers Drs. Dominic Farris and Gregory Sawicki, the co-authors of a study on the mechanics of walking and running. The two researchers are part of NC State's Human PoWeR (Physiology of Wearable Robotics) Lab.

The study is the first to zoom in on the mechanical power generated by specific lower-limb joints in a single comprehensive study of walking and running across a range of speeds, Sawicki said.

The study shows that, overall, hips generate slightly more power when people walk. That is, until humans get to the point at which they're speed walking – walking so fast that it feels more comfortable to run – at 2 meters per second. Hips generate 44 percent of the power when people walk at that rate, with ankles contributing 39 percent of the power.

When people start running at this 2-meter-per-second rate, the ankles really kick in, providing 47 percent of the power compared to 32 percent for the hips. Ankles continue to provide the most power of the three lower-limb joints as running speeds increase. Switching to a run may be a strategy that allows people to make more use of the long elastic Achilles tendon at the ankle joint to recycle the body's mechanical energy.

Knowing which part of the lower limbs provides more power during the different activities can help engineers figure out how, depending on the person's speed and gait, mechanical power needs to be distributed for people who need help walking and running. ▪



Creating magic

Four NC State students have been living in a kind of fantasy world for the past year.

But dreams turned to reality when the students traveled to Southern California in June as finalists in the Disney ImagiNations competition. The team's project, a Disney attraction called "Fantasia: The Lost Symphony," scored second place in the prestigious competition.

Team members brought diverse skills to the demanding endeavor. Patrick Carroll is a senior in electrical and computer engineering, Adam Newton is majoring in industrial and systems engineering with a minor in creative writing, and Jay Brown and Michael Delaney just graduated with undergraduate degrees in art and design.

That's par for the course at Walt Disney Imagineering, the creative division that sponsors the annual competition for college students. Its workforce — called imagineers — is made up of creative professionals in 140 disciplines, from artists and writers to architects and engineers. Together, they create all Disney theme parks, resorts, attractions, cruise ships, real estate developments and regional entertainment venues worldwide.

The students' project was inspired by Fantasia, Disney's 1940 film that featured classical music conducted by Leopold Stokowski as the score for a series of animated scenes. They proposed creating a theme park attraction that would allow guests to conduct a new musical score and control various magical effects using their hands.

For the contest, they developed an exhaustive array of materials, including concept art, a storyboard, posters, a PowerPoint presentation, a software program, a scale model and an animation. They even developed a working prototype of a device, a sorcerer's hand, that could be sold in Disney gift shops to promote the ride.

"I've gotten this taste of creative innovation," Newton said. "Now I want to have a job like that, a job that makes people ask, 'You get paid to do that?'" ▪

Changing the tide on rip currents

Rip currents can turn a carefree day into a tragedy. At least three people drowned off the North Carolina coast during the summer of 2010 after getting dragged offshore, and lifeguards and bystanders had to pull hundreds of others to safety from the powerful currents.

Dr. Jie Yu, an assistant professor in the Department of Civil, Construction, and Environmental Engineering, is trying to gain a better understanding of the mechanisms involved in the formation of rip currents so coastal communities can better forecast them and make beaches safer.

An expert in fluid mechanics, Yu is studying the interaction between waves, currents and the movement of sand.

A rip current can begin to form when waves break near shore. Under certain conditions, these currents move in a circular pattern — water moves onshore in some places and flows back out to sea in others. The beach topography affects this circular flow since wave crests tend to follow the depth contours in the shallows near shore.

Dr. Jie Yu is trying to gain a better understanding of the mechanisms involved in the formation of rip currents so coastal communities can better forecast them and make beaches safer.

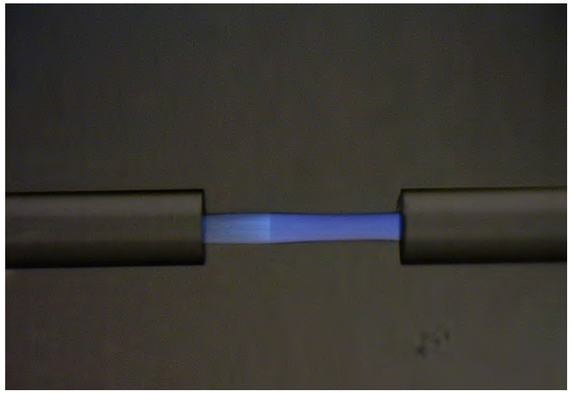
Undulations in the beach can make the wave non-uniform when it rolls in perpendicular to the shoreline, Yu said, forcing the water to move sideways and converge into offshore flows — rip currents — at the low spots in the beach topography.

As the circular flows develop, they interact with the waves. When two of these circulation patterns are in close proximity, the outward flow confined between them becomes very strong.

"Is the lack of uniformity on the beach causing the rip current, or does the circular motion create the beach undulations?" she said. "It's a chicken-and-egg proposition."

To solve the riddle, Yu is developing mathematical models that include data such as wave height, the angle at which waves hit the beach, and the location of nearby sandbars. In a five-year project funded by the National Science Foundation, she will combine models to reflect the interaction of waves and currents, nonlinear dynamics, and sediment movement along the shore. ▪

Sensor, heal thyself



NC State engineers have designed a sensor that can measure strain in structural materials and is capable of healing itself — an important advance for collecting data to help us make informed decisions about structural safety in the wake of earthquakes, explosions or other unexpected events.

Engineers use sensors to measure the strain, or forces, exerted on materials used to build everything from airplanes to civil infrastructure. For example, these sensors can tell us how an airplane wing is performing in flight and give maintenance authorities advance notice when the wing may be near failure.

But sensors can break under stress. That means the sensors can no longer provide information to users, but it doesn't necessarily mean that the material they were monitoring has been irreparably harmed. And, as in the airplane example, the sensors may be inaccessible — making them difficult or impossible to replace.

"To address this problem, we've developed a sensor that automatically repairs itself, in the event that it is broken," said Dr. Kara Peters, an associate professor of mechanical and aerospace engineering who co-authored a paper on the research with PhD student Young Song.

The sensor can stretch and compress along with the material it monitors. An infrared (IR) light wave runs through the sensor and detects these changes in length, which tells us how much strain the material is undergoing.

The sensor contains two glass optical fibers that run through a reservoir filled with ultraviolet (UV)-curable resin. The ends of the glass fibers are aligned with each other, but separated by a small gap. Focused beams of IR and UV light run through one of the fibers. When the tightly focused UV beam hits the resin, the resin hardens, creating a thin polymer filament that connects the glass fibers — creating a closed circuit for the IR light. The rest of the resin in the reservoir remains in liquid form, surrounding the filament.

If the polymer filament breaks under stress, more liquid resin rushes into the gap, comes into contact with the UV beam and hardens — repairing the sensor automatically. ▪

Paging Han Solo: A better way to steer laser beams

Steering laser beams is important — just ask Han Solo. NC State engineers have come up with a very energy-efficient way of steering laser beams that is precise and relatively inexpensive.

"In many cases, it is much easier to redirect a laser beam at a target than to steer the laser itself. We intended to develop a way to do this efficiently and without moving anything," said Dr. Michael Escuti, an associate professor of electrical engineering and co-author of a paper on the research.

The key to the Escuti team's success was the use of "polarization gratings," which consist of a thin layer of liquid crystal material on a glass plate. The researchers created a device that allows a laser beam to pass through a stack of these polarization gratings. Researchers manipulated the optical properties of each grating and were able to steer the laser beams by controlling how each individual grating redirects the light.

"Because each individual grating is very good at redirecting light in the desired directions with almost no absorption, the stack of gratings do not significantly weaken the laser power," Escuti said.

Another advantage of the system is that by adding more gratings, the number of steerable angles increases exponentially. And by using materials and techniques that are already used widely in the liquid crystal display sector, the new method is extremely cost effective.

Potential applications include free space communication, which uses lasers to transfer data between platforms — such as aircraft and soldiers on the battlefield. Technologies such as laser weapons and LIDAR, or laser radar, could also benefit from the research.

Escuti's team has already delivered prototypes of the technology to the US Air Force. The research was funded by the US Air Force Research Laboratory.

The other co-authors of the paper were former NC State PhD students Jihwan Kim and Chulwoo Oh, along with Steve Serati of Boulder Nonlinear Systems, Inc. ▪

Engineering a color changer

Researchers from NC State have created a range of soft, elastic gels that change color when exposed to ultraviolet (UV) light — and change back when the UV light is removed or the material is heated up.

The gels are impregnated with a type of photochromic compound called spiropyran. Spiropyrans change color when exposed to UV light, and the color they change into depends on the chemical environment surrounding the material.

The researchers made the gels out of an elastic silicone substance, which can be chemically modified to contain various other chemical compounds — changing the chemical environment inside the material. Changing this interior chemistry allows researchers to fine-tune how the color of the material changes when exposed to UV light.

"For example, if you want the material to turn yellow when exposed to UV light, you would attach carboxylic acid," explained Dr. Jan Genzer, Celanese Professor of Chemical and Biomolecular Engineering at NC State and co-author of a paper describing the research. "If you want magenta, you'd attach hydroxyl. Mix them together, and you get a shade of orange."

> Photochromic compounds are not new, but this is the **first time** they've been incorporated into an elastic material without impairing the material's elasticity.

Photochromic compounds are not new, but this is the first time they've been incorporated into an elastic material without impairing the material's elasticity.

The researchers were also able to create patterns by using a shaped mold to change the chemical make-up of specific regions in the material. For example, applying hydroxyl around a star-shaped mold (like a tiny cookie cutter) on the material would result in a yellow star-shaped pattern appearing on a dark magenta elastic when it is exposed to UV light.

The paper was co-authored by Genzer; Dr. Hyun-Kwan Yang, a postdoctoral research associate; Dr. A. Evren Ozcam, a former PhD student; and Dr. Kirill Efimenko, an assistant research professor of chemical and biomolecular engineering. ▪

Picture perfect

Family and friends of Dr. Nino A. Masnari, dean emeritus and distinguished professor of electrical and computer engineering, joined faculty and staff in Engineering Building II on March 18 to celebrate Masnari's contributions to NC State and see for the first time a portrait created in his honor.

The painting, created by the artist Ned Bittinger, now hangs in the dean's conference room in Page Hall alongside portraits of other former College of Engineering deans.

Masnari joined NC State in 1979 as head of the Department of Electrical and Computer Engineering. In 1988 he became the founding director of the National Science Foundation (NSF) Engineering Research Center on Advanced Electronic Materials Processing (AEMP) and the SEMATECH Center of Excellence on Advanced Single Wafer Processing. AEMP was the first NSF Engineering Research Center awarded to NC State. Masnari was appointed dean of the College in 1996 and served in that position until 2006, when he returned to the electrical and computer engineering department.

During Masnari's tenure as dean, the College experienced major growth in enrollment, research funding, facilities and private financial support for scholarships and professorships. This growth included the opening of three new buildings on Centennial Campus, the establishment of the Joint Department of Biomedical Engineering with UNC-Chapel Hill, and the naming of the Edward P. Fitts Department of Industrial and Systems Engineering, the first named academic department in the history of NC State. ▪

Tiny images, big results

Two new state-of-the-art microscope systems at NC State will help faculty and others understand materials at the smallest levels and provide an advantage in the tough competition for federal research dollars.

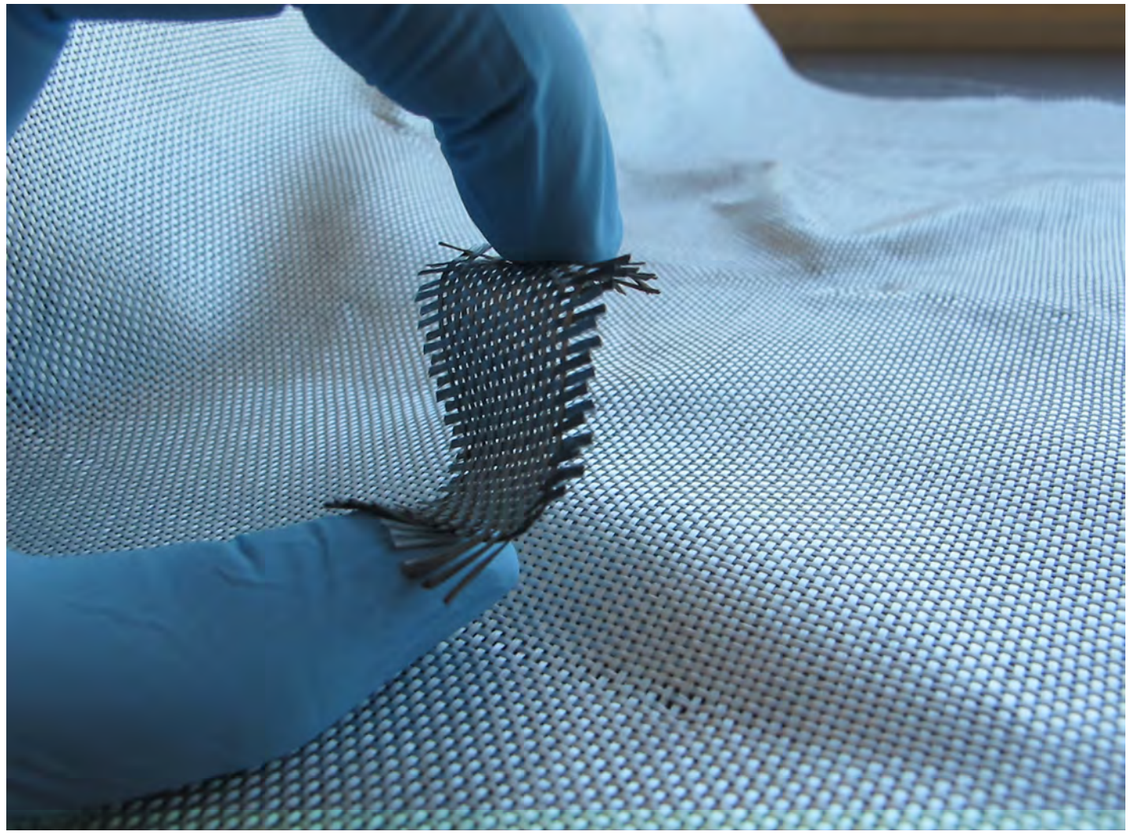
One system, an FEI Titan electron microscope, can enlarge images to more than 15 million times their actual size at resolutions up to two-billionths of an inch, image clarity so exact it's known as "true atomic resolution." The microscope can also perform two different types of spectroscopy, allowing researchers to determine the elements that make up a material.

Together, these technologies help researchers gain exquisitely detailed understandings of the materials they are studying. That should prove helpful as they seek grants for their work.

"This combination of imaging and analytical capabilities will give NC State and other NC university faculty almost an unfair competitive advantage as they compete for federal research funding," said Dr. Dieter Griffis, director of the College of Engineering Analytical Instrumentation Facility (AIF) in the Monteith Engineering Research Center, where the new equipment is housed. "It also provides a similar advantage to North Carolina for recruiting and retaining high-tech industries."

The AIF also recently obtained a piece of equipment that combines a high-resolution microscope with a focused ion beam, which allows researchers to cut and build materials at the nanoscale level (the head of a pin is about 1 million nanometers in diameter).

As with all the equipment at the AIF, the new technology will be available for use by researchers and industry throughout North Carolina. ▪



Plug-in textiles

Imagine plugging a USB port into a sheet of paper and turning it into a tablet computer. It might be a stretch, but ideas like this have researchers at NC State examining the use of conductive nanocoatings on simple textiles — such as woven cotton or even a sheet of paper.

"Normally, conductive nanocoatings are applied to inorganic materials such as silicon. If we can find a way to apply them to textiles — cheap, flexible materials with a contorted surface texture — it would represent a cost-effective approach and framework for improving current and future types of electronic devices," said Dr. Jesse Jur, assistant professor of textile engineering, chemistry and science, and lead author of a paper describing the research.

Using a technique called atomic layer deposition, coatings of inorganic materials, typically used in devices such as solar cells, sensors and microelectronics, were grown on the surface of textiles like woven cotton and nonwoven polypropylene — the same material that goes into reusable grocery store bags. The research, done in collaboration with Dr. Gregory Parsons, Alcoa Professor of Chemical and Biomolecular Engineering; post-doctoral researcher Christopher Oldham; and graduate student William Sweet, shows that common textile materials can be used for complex electronic devices.

As part of their study, the researchers created a new procedure to quantify effective electrical conductivity of conductive coatings on textile materials. The current standard of measuring conductivity uses a four-point probe that applies a current between two probes and senses a voltage between the other two probes. However, these probes were too small and would not give the most accurate reading for measurements on textiles.

In their paper, the researchers describe a new technique using larger probes that accurately measures the conductivity of the nanocoating. This new system gives researchers a better understanding of how to apply coatings on textiles to turn them into conductive devices.

"Research like this has potential health and monitoring applications since we could potentially create a uniform with cloth sensors embedded in the actual material that could track heart rate, body temperature, movement and more in real time," Jur said. ▪

Martin-Vega named to two top ASEE posts

Dr. Louis A. Martin-Vega, dean of the College of Engineering, has been appointed chair of the Public Policy Colloquium (PPC) of the American Society for Engineering Education (ASEE) Engineering Deans Council for the 2011-13 term. He is also serving as vice chair of the Engineering Deans Council Executive Board during the term.

The PPC has two goals: Strengthen the discussion of engineering education and research issues between the deans of engineering and key public policy makers and enable the deans to refine their public policy agenda. Objectives of the Engineering Deans Council include assessing and recommending policies affecting the overall administration of ABET-accredited engineering colleges and schools; providing a forum for discussion and an information exchange concerning problems and experiences at engineering colleges and schools; and representing and speaking on behalf of member institutions.

Martin-Vega has been dean of engineering at NC State since 2006. ▪

Baliga receives Holladay Medal

Dr. B. Jayant Baliga, Distinguished University Professor of Electrical and Computer Engineering and director of the Power Semiconductor Research Center (PSRC), was one of four NC State faculty members awarded the Alexander Quarles Holladay Medal for Excellence from the university's Board of Trustees in 2011. The Holladay Medal is the highest honor bestowed on a faculty member by the trustees and the university.

Baliga, who has served NC State for 22 years, invented the insulated gate bipolar transistor (IGBT), which is pervasively used in consumer, industrial, lighting, medical, transportation, defense, and renewable power generation applications worldwide. The energy efficiency improvements achieved using the IGBT have saved consumers more than $3 trillion while reducing worldwide carbon emissions by more than 30 trillion pounds.

He is a member of the National Academy of Engineering and was recently inducted into the *Electronic Design* Engineering Hall of Fame. ▪

Misra, Escuti receive Alcoa Foundation Awards

The Alcoa Foundation Engineering Research Awards for 2011 were presented to Dr. Veena Misra, professor of electrical and computer engineering, and Dr. Michael J. Escuti, associate professor of electrical and computer engineering, at the spring faculty meeting for the College.

Misra received the Alcoa Foundation Distinguished Engineering Research Award, made to a senior faculty member for research achievements over a period of at least five years at NC State. She is a world-renowned expert in the area of advanced CMOS materials and devices, nanoelectronics for memory and logic, organic solar cells, wide bandgap power devices, and bioelectronics.

Escuti was awarded the Alcoa Foundation Engineering Research Achievement Award, intended to recognize young faculty who have accomplished outstanding research achievements during the preceding three years. His work developing new polarization gratings, as well as devices and applications based on them, has been extremely influential at the international level. ▪

SHAPING THE DEBATE

NC State engineers help state and national leaders craft policy on society's most pressing issues.

When some of the nation's most powerful people need help, they turn to NC State engineers and computer scientists.

In addition to running research programs, leading classes and advising students, these researchers influence some of the most important policy decisions facing society.

They're advising the Department of Homeland Security on ways to keep personal information safe helping the Environmental Protection Agency refine air quality and drinking water standards and working with the Department of State to end sales of conflict diamonds.

Meet some of them.

Annie Antón

Professor of computer science

As a member of the US Department of Homeland Security's Data Privacy and Integrity Advisory Committee, Annie Antón advises the department's secretary and chief privacy officer on computer-and-Internet security issues related to personally identifiable information, data integrity and other privacy-related matters. She's even testified before Congress on protecting the privacy of Social Security numbers and handling the security shortcomings of E-Verify, an online employment verification system.

Roger Barker

Burlington Industries Professor of Textile Technology; director of the Textile Protection and Comfort Center

Roger Barker sits on a panel of experts involved in a technology readiness assessment for the US Army's Future Ground Soldier Integrated Protective Ensemble Program. He also serves on the Standing Committee on Personal Protective Equipment for Workplace Safety and Health, which was formed by the National Academy of Sciences' Institute of Medicine.

Joel Ducoste

Professor of civil, construction, and environmental engineering

Joel Ducoste sifts through piles of scientific studies to determine whether replacing some lead pipes with copper pipes in water systems significantly reduces lead levels in drinking water.
A member of the Environmental Protection Agency's (EPA) Science Advisory Board Drinking Water Committee, Ducoste makes recommendations to the EPA administrator on this and other important drinking-water-related issues. This advice influences the nation's drinking water standards.

Chris Frey

Professor of civil, construction, and environmental engineering

Chris Frey makes sure we're all breathing clean air. He chairs the Lead Review Panel of the Environmental Protection Agency's Clean Air Scientific Advisory Committee (CASAC), which provides advice on the National Ambient Air Quality Standard for lead — a naturally occurring metal that, in excess, can harm humans and the environment. CASAC makes sure this standard for safe lead levels is based on the latest research.

Abhinav Gupta
Associate professor of civil, construction, and environmental engineering; associate director of the Center for Nuclear Power Plant Structures, Equipment, and Piping

Abhinav Gupta has been partnering with the US Nuclear Regulatory Commission to evaluate the seismic risks associated with nuclear power plants. He works to improve the way nuclear reactor systems, equipment and piping perform during earthquakes.

Ayman Hawari
Professor of nuclear engineering; director of Nuclear Reactor Program

Ayman Hawari is commissioner for nuclear reactors on the Jordan Atomic Energy Commission. The group is helping the country establish a peaceful nuclear energy program. Hawari also works closely with the US Department of State and the International Atomic Energy Agency on issues related to the global implementation and utilization of research reactors.

Thom Hodgson
James T. Ryan Distinguished University Professor of Industrial and Systems Engineering; director emeritus of the Integrated Manufacturing Systems Engineering Institute; co-director of the Operations Research Program

Manufacturing expert Thom Hodgson helps leaders bolster the nation's economy. He was selected by NC State Chancellor Randy Woodson to sit on the executive advisors committee of the US Council on Competitiveness, which is working to improve our nation's competitiveness, productivity and leadership among world markets.

Bill Hunt
Associate professor and extension specialist in biological and agricultural engineering

Bill Hunt helps the North Carolina Department of Environment and Natural Resources establish effective stormwater management standards so state waterways flood less frequently and carry fewer pollutants.

George List
Professor of civil, construction, and environmental engineering

George List is the principal investigator on a project being conducted for the Governor's Logistics Task Force, which is studying how transportation infrastructure investments can create jobs and recruit industry to North Carolina. List is assessing options for enhancing the state's roads, highways, airports and railroads to get the most out of existing transportation systems and prepare for future growth.

Marian McCord
Associate professor of biomedical engineering and textile engineering; director of Global Health Initiatives

Marian McCord sits on the board of directors of the Triangle Global Health Consortium, which encourages North Carolina's global health leaders — including research centers, universities and companies — to use their combined expertise to fight diseases like HIV/AIDS.

Wayne Skaggs
William Neal Reynolds Professor and Distinguished University Professor of Biological and Agricultural Engineering

Wayne Skaggs developed the water management model, DRAINMOD, that's been used to help leaders identify and protect the nation's wetlands — swamps, marshes and other critical areas. The model has been used to evaluate proposed changes in wetland hydrologic criterion since 1990.

Daniel Stancil
Alcoa Distinguished Professor; head of the Department of Electrical and Computer Engineering

Daniel Stancil is a member of the US Department of Commerce's Spectrum Management Advisory Committee. He offers advice on reforms to the nation's radio spectrum policies to encourage innovation and improve access to broadband wireless services while supporting the country's security and defense needs.

Paul Turinsky
Professor of nuclear engineering

Paul Turinsky is chief scientist for the Consortium for Advanced Simulation of Light Water Reactors — a national partnership of universities, laboratories and industry representatives that uses advanced computer models to evaluate the performance of nuclear reactor designs. NC State is a key player in the $122 million Department of Energy-funded effort.

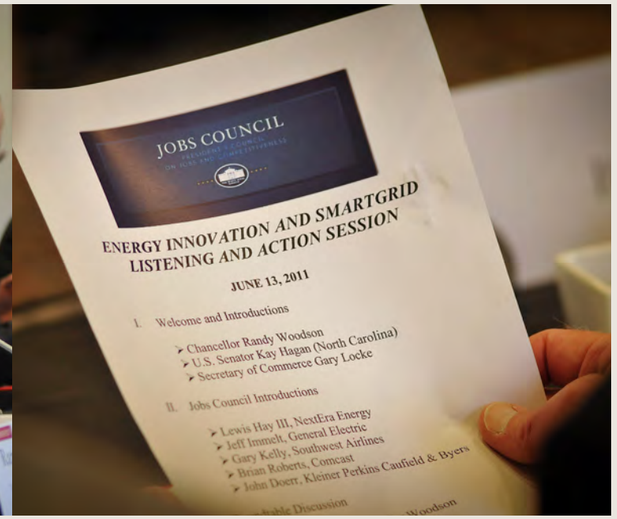
Phillip Westmoreland
Professor of chemical and biomolecular engineering; executive director of the Institute for Computational Science and Engineering

Phillip Westmoreland sits on the governing board of the National Collaborative for Bio-Preparedness, a group of academic, government and industry leaders working to develop, test and implement a nationwide, cyber-enabled bio-surveillance system.

Laurie Williams
Professor of computer science; research director of the Institute for Next Generation IT Systems

Laurie Williams is spreading the word about making health care IT — in particular, its security — a national priority. She is the research director of the Institute for Next Generation IT Systems at NC State and hosts forums encouraging collaboration among health care researchers, academics and professionals.

US Senator Kay Hagan (center) and US Commerce Secretary Gary Locke (second from right) joined NC State Chancellor Randy Woodson (left) during a June meeting of the President's Council on Jobs and Competitiveness on Centennial Campus.



NC State hosts White House summit

NC State engineers' groundbreaking smart grid work helped prompt the White House to choose the university to host a roundtable discussion on the smart grid and energy with members of President Barack Obama's Council on Jobs and Competitiveness.

The June 13 event on Centennial Campus was one of five breakout sessions held in the Triangle to coincide with Obama's visit to the region. The NC State session included a tour of the FREEDM Systems Center, a National Science Foundation Engineering Research Center dedicated to smart grid technology and distributed energy.

The main event at NC State was a morning roundtable discussion hosted by NC State Chancellor Randy Woodson and led by Jeffrey Immelt, chair of the council and chairman and CEO of GE. US Senator Kay Hagan and US Commerce Secretary Gary Locke attended the session, along with executives from Southwest Airlines, Comcast Corp., NextEra Energy and many of the region's leading smart grid companies.

NC State engineering alumni Michael Creed, chairman, CEO and co-founder of McKim & Creed; Rob Manning, executive vice president of power system operations at the Tennessee Valley Authority; Mark Munday, president and CEO of Elster; Robert Sipes, vice president of distribution at Progress Energy; and Ed White, chairman and CEO of Field2Base, Inc., also participated in the event.

The alumni joined local energy experts and business leaders to discuss ways to create jobs in the energy and smart grid industries through partnerships with academia and state and federal government agencies. Several executives said spending on the energy sector and infrastructure was the key.

Obama was later briefed on the council's findings during an afternoon event at Cree, the Durham-based LED lighting company co-founded by NC State engineering alumni.

Michael Young
Associate professor of computer science; executive director of the proposed Digital Games Research Center

Thanks in part to the persistence of the Triangle Game Initiative (TGI), of which Michael Young is a board member, gaming companies have one more reason to do business in North Carolina. Strong support for digital media tax incentives from the TGI and Young helped convince state leaders to pass House Bill 1973, giving companies tax breaks for working with the state's colleges and universities and developing gaming projects here.

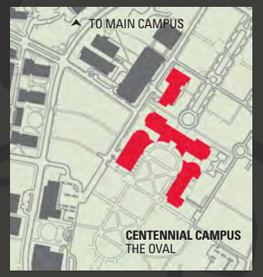
Mohammed Zikry
Zan Prevost Smith Distinguished Professor in Mechanical Engineering

Mohammed Zikry's work transcends national borders. In 2008, he served a one-year term as a Jefferson Fellow with the US Department of State, meaning he reported to the president's chief foreign affairs adviser — the secretary of state. Zikry worked to stop the flow of conflict diamonds that are sold to fund armed conflicts and civil wars, efforts that continue today in his role as a state department consultant. ▪

THE FANTASTIC FIVE

The past five years have been very good to the College of Engineering. Thanks to strong leadership, robust outside support and the amazing work of our faculty and students, the College is even more admired and serves more people than at any time in its history.

- 21 National Science Foundation CAREER Awards
- Research awards grew from $43 million to $78 million
- More than 60 faculty hires
- 15 new distinguished professorships established



2007

- Opening of Golden LEAF BTEC
- Alumnus Rajendra Pachauri shares Nobel Peace Prize

2006

- Dedication of Engineering Building II
- Dean Martin-Vega named College's first Hispanic dean

2008

- Awarded NSF FREEDM Systems Center
- Collaboration with the College of Veterinary Medicine produces world's first osseointegrated leg implant for a dog
- Joseph DeSimone, Keith Gubbins and Carol Hall named to list of "One Hundred Engineers of the Modern Era" by American Institute of Chemical Engineers

2009

- *US News & World Report* lists Engineering Online as the nation's largest public online engineering graduate program
- Nancy Allbritton named head of biomedical engineering; the College's first female department head
- Industrial Extension Service reaches goal of creating $1 billion in economic value to NC manufacturers from 2006 to 2010
- Laura Bottomley wins Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring

2010

- Ranked 15th in *Wall Street Journal* recruiters' survey
- Granted leadership role in US Dept. of Energy nuclear energy hub
- Joined Duke University to co-host National Academy of Engineering Grand Challenges Summit
- Opening of Engineering Building III
- Michael Steer receives US Army Commander's Award for Public Service

2011

- Ranked in top 15 for video game design and development
- Hosted President's Council on Jobs and Competitiveness
- Jay Narayan recognized with Acta Materialia Gold Medal and Prize

Enrollment

- Master's enrollment increased by 47.5 percent
- Doctoral enrollment increased by 20 percent
- More than half of incoming freshmen in top 10 percent of high school class

Students

- 1st Place, 2010 BMEStart Design Competition
- 2010 Women in Aerospace Foundation Scholarship, inaugural winner
- 1st Place, 2006 IEEE Computer Society International Design Competition

Economic Development

- 295 new invention disclosures
- 258 new patents filed
- 95 new patents issued
- 15 new startups

Distance Education

- 8 new Engineering Online master's programs

Outside Support

- More than $265 million raised in *Achieve!* Campaign, exceeding College goal by $40 million
- Endowment corpus grew from $35.8 million to $56.7 million (58 percent)

Research

- Research expenditures grew from $103 million to $136 million (32 percent)

New Faculty

- 8 new department heads
- 10 new underrepresented minority faculty
- 18 new female faculty

WORK HARD PLAY HARD

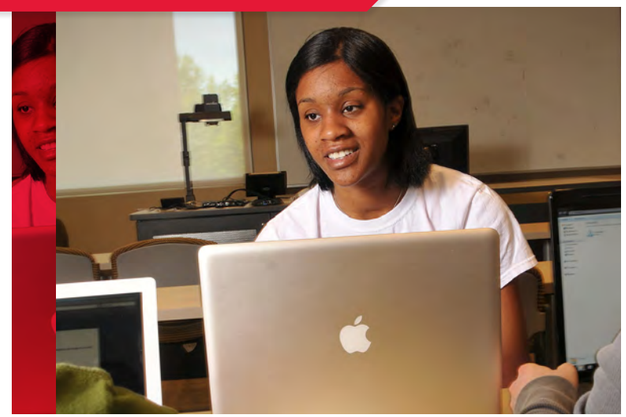
Dozens of NC State engineering students make varsity sports part of their college experience.

For an NC State engineering student, challenging classes and marathon lab sessions come with the territory. But if you're an engineering student-*athlete*, you're adding long bus rides, grueling practices, and the pressure that comes with competing in the Atlantic Coast Conference.

Talk about multitasking.

Today more than 50 engineering students compete in NCAA Division I varsity athletics at NC State. On the field and in the classroom, they aim to win.

Brittany Strachan
Kernersville, NC
Computer Science
Basketball
Graduate Student



Brittany Strachan works best during her "power hours" — 10 p.m. and later. That's when she gets her second wind after a long day of classes, practice and volunteer activities.

The 6-foot-3 basketball forward averaged a career-best 8.1 points and 5.3 rebounds per game in her final collegiate season that ended earlier this year. She scored a career-best 22 points during a game against the University of Southern California.

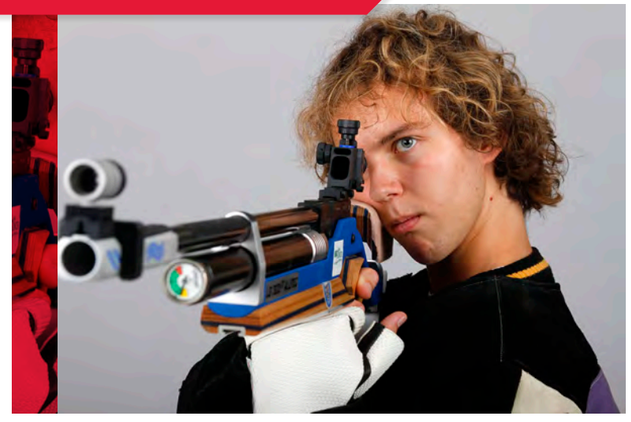
She was named four times to the ACC Academic Honor Roll and twice to the All-ACC Academic Team. Now she's pursuing a master's degree in computer science at NC State, in which she'll hone her software development skills and take classes in artificial intelligence and network security.

A member of organizations like Habitat for Humanity and Women Empowering Society Together, Strachan was also a mentor for the NC State Minority Engineering Programs.

On the court, she played part of her basketball career for the iconic Kay Yow, who died in 2009 after 34 years of coaching at NC State.

"I'm big on faith, especially with Coach Yow," Strachan said. "I feel like we were given talents, and we were blessed with certain opportunities not to just hold to ourselves, but to share with others." ▪

William Teller
King and Queen County, VA
Nuclear Engineering
Rifle
Junior



Imagine the cap of a Gatorade bottle. In the middle is a target — a half-millimeter dot that is the size of a period on the end of a sentence. It's William Teller's job to hit that target during matches. Sounds easy, right?

Teller is one of the top shooters on the NC State rifle team. If you're thinking about William Tell — the Swiss folk hero who famously used his crossbow to shoot an apple from the top of his son's head — he's not a relative.

"The unique aspect of rifle was something that allured me," Teller said. "As opposed to moving quickly, most of the time you're trying to actually move as little as possible and stay very still."

This is Teller's third year balancing the demands of a collegiate athlete with a major in nuclear engineering. Without a home shooting range at NC State, each match is "away," and Teller has learned to buckle down with schoolwork on the road.

Teller has read about the earthquake and tsunami that devastated the Fukushima Daiichi nuclear power plant in Japan, and it hasn't changed his mind about pursuing a career in nuclear engineering. He interned at the Surry Power Station in Virginia this past summer, which generates nearly 1,600 megawatts of electric power from its two nuclear reactors.

"I think that nuclear energy is the direction that the US is going to end up going after oil and coal start running out," he said. ▪

Whitney Barnette
Jacksonville, NC
Biomedical Engineering
Cheerleading
Senior

Winter break games. Football bowl games. Spring break games. If the Wolfpack is playing, Whitney Barnette is there.

NC State cheerleaders work with four sports — basketball, wrestling, gymnastics and football — and Barnette is involved with all of them. Three-to-four-hour practices are part of her daily routine.

She was named the squad's MVP for the 2008-09 season. And this past spring, she was recognized as one of NC State's top 10 scholar-athletes.

"The best part of being a cheerleader is running on the field for the first football game because it's never the same," she said. "You hear the fireworks go off, you start running and you get so pumped."

Outside games and practices, Barnette is working in rehabilitation engineering, which applies engineering theory and know-how to help solve problems faced by people with disabilities.

Over this past summer, she continued her research in NC State's Human Physiology of Wearable Robotics (PoWeR) Laboratory, where she studied hemiparesis — muscular weakness or partial paralysis that affects patients suffering from stroke, cerebral palsy and other diseases of the brain and nervous system. Barnette hopes that as researchers learn more about how these patients walk, they can continue to develop prosthetics that fit patients' needs.

Her big plans for the future include studying stem cells "and how they can improve the lives of people across the world and possibly be the answer to putting an end to cancer." ▪

Robert Beatty
Matthews, NC
Aerospace Engineering
Soccer
Sophomore

Robert Beatty grew up at the YMCA soccer fields — and the Charlotte airport. When he wasn't kicking the soccer ball around, he was spending hours watching giant planes from all over the world land right in front of him.

Beatty, a midfielder on the NC State men's soccer team, hopes to one day work for Boeing, the giant aerospace company, where he can test and develop aircraft for the defense or commercial airline industries.

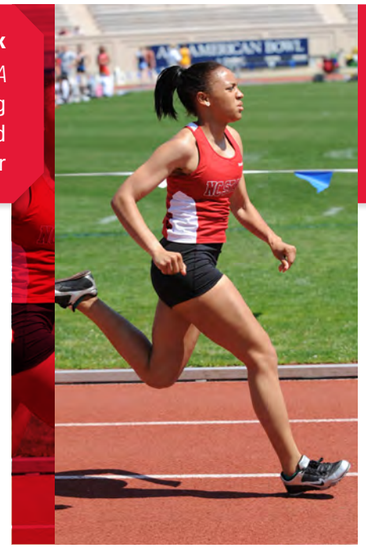
"That would bring together all of my interests," he explained. "The awe of flight and the wonder of exploration, as well as what my education is teaching me — thermodynamics and erodynamics."

When Beatty's not studying the principles of flight, he's on the soccer field. As a midfielder, his job is to use passing and ball control to connect the offense and defense. The back-and-forth position requires agility and loads of energy.

Beatty leads a busy life, even during the off-season. He jump-starts his day at 7 a.m., lifts weights with the team, practices on the field, and heads to class looking ahead to his future career.

"It just honestly feels amazing that one day you can call yourself an aerospace engineer or a rocket scientist," Beatty said. "And when someone says, 'It's not rocket science,' you can say, 'I know, it's not.'" ▪

Amira Chowyuk
Virginia Beach, VA
Industrial Engineering
Track and Field
Senior



"I don't have relaxed days during the week. My schedule is very structured," Amira Chowyuk said. "It's practice and class, and homework has to be squeezed in."

Chowyuk is part runner, part scholar and part leader. On the NC State women's track and field team, she competes in the grueling 800-meter event, which requires the speed of a sprinter and the endurance of a distance runner. She ran a career best of 2 minutes, 13 seconds at the Carolina Classic, which was held at the end of the 2011 outdoor season.

Chowyuk has been running track competitively since the ninth grade, but deep down she's always known she wanted to be an engineer. Her experience in industrial engineering includes an internship at the Hershey Company and energy conservation work at the North Carolina Arboretum. After she graduates, she hopes to enter a graduate assistantship program and pursue an MBA with a focus in operations management.

"I like industrial engineering and the potential that it offers," Chowyuk said. "I really like my department … there are a gazillion internship opportunities."

Chowyuk also believes in leadership and service. She serves as president of the Student Athlete Advisory Committee and vice president of Women Empowering Society Together; holds membership in the Institute of Industrial Engineers; and is a mentor with the NC State Minority Engineering Programs.

Her advice for balance: Work hard during the week so your weekend can move a little slower. ▪

Akash Gujarati
Pune, India
Electrical Engineering
Tennis
Senior

Watch out for Akash Gujarati on the tennis court if you're a top player. He's known for engineering upsets.

In 2010, he won the deciding match against the University of Michigan, a highly ranked opponent.

"I still remember that last point," Gujarati said. "I looked to my teammates and did a massive fist pump, and they all came storming onto the court. It was a great moment."

Gujarati has played tennis every day since he was six years old; he and a partner were under-18 national doubles champions in India in 2006. But forehands and backhands aren't the only things that create excitement in his life — he has always enjoyed math and physics.

Now a senior in electrical engineering with a concentration in renewable energy, Gujarati is working on ways to help society make the transition from conventional fossil fuels to renewable energy, such as solar and wind.

Over the summer he had the chance to catch up with his family in India. While there, he worked for a company doing circuit design and testing for battery chargers and power supply systems. He's back at NC State now.

"The part when you get to explore stuff is what I look forward to the most," he said. ▪

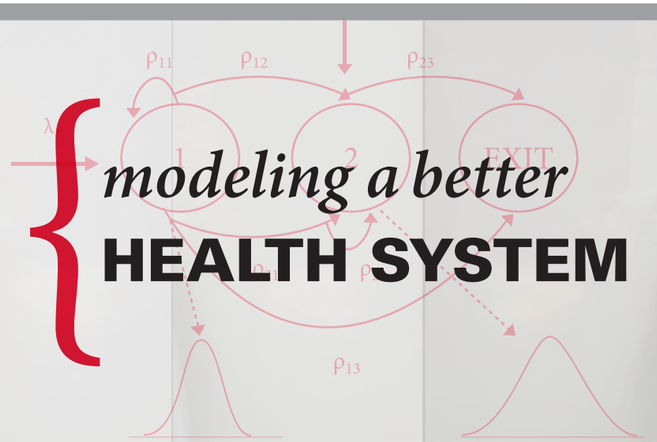
AN ENGINEERING SCHOLARSHIP FOR STUDENT-ATHLETES

Student-athletes majoring in engineering can take advantage of a $100,000 scholarship endowment established by NC State engineering alumnus Robert Lee Brooks.

Students who play on either the varsity football team or the men's or women's basketball teams will receive first preference for the Robert Lee Brooks Scholarship. Second preference will go to students participating in any other NC State intercollegiate sport.

Brooks, who graduated from NC State in 1969 with a bachelor's degree in engineering operations, is executive vice president at LS Power Development, LLC, a privately held company with offices in several states that develops, acquires and manages power generation and transmission infrastructure throughout the US. He previously held various engineering and management positions of increasing responsibility in the operations, project management, sales and marketing functions within the power generation business unit of Westinghouse Electric Corporation.

Brooks' brother and daughter are also graduates of the College. Brooks previously endowed two football scholarships through the Wolfpack Club.



modeling a better HEALTH SYSTEM

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NC State health systems engineers make your health care more organized, efficient and cost-effective.

Dr. Julie Ivy wants everyone to spend less time and money on their health care.

So when she learned that hospitals were having a difficult time deciding how much medication to order — and sometimes ending up with more than they needed — she knew there had to be a better way to manage the inventory. Without a solution, hospitals could continue to spend lots of money on medication that wound up in trash bins or, even worse, become inundated with sick people and not enough drugs to treat them.

Ivy is one of about 20 NC State faculty members and graduate students in the Edward P. Fitts Department of Industrial and Systems Engineering working in the emerging field of health systems engineering. These researchers strive to make health care more organized, efficient and cost-effective — results that keep patients healthy and save everybody money.

These engineers think of health care as an interconnected system, rather than as individual components, and they focus on health care delivery and medical decision-making. They're advising doctors on the right times to prescribe medication; finding the most efficient cancer-screening methods; and, thanks to a $1.6 million grant from the Centers for Disease Control and Prevention, improving North Carolina's Health Alert Network, a system that keeps health workers on the same page during statewide health emergencies.

Students interested in the field are gaining hands-on experience in the department's health systems engineering concentration, which was established in 2009. This certificate program, led by Dr. Stephen Roberts, the A. Doug Allison Distinguished Professor in Industrial and Systems Engineering, provides students with a paid mentored internship at a sponsoring health organization.

The field is emerging as US health care costs for prescription medication, hospital care, doctors' fees and other services continue to rise; they accounted for more than 17 percent of the national gross domestic product in 2009. As these costs go up, health systems engineers look for ways to give patients, doctors and hospitals the most bang for their health care buck.

That's where quantitative modeling, a method using mathematical equations to predict behavior and simulate health care-related situations, plays a major role.

"With simulation, we try to create a computer model of the particular system, whether it's a pharmacy or a laboratory," Roberts said. "Then we experiment with it to find a better system."

Ivy's work with NC State alumna Dr. Anita Vila-Parrish, teaching assistant professor and director of undergraduate programs in the department, holds promise for improving inventory management policies at hospitals. This would allow hospital staff to order medication with more certainty and limit purchases that don't fit the budget.

"You can get what you need, at the best possible price, when you need it," said Ivy, associate professor of industrial and systems engineering.

Drs. Anita Vila-Parrish *(left)* and Julie Ivy are among about 20 NC State faculty members and graduate students working in health systems engineering.

The engineers are also interested in the early detection of different types of cancer. Ivy, Roberts and Dr. Brian Denton, associate professor of industrial and systems engineering, are comparing screening methods for breast cancer, colorectal cancer, and prostate cancer, respectively. They're looking at screening times, frequencies and costs, all geared toward finding the most efficient way to catch the diseases early, when treatment is more likely to work.

Denton is also using modeling to show how heart disease progresses in patients affected by a condition that causes more deaths per year than breast cancer and AIDS combined — diabetes.

"We look at the optimal time to begin treatment," Denton said. "And that means trying to figure out which treatment to use first, when to use it, at what age, and how things like gender, for example, affect treatment."

Denton's research with Jennifer Mason, a PhD student in the department, focuses specifically on patients living with type 2 diabetes, the most common form of the chronic disease. Their recent work revealed that only 48 percent of patients who were prescribed statins — medication that lowers cholesterol levels and reduces the risk of heart disease and stroke — were taking the prescribed dose on a regular basis after one year.

For diabetics, who are at particularly high risk for heart attack and stroke, the findings let them know how important it is to stick to their medications.

These types of results give patients, policy makers and hospital staff important information as they make decisions that can save time, money and lives.

"There's going to be an increasing need for people who look at these systems of health care," Roberts said. "And NC State engineers will be prepared for the job." ▪

The *THRILL* of eVictory

Engineering students at NC State's Prometheus Group eGames compete to invent the next big thing.

Bedbugs aren't picky.

They'll take over your roommate's comfy green couch or a ritzy hotel's 1,000-thread-count sheets. But up until about 10 years ago, advances in hygiene had relegated the tiny biters to little more than uncomfortable memories in many parts of the developed world.

Now, thanks to growing cities, more global travel and a stubborn resistance to pesticides, they're back, wreaking havoc on unsuspecting sleepers everywhere. But through the enterprising work of a few engineering students who showcased their new bedbug-sensing device at NC State's eGames competition, exterminators may be one step closer to finding these critters a little faster.

The eGames — a university-wide competition for new venture standouts — has featured hi-tech motorcycle boosters, temperature-sensing bathmats, antibacterial children's apparel and many other ideas from students hoping to make it big in the marketplace. The event has helped engineering students, as well as those from other colleges, become well-versed in marketing, business planning, financing, and other skills entrepreneurs need to be successful.

Competitors work in multidisciplinary teams and try to convince judges that they have developed a life-changing product or idea that's going to sell big. The competition offers gold, silver and bronze medals — and prizes totaling $30,000.

This year, the university presented the first named version of the competition — the 2011 Prometheus Group eGames — to recognize the contributions of the company and its co-founders, NC State alumni Eric and Amy Huang. The Huangs made the gift to the event to help student entrepreneurs succeed.

"It's absolutely essential that we have donors who believe in what we're doing and want to support it," said Dr. Tom Miller, the McPherson Family Distinguished Professor in Engineering Entrepreneurship. "I was thrilled when the Huangs stepped up to the plate and offered to fund the entire competition this year."

Students competed in four categories in 2011 — extreme website makeover, new venture, design and prototype, and a sustainability challenge sponsored by Coca-Cola. The preparation for the event is intense, with multiple competition rounds and submission dates beginning up to two months before the final presentations in April. The new venture challenge, for example, had four rounds that required students to master business plans, investor pitches and public speaking skills — all of which would play a major role for teams advancing to the final round.

Taking the initiative

This year was the third for the eGames, but Miller has been grooming future startup leaders for close to two decades.

In 1993 he created the Engineering Entrepreneurs Program (EEP) at NC State to help prepare students with big ideas to start their own companies. Today he is executive director of the NC State Entrepreneurship Initiative (EI), which was created in 2008 as part of a university-wide commitment to developing entrepreneurial solutions to society's current problems and future needs. By helping students build businesses, the initiative also creates jobs and boosts the state's economy.

In 2009, under Miller's direction, the EI launched the eGames. Since its inception, the competition's organizers have worked to promote the event across campus, encouraging multidisciplinary collaboration. In addition to engineering students, this year's event featured students from six other colleges at NC State, including design, humanities and social sciences, management and textiles.

"We think of the eGames as a celebration of student innovation and entrepreneurship," Miller said. "It's more than just a traditional business plan competition."

Practice makes perfect

Winning at the eGames starts with a great idea. After a brainstorming session with an EEP professor, a team calling itself GreenSleeves Solutions thought they had one for this year's event.

A bedbug finder.

"We wanted to make a bedbug detector that tests specifically for bedbug pheromones," said team member Sean Austin, at the time a senior in chemical engineering. "We want to give exterminators a device that will just scan along the bed seams and detect bedbugs — a simple solution."

The team pitched an idea for a handheld sensor designed to help exterminators quickly detect bedbugs. They started with a carbon dioxide sensor, which served as a proof of concept for the judges, demonstrating the team's ability to create an easy-to-use detector.

2011 Prometheus Group eGames

Competition Categories
Coca-Cola Sustainability Challenge
Extreme Website Makeover Challenge
New Venture Challenge
Design and Prototype Challenge

Colleges Represented
Agriculture and Life Sciences
Design
Engineering
Humanities and Social Sciences
Management
Physical and Mathematical Sciences
Textiles

A Home for Entrepreneurs
The Phase I Garage is a 2,000-square-foot space located in Research IV on Centennial Campus. The innovative workspace includes prototyping studios, a woodworking shop and state-of-the-art learning spaces.

The Phase II Garage will be an expansion of the current space, with a continued focus on collaboration, connectivity and sustainability. Dr. Tom Miller envisions a living-learning village on Centennial Campus.

The next step is to purchase a powerful miniaturized ion mobility spectrometer that can be programmed to detect trace quantities of pheromones released by bedbugs.

The judges were sold; the team won gold in the new venture challenge and grabbed an honorable mention in the design and prototype challenge. And they owe a lot of their success to EEP.

"When we got to our investor presentation, every question they asked, we heard it before from our instructors or someone along the way," said team member Andrew Williams, then a senior in electrical engineering.

Scott Klein, a computer engineering alumnus, and his brother, Steve, were EEP veterans when they introduced their mobile application creator, Sound Around, during the 2010 eGames.

"Our idea went through EEP, and we had help from fellow students," said Scott Klein. "Going through the class helped validate what we were doing."

Sound Around allows bands and musicians to create and customize mobile apps that enable fans to purchase concert tickets and get their favorite band's latest news. The stamp on the company's success came later in the year when it was bought by ReverbNation, an online music marketing platform used by more than 900,000 artists, managers, record labels and venues.

"The eGames is a great exercise with zero risks," said Scott Klein. "It's part of the advantage of being a student — you have access to feedback and advice, as well as mentors and judges who are part of the community."

The next generation

The eGames winners succeeded by identifying problems and solving them. A partial list of this year's successful pitches showcases the competitors' ideas for making life a little easier, safer and more fun:

- A team called Albatross introduced its Safetouch Bathmat, which changes colors depending on the temperature, indicating if the water in the shower or bathtub is too hot or too cold for bathers. The team placed second in the design and prototype challenge and has lined up a few boutiques that have agreed to sell the product when it's ready for release.

"To come to an award show and be able to display our product and see a thought come to fruition is a great experience," said team member Quan Ha, then a senior in electrical and computer engineering.

- A safer ride for motorcycle enthusiasts inspired Andrew Misenheimer's company: SPARKmoto, Inc. The electrical engineering graduate student has developed an electric supercharger that uses sensor technology similar to what is used on the two-wheeled Segway scooter. If the sensors detect that the rider is in danger of crashing, the bike's power is reduced to keep the rider safe. The technology gives the motorcycle more power without the extra weight of a larger bike.

"I actually competed last year in the eGames and this year I've been much more prepared," Misenheimer said. "I've taken entrepreneurial classes, and I've really honed my skills for giving pitches, talking to new people and getting my point across."

- Angela Hollen, a graduate student in the College of Textiles and co-founder of the Spitter Spatter team, knows that keeping little kids' clothes clean is nearly impossible. But when kids are going through multiple outfits each day, parents may find themselves eventually running out of onesies and other staple garments.

"We're creating a kids clothing line for infants and toddlers that utilizes cutting-edge technology to provide antimicrobial and odor-free garment properties," Hollen said. "These properties are permanently bonded to the fabrics, so they do not wash off, wear off or degrade over time, ultimately allowing us to offer consumers higher quality garments."

Building an entrepreneur's dream

Thanks to the support of the EI and open source giant Red Hat, which has its corporate headquarters on NC State's Centennial Campus, eGames contestants now have their own idea lab — the Garage. The 2,000-square-foot space includes meeting rooms, a machine and parts area, and a prototyping studio.

"The Garage that we currently have is called 'Phase I' because our vision is much bigger than that," Miller said. "We want to have a larger space specifically designed to support this creativity, this innovation, this entrepreneurship of students."

That space will support the next wave of job creators — and eGames winners — produced by NC State.

"We need students coming through college not just saying, 'I'm going to graduate from college so that I can get a good job,'" he said. "I want them to say, 'I'm going to learn things in college that will help me create a job for me, my family and the future.'" ▪

eAlumni

Past eGames have spawned a host of successful ventures.

MyFit.com – 2009
Jason Mueller, a double major in computer engineering and management, co-founded MyFit.com, an innovative web-based college recommendation engine that uses advanced data modeling to help students find the right college. His company was acquired by Naviance, an educational software provider, last year, and today he is a product manager at Yelp, a San Francisco-based local business review company.

Sound Around – 2010
Computer engineering student Scott Klein and his brother, Steve, a business major, founded Sound Around, a mobile app creator that allows bands and musicians to customize apps for their fans. Last year, their company was acquired by ReverbNation, the large New York-based music platform company.

Leiva Strings – 2010
Italo Leiva, a psychology major, created Leiva Strings, a product that uses colored strings to help people learn to play guitars and other stringed instruments. Leiva hopes to release his product in the NC State Bookstores in late 2011 or early 2012.

eGames participant Andrew Misenheimer, as seen on pages 29 and 30, developed an electric supercharger for a motorcycle with safety features similar to technology found in a Segway scooter.

SURVEY SAYS SUCCESS

The numbers don't lie. Holders of NC State engineering degrees provide a big boost to the state and national economies.

NC State engineering graduates combine technical know-how with business savvy. The result: Highly successful people who hold top jobs or start their own companies, making them big players in the economy.

And now, you can look it up.

A group of alumni volunteers recently commissioned an international economics and public policy consulting firm to study the College of Engineering's economic impact. A key part of that study was a survey of alumni that asked about their NC State education and professional careers. The idea was to see how alumni used their engineering degrees, and how those degrees helped them succeed.

The survey results show that an NC State engineering degree is a powerful determinant of a successful career. It's borne out by the respondents' impressive salaries and business-building activities.

Of particular note are the entrepreneurs, who have founded at least 1,791 companies employing more than 68,000 people. Those numbers are absolute minimums, as they reflect only those companies and jobs created by survey respondents. Those who did not respond almost certainly started companies at a high rate, but the survey results can not be generalized to all alumni.

These survey highlights show what our graduates have long known: The College of Engineering at NC State is a job-creating, revenue-generating, business-building dynamo.

$11.4 billion [TOTAL] **$4.5 billion** [NC]

GROSS REVENUE AT ALUMNI-FOUNDED AND ALUMNI-OWNED BUSINESSES IN 2010

68,200 total **24,900** nc

EMPLOYEES AT ALUMNI-FOUNDED AND ALUMNI-OWNED BUSINESSES IN 2010

$168,300

AVERAGE SALARY OF ALUMNI WHO HAVE STARTED OR OWNED A BUSINESS

35

PERCENTAGE OF ALUMNI WHO'VE ENGAGED IN SOME FORM OF **ENTREPRENEURIAL ACTIVITY**

79

PERCENTAGE OF ALUMNI WHO FELT THEIR EDUCATION LEFT THEM ***WELL PREPARED OR EXTREMELY WELL PREPARED*** TO SUCCEED IN THEIR CAREERS

$20.2 million

TAX REVENUE GENERATED FOR NORTH CAROLINA IN 2010 BY ALUMNI-FOUNDED AND ALUMNI-OWNED BUSINESSES

91

PERCENTAGE OF ALUMNI WHO SAY THE **PROBLEM-SOLVING AND ANALYTICAL SKILLS** THEY LEARNED IN THE COLLEGE HAVE BEEN ***VALUABLE OR EXTREMELY VALUABLE IN THEIR CAREERS***

1,791 [TOTAL] **1,006** [NC]

BUSINESSES FOUNDED OR OWNED BY ENGINEERING ALUMNI AS OF 2010

$128,000

AVERAGE SALARY EARNED BY ALUMNI WITH BACHELOR'S DEGREES

About the survey

Keybridge Research emailed its survey to more than 33,000 alumni who earned NC State undergraduate or graduate degrees in engineering or computer science between 1929 and 2010. A total of 2,887 alumni responded.

The data in this story reflects responses received and cannot be extrapolated to include all alumni.

A PAIR *for* PROFESSORS

Frank and Doris Culberson, who just established two new endowed professorships, are serious about giving back to the College.

Doris and Frank Culberson's latest gift will establish two new professorships in the College.

Frank and Doris Culberson have made giving to the College of Engineering a lifetime commitment.

The couple has hosted two "Meet the Dean" alumni events. They often house NC State staff members at their Houston home when staff work in east Texas. Frank Culberson has long served on NC State leadership boards, and he's devoted countless hours visiting alumni to talk up the College and the university.

"My NC State engineering education contributed a great deal to where I am today," said Frank Culberson, a chemical engineering alumnus. "We like to support things that are worthwhile, and this is a worthy program in which to be involved."

The couple's most recent contribution provides ample evidence of that commitment. They have pledged $1 million over five years to establish two professorships in the Department of Chemical and Biomolecular Engineering.

The gift will be supplemented by contributions from the state's Distinguished Professorship Endowment Trust Fund, bringing the total donation to $1.5 million. One professorship will help recruit or retain a senior faculty member, while the second could be filled by another established professor or a rising star in the field.

The commitment comes at a time when the NC State Engineering Foundation, for which Frank Culberson serves as president of the board of directors, is placing added emphasis on boosting the number of endowed professorships in the College. Professorships provide top faculty with extra funds for research activities — including graduate assistants and equipment purchases — course development and salary support.

Competition among engineering schools for talented faculty is fierce, and professorships give the College an advantage.

"Frank and Doris Culberson have made a wonderful gift to this College, and we appreciate their longstanding support of our people and programs," said Dr. Louis A. Martin-Vega, dean of the College. "These professorship endowments continue to move the College forward by helping us recruit and retain some of the world's finest engineering researchers and educators."

Frank Culberson (left) and Dean Louis A. Martin-Vega work together to boost the College's endowment.

Frank Culberson, a native of Siler City, NC, earned his bachelor's degree in chemical engineering from NC State in 1960 and received his MBA from the University of Houston in 1966. He is chairman and a director of Rimkus Consulting Group, a 400-person forensic consulting and engineering firm headquartered in Houston. The company investigates energy and construction accidents and disputes; residential and commercial problems; product failures, including major equipment and machinery; motor vehicle and marine accidents; and industrial fires and explosions.

When he joined Rimkus in 1987, it had just eight employees, but he helped grow it into a large firm with more than 30 offices in the US and Europe. He is a member of the American Institute of Chemical Engineers and a registered professional engineer in Florida, Arizona and Texas.

Frank Culberson has participated in various speaking engagements at NC State, including the dedication of Engineering Building I on Centennial Campus in 2005 and the commencement program for the Department of Chemical and Biomolecular Engineering in 2007, and was named a Distinguished Engineering Alumnus by the College in 2002. He was also the College of Engineering's co-chair for NC State's successful *Achieve!* fundraising campaign and has been among the most generous contributors to the College's Dean's Circle and Director's Fund giving programs over the years.

Doris Culberson, a native of Liberty, NC, earned a bachelor's degree in English and education with a Texas Teaching Certificate from the University of Houston and later taught at a Houston-area high school. The couple has two daughters and three grandchildren.

The Culbersons previously endowed the S. Frank and Doris Culberson Academic Enhancement Fund in Chemical Engineering. Frank Culberson said they wanted to create professorships with their most recent gift because outstanding faculty can boost the College's reputation and create new opportunities for students.

"World-class faculty members not only bring their own research projects to an institution, they also open doors and serve as outstanding mentors and role models for their students," he said. "Endowed professorships are instrumental for moving the College and the Department forward." ▪

The annual spring endowment dinner provides a wonderful opportunity for donors to get together with the people they are sponsoring.

What is endowment?

A primer on building the endowment, a key component to the College's future success.

Building the endowment.

The phrase gets thrown around often in academic circles, but what does it really mean, and how does it work?

Here's a primer from the NC State Engineering Foundation, which works with donors to secure private financial support for the College. The bottom line: Endowment gifts are the most important long-term investments a donor can make in the College.

What is endowment?

In higher education, the word "endowment" has a couple of meanings. One definition refers to the big picture — the total value of an institution's investments. The word is also used to describe the individual gifts that make up that larger endowment. These gifts support professorships, scholarships, graduate fellowships and programmatic activities in the College.

All endowment gifts are important, but the **Foundation places special emphasis on endowed professorships,** the most important vehicle for recruiting and retaining talented faculty.

How are endowment funds distributed?

After a supporter makes an endowment gift, the principal is deposited in an investment account, and only the endowment's annual income is used for the donor's chosen purpose. So, if a donor makes a $500,000 endowed professorship gift, a set percentage of the interest building off that amount goes to the chosen faculty member each year. Endowments last forever and touch many lives as the principal grows over time.

Why is supporting the endowment so important?

The College's $76.3 million endowment ranks behind many of its peers. Schools with larger endowments have a greater chance of luring top faculty and students with endowed professorship and scholarship offers. These talented people can start distinctive research efforts that separate NC State from the competition.

Are some endowment gifts more important than others?

All endowment gifts are important, but the Foundation places special emphasis on endowed professorships, the most important vehicle for recruiting and retaining talented faculty. These endowments create funds used for salary support and research activities, including graduate assistants, equipment and course development. A state matching program helps donors get more for their money.

I want to make an endowment gift, but I can't do it now. What are my options?

You may want to consider a planned gift. Donations through wills or trusts support the College and can create lifetime income for the donor or a loved one. Some planned gifts make the supporter eligible for estate tax deductions. When donors let the Foundation know about these commitments, it gives staff the chance to answer questions, recognize the donors' generosity, and tell their story to inspire others to make similar commitments.

How are endowment donors recognized?

Endowment donors are recognized in a number of ways, including at an endowment dinner held each spring (see photos at left). The dinner brings together supporters with the student or professor receiving the endowment funds, providing a wonderful opportunity for donors to learn about the people and projects they are sponsoring. ▪

For more information, please contact Martin Baucom at the NC State Engineering Foundation at (919) 513-3950 or visit www.engr.ncsu.edu/foundation.

A good friend retires

Ben Hughes, executive director of the NC State Engineering Foundation, is retiring in September 2011 after an 18-year career with the College.

Hughes has presided over the most successful fundraising period in the College's history, growing its overall endowment from about $10 million in 1993, his first year with the College, to $76.3 million in 2011. The number of professorships and scholarships increased fourfold, and endowments for programmatic activities jumped nearly 600 percent.

"I can't emphasize enough how important Ben has been to the success of this College over the past 18 years," said Dr. Louis A. Martin-Vega, dean of the College of Engineering. "He's been the cornerstone of our development efforts and has established wonderful relationships with our alumni and friends. He is a very special person, and we are all going to miss him dearly."

Hughes graduated from Tulane University with a bachelor's degree in political science in 1970. He eventually joined the development office at UNC-Chapel Hill, where he rose through the ranks and became the university's director of major gifts.

NC State fundraising efforts were in their infancy when Hughes joined the Foundation in the early 1990s, and he knew the College needed a much larger endowment to keep pace with its competitors.

Supporters appreciated his friendly, businesslike manner, and the gifts rolled in. Among the many highlights was the $10 million gift from alumnus and Foundation board member Ed Fitts in 2005 to endow the Edward P. Fitts Department of Industrial and Systems Engineering.

In retirement, Hughes plans to volunteer with his church, tend to his garden, and get involved with the arts. He is quick to deflect credit from himself, saying the work of the Engineering Foundation board and staff, as well as Dean Martin-Vega and Dean Emeritus Nino Masnari, has been critical to the College's fundraising success, particularly its efforts reaching out to alumni.

"When you see people who have not had much involvement with the College, and they say, 'I'm glad you're coming to see me and I want to get involved,'" Hughes said, "that's really the most personally rewarding part of this job." ▪

alumni & donor stories

ALUMNUS MAKES GIFT TO DUAL-DEGREE PROGRAMS

An engineering alumnus has made a gift to two unique education programs at NC State.

The $125,000 gift from Thomas K. Laundon supports the Benjamin Franklin Scholars Program and the Thomas Jefferson Scholars Program, dual-degree programs that pair coursework in engineering or agriculture and life sciences with humanities and social sciences. Each program will receive half the gift, or $62,500.

Laundon, a 1974 industrial engineering alumnus, is the former president and chief financial officer of PhaseBio Pharmaceuticals, Inc., a Pennsylvania-based biopharmaceutical company. His youngest son, Will, is a rising junior in the Franklin program, pursuing degrees in industrial engineering and economics. His oldest son, Russell, is an alumnus of the Jefferson program and went on to earn a doctor of pharmacy degree.

The Franklin Scholars Program, a dual-degree program between the College of Engineering and the College of Humanities and Social Sciences (CHASS), allows students to earn a bachelor's degree in an engineering discipline or computer science and a bachelor's degree in the humanities or social sciences. Students in the Jefferson Scholars Program earn bachelor's degrees in both the College of Agriculture and Life Sciences and CHASS, respectively.

Laundon is a longtime NC State supporter. He has served on the Alumni Association Board of Directors, and his family has endowed a Caldwell Scholarship. He was recognized as a Distinguished Alumnus by the Edward P. Fitts Department of Industrial and Systems Engineering in 2008. An office in the Park Alumni Center was named to honor the memory of his wife, Dr. Caroline Laundon, a graduate of the College of Agriculture and Life Sciences in 1976. ▪

FIRST-YEAR STUDENTS WELCOMED BY ALUMNUS

Jake Hooks

Engineering isn't easy, Jake Hooks told first-year students at North Carolina State University in August. But if you're persistent, all that hard work will pay off with a dynamic career.

"You may study longer than anyone else on campus," Hooks said. "The benefit is that you will receive some of the most challenging and rewarding assignments when you graduate."

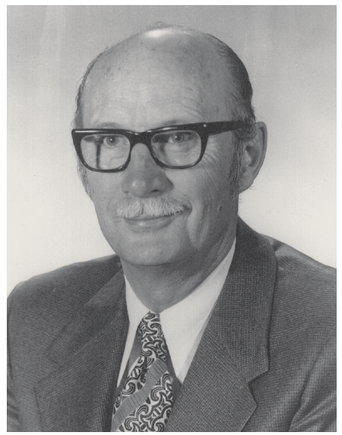
Hooks, a 1978 NC State alumnus in materials engineering and president of the Automotive North America business of Eaton Corp., was the keynote speaker at the 11th annual College of Engineering Welcome event on Aug. 18.

About 1,000 first-year engineering students packed the McKimmon Center for the event, which was organized by the College's First-Year Engineering Program. The program also runs new student orientation activities and guides students during their first year toward matriculation into an engineering department.

During his address, Hooks offered five life lessons that had their genesis at NC State: Surround yourself with smart people; develop an intellectual curiosity basis for lifelong learning; develop discipline and critical-thinking skills; show initiative; and develop the confidence to be a leader.

"An engineering degree from NC State will open many doors for you," Hooks said. "It gave me the confidence to be a leader." ▪

REMEMBERING TWO GIANTS OF ENGINEERING



Dr. Raymond L. Murray

C.E. "Ed" Vick, Jr.

The College lost two engineering giants during the spring and summer.

Dr. Raymond L. Murray, professor emeritus of nuclear engineering at NC State and a pioneer of the atomic age, passed away on June 22. He was 91.

Murray contributed to the Manhattan Project and the Three Mile Island recovery and was a leading figure in establishing and growing NC State's nuclear engineering program.

In 1950, the year he joined the faculty, NC State introduced the nation's first university nuclear engineering educational curriculum and broke ground on America's first university-based nuclear reactor. Murray contributed to its design, construction and operation.

With Murray's help, NC State awarded the first bachelor of science degree in nuclear engineering in 1951. Three years later, NC State awarded the first two nuclear engineering PhDs in the nation.

Murray led the newly formed Department of Nuclear Engineering from 1963 to 1974. During his tenure as department head, a new building was constructed, and the PULSTAR reactor, which remains in use today, was acquired and activated.

In recent years, several of his former students have banded together to raise money to support the Raymond L. Murray Engineering Scholarship for nuclear engineering students.

C.E. "Ed" Vick Jr., an engineering alumnus whose love for NC State led him to play an integral role in designing Centennial Campus, creating the Caldwell Fellows program and building the Dorothy and Roy Park Alumni Center, died in May. He was 76.

Vick, who received bachelor's and master's degrees in civil engineering from NC State in 1956 and 1960, respectively, was one of the founders of Kimley-Horn and Associates, Inc., a Raleigh-based engineering, planning and environmental consulting firm that grew to have more than 1,500 employees and offices in 17 states. He was the longtime president and then chairman of the company before retiring in 2001.

His long engineering career included key roles in the master development planning of NC State's Centennial Campus as well as major developments and road projects in the Triangle and major cities throughout the Southeast.

Vick served on a number of NC State boards, including the university's Board of Visitors and the NC State Engineering Foundation Board of Directors. He was recognized in 1991 with the Distinguished Engineering Alumnus Award and in 2006 with the Alumni Association Meritorious Service Award. In 2007, he was inducted into the NC Transportation Hall of Fame. Vick also served as co-chair of the Alumni Association Campaign for Excellence that led to the construction of the Park Alumni Center.

Vick was generous with his financial contributions to the university, including endowing the C.E. Vick/Caldwell scholarship in honor of his father. Kimley-Horn later endowed a civil engineering scholarship in Vick's honor. ▪

Foundation Year in Review

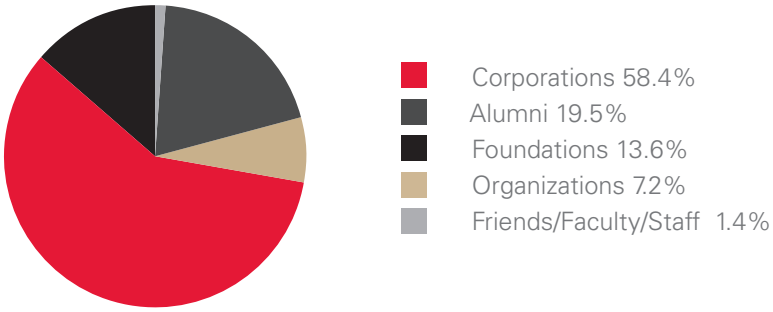
Alumni, friends and corporate partners make long-term investments in the College of Engineering.

The NC State Engineering Foundation raised more than $12 million in private gifts and new commitments in fiscal year 2011 to support educational experiences and groundbreaking research being conducted by students and faculty in the College of Engineering. The charts below illustrate the sources and uses of that private support.

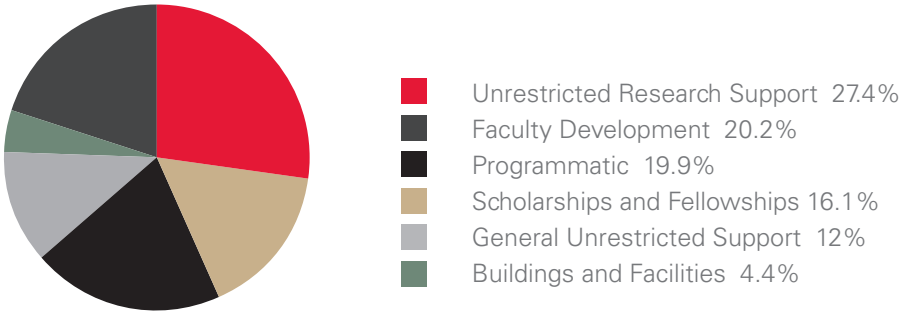
Our priority remains raising gifts to build the College's endowment. Those gifts are the most important and enduring investments donors can make in the College, and have a profound impact on our ability to attract and retain people — the students and faculty who define the College. The principal of an endowment gift is invested while its annual income is used to support the donor's purpose. Gift agreements are tailored to achieve the kind of impact a donor desires. As the principal grows over time, so too does the capacity for students and faculty to pursue their dreams.

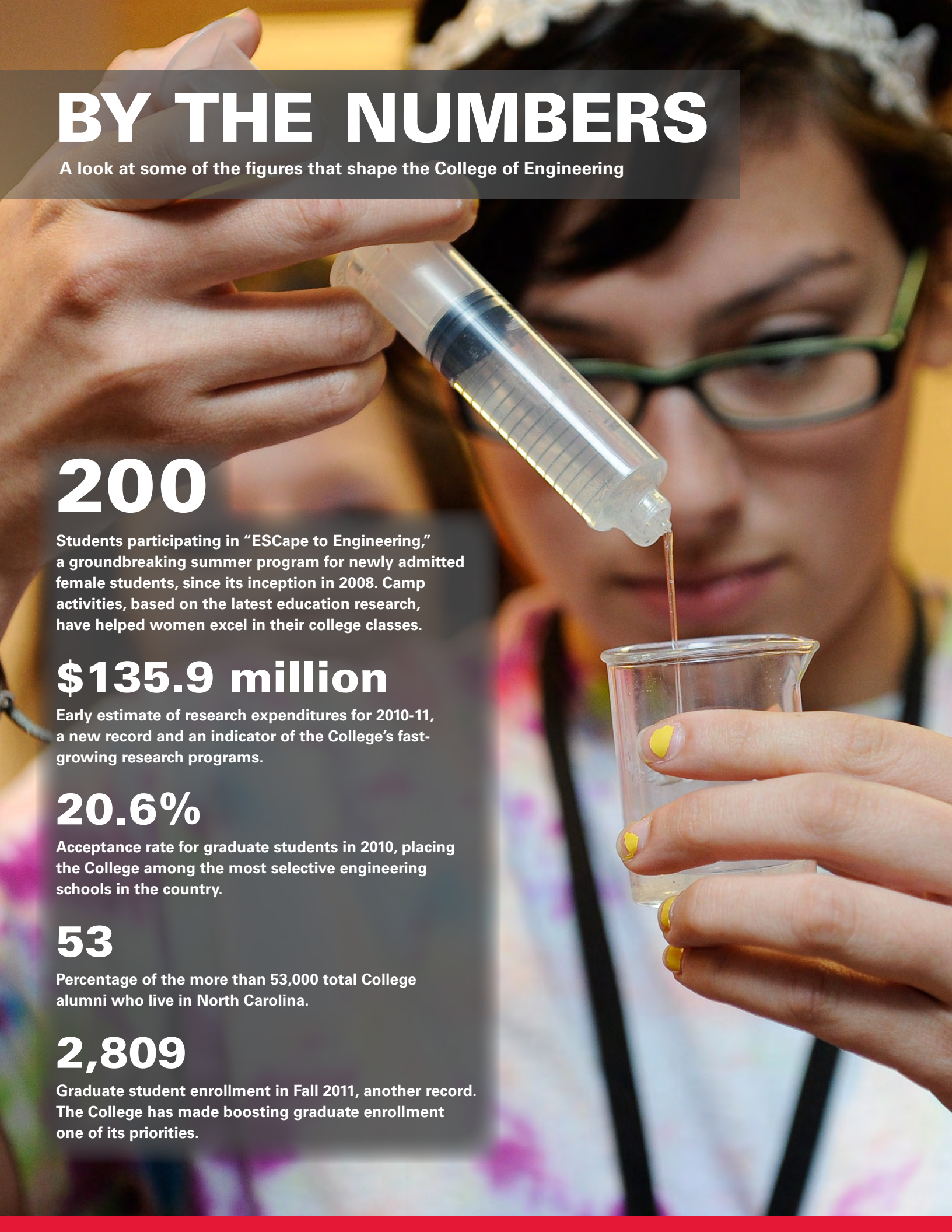
As engineers, those dreams involve solving big challenges, so the generosity of donors and every new endowment that is established plays a unique role in inspiring education and research that will advance society. This past year, the Foundation established nine new endowed scholarships, two new endowed graduate fellowships, two new programmatic endowments and three endowed professorships. On behalf of the students, faculty and staff, the Foundation expresses its sincere thanks to all who continue to give so generously. ▪

NCSEF Source of Gifts 2010/2011



Private Support to the College of Engineering 2010/2011





BY THE NUMBERS

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

200

Students participating in "ESCape to Engineering," a groundbreaking summer program for newly admitted female students, since its inception in 2008. Camp activities, based on the latest education research, have helped women excel in their college classes.

$135.9 million

Early estimate of research expenditures for 2010-11, a new record and an indicator of the College's fast-growing research programs.

20.6%

Acceptance rate for graduate students in 2010, placing the College among the most selective engineering schools in the country.

53

Percentage of the more than 53,000 total College alumni who live in North Carolina.

2,809

Graduate student enrollment in Fall 2011, another record. The College has made boosting graduate enrollment one of its priorities.

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College of Engineering
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PLANNED GIVING

Planning for the future through a will or trust can help you care for loved ones, manage your own care or even make a lasting gift to charity.

If you would like to include the College of Engineering in your long-term financial planning, here are some ideas to help you achieve your goals.

BEQUEST
Make a gift to the NC State Engineering Foundation and receive an estate tax deduction.

CHARITABLE GIFT ANNUITY
Make a gift to provide fixed income for a loved one.

CHARITABLE REMAINDER TRUST
Create life income for you and your spouse.

CHARITABLE LEAD TRUST
Pass property and other assets on to your family and support our mission.

Please call Martin Baucom at 919.515.7458 to discuss any of these charitable options or visit www.engr.ncsu.edu/foundation for more information.