Evolution

NORTH CAROLINA A&T STATE UNIVERSITY

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EDITOR
Shena L. Crittendon

DESIGN
M Creative

PHOTOGRAPHY
Black Horse

CONTRIBUTING WRITERS
Leslie Brown
Shena L. Crittendon
Chris Gigley
Bernetta Hill

N. RADHAKRISHNAN (RADHA), PH.D., P.E.
Vice Chancellor for Research & Economic Development

MITZI BOND, ED.D.
Assistant Vice Chancellor for Research Administration

SHENA L. CRITTENDON, M.A.
Assistant Vice Chancellor for Communications & Operations

M. DOUGLAS SPEIGHT, M.B.A.
Assistant Vice Chancellor for Outreach & Economic Development

North Carolina A&T State University is a land grant doctoral/ high research activity institution and an AA/EEO employer.

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Welcome to the first edition of *Evolution* —

North Carolina Agricultural & Technical State University's research magazine. It is an exciting time to be a part of the research enterprise at A&T. Every day new findings and results take our researchers on a stimulating journey of discovery. As an educational leader in the Piedmont Triad region of North Carolina, North Carolina A&T is committed to life-enhancing research, teaching excellence, and community service.

Our growth is apparent. We were recently designated by the Carnegie Foundation for the Advancement of Teaching as one of the nation's top-tier research institutions with the classification, "High Research Activity." There are 103 universities with this designation, which puts A&T in the distinguished company of institutions like Syracuse University, Wake Forest University, and the College of William and Mary. Further, only two universities in the University of North Carolina system have this designation, and we are one of only four Historically Black Colleges and Universities with the "High Research Activity" ranking.

We also have the distinction of ranking third in research funding in the University of North Carolina system, only behind the University of North Carolina at Chapel Hill, and North Carolina State University. A&T's research funding totaled $38.6 million for fiscal year 2006.

Serving approximately 11,000 students, we offer 89 bachelor's, 43 master's, and 5 doctoral degrees within eight colleges and schools. We are committed to being the premier interdisciplinary university in the country by building on our advantages in engineering, agriculture, technology, and business; celebrating our strong civil rights legacy and status as an 1890 land-grant institution; and attracting bright minds and independent thinkers who achieve distinction in the laboratory, classroom, and workplace.

Despite our accomplishments, we are not content to rest on our laurels. This first issue of *Evolution* introduces you to the major advancements we have made in the field of nanotechnology. It also offers you a glimpse into some of the other outstanding research being done on our campus. We hope you enjoy our premiere issue and thank you for allowing us the opportunity to share our successes with you.

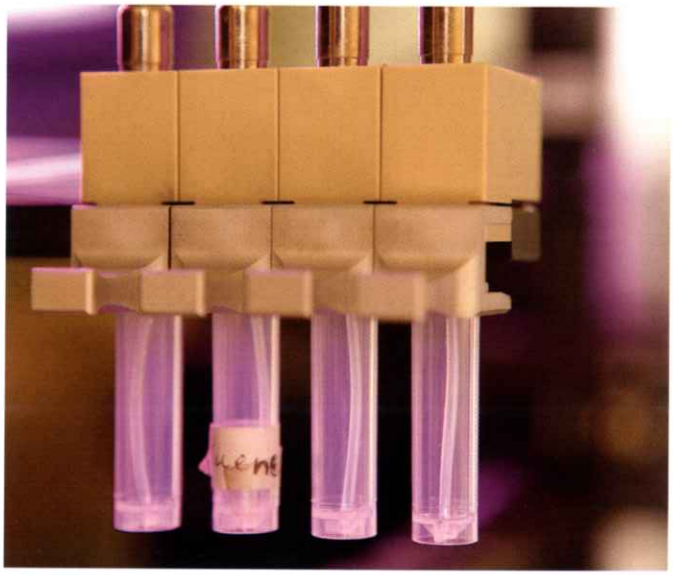
Sincerely,

N. RADHAKRISHNAN, PH.D., P.E.
Vice Chancellor for Research & Economic Development

Evolution

>> RESEARCH MOVING FORWARD

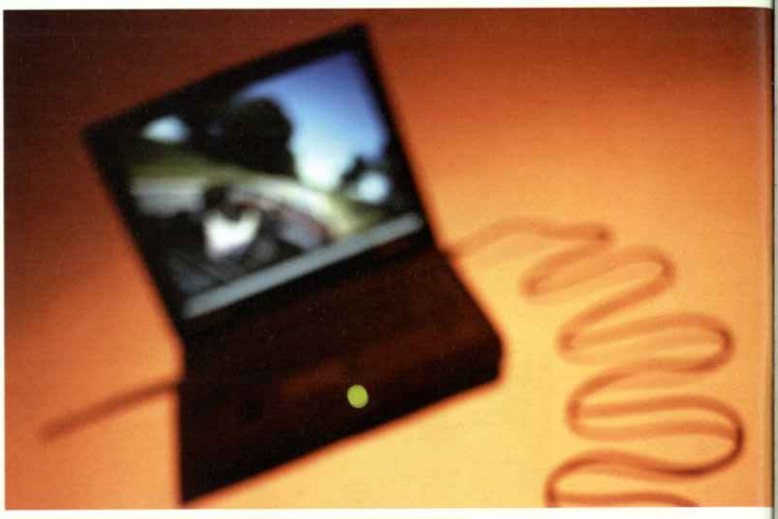
NORTH CAROLINA A&T STATE UNIVERSITY



FEATURES

DEPARTMENTS

NC A&T PROFESSOR DEVELOPS LEADERS IN A UNIQUE WAY



STUDENTS AT NC A&T are products of the "video game generation." They've grown up with video games, they've played them most of their lives, and they probably can't imagine a world without them. One professor at the university wants to capitalize on that video game culture by using the same kind of technology to improve leadership skills.

Dr. Alice Stewart, associate professor of strategic management in the School of Business and Economics at NC A&T, is the principal investigator on the project called "Developing 21st Century Leaders Using 21st Century Technology." The goal is to use technology to improve leadership skills of upper-level honors students.

In an effort to determine the best way to train students, honors students across the University are assigned to one of two different groups: traditional and nontraditional. According to Stewart, "The traditional students are taught leadership skills using conventional methods such as lecture, discussion, and case studies. The nontraditional students play a computer-simulated video game called Virtual Leader to learn how to accomplish tasks within an organization." The purpose of the exercise is to teach students new and effective ways to work in an organization.

Virtual Leader simulates real-life events that take place within a work environment. Students act as managers in the game to help them understand leadership techniques and to develop awareness of cause and effect so they understand that their actions and attitudes have consequences in organizational life.

After evaluating the two groups, Stewart found that "students trained with Virtual Leader tend to interact up and down and across the organization to a greater degree. There is more of the cross-talk outside of their organizational silos than is seen with students trained in the traditional way. They are not told to communicate this way, but apparently they see something in the simulation that indicates it is a good thing to do." She adds, "The traditionally trained students tend to talk to people within their silos or to someone who has the same role, but this student does not branch out."

Stewart thinks the research is promising and could improve future managers' social awareness and communication skills. She says, "The use of computer-based simulations and other experiential-learning activities represents a new way of helping people learn that might be more effective, particularly in areas like business where there is this kind of practical element."

According to Stewart, bad management costs everybody something. "A lot of people are bad managers because they have never really learned better managing techniques and because they don't know that what they are doing doesn't work. Unfortunately, many only know negative ways of getting people to do what they want them to do — threatening them, coercing them, embarrassing them, etc. All the research reveals that these are not the best ways to get people to do things."

A&T Professor Receives Award from the American Cancer Society

DR. PHOEBE BUTLER-AJIBADE, assistant professor in the department of human performance and leisure studies at North Carolina A&T State University, recently received an award from the American Cancer Society to establish a chapter of Colleges against Cancer (CAC) on the NC A&T campus. The chapter will work to bring together the campus community to address cancer disparities.

Funds from the grant will be used to train students in health-disparity program planning and advocacy. The students will conduct a Great American Smokeout campaign in November and organize a team for the annual cancer walk. They participated in the regional tobacco conference for HBCUs in March 2007.

According to Dr. Butler-Ajibade, "This program will provide us with an opportunity to prepare our human performance and leisure studies (HPLS) majors for leadership in conducting wellness campaigns. Students will play a leadership role in producing creative campaigns to reduce tobacco use and exposure to secondhand smoke. I think that it will be helpful for our campus to address health disparities regarding cancer. Cancer is very scary in the African-American community."

The CAC program allows college students, faculty and staff to work together to bring American Cancer Society programs and services to college communities nationwide. The A&T chapter will become part of a network of more than 175 other colleges and universities.

NOAA Funds $12.5M Interdisciplinary Center at North Carolina A&T

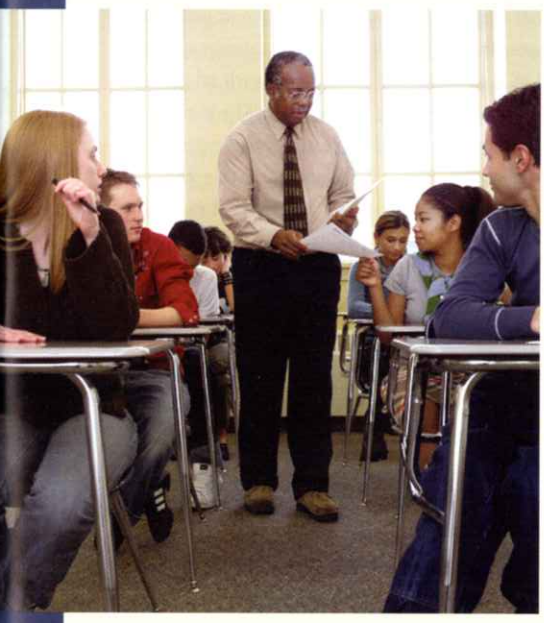
RESEARCHERS AT NORTH CAROLINA A&T State University have received a $12.5 million grant from the National Oceanic & Atmospheric Administration (NOAA) to fund an Interdisciplinary Scientific Environmental Technology (ISET) Cooperative Research and Education Center on campus.

According to Dr. Solomon Bililign, chair of the department of physics and principal investigator on the grant, "The ISET Center will cooperate with NOAA's Earth Science Research Laboratory in Boulder, Colorado, and is aligned with NOAA's mission to provide the data needed to address specific climate- and weather-related concerns, such as hurricanes, droughts, tornadoes, global warming, and ecosystem degradation. The ISET Center will provide opportunities for underrepresented students to study in NOAA-related sciences."

The center will perform research in areas including: sensor science and sensor technology for oceanic and atmospheric applications; analysis of global observing systems that includes numerical and physical research and analysis of hurricanes; and information technology tools for data fusion, data mining, and geospatial modeling and analysis.

According to Dr. N. Radhakrishnan, vice chancellor for research & economic development, "We are very excited about this grant, which gives us the opportunity to partner with NOAA. A&T has internationally known researchers whose work is capable of impacting the world. This grant is evidence of that fact."

Dr. Bililign's team includes a diverse network of scientists, engineers, and students from NC A&T, North Carolina State University, University of Minnesota, University of North Carolina at Pembroke, City University of New York, University of Alaska Southeast, California State University-Fresno, and Fisk University, as well as industrial, state, and federal government partners. Cooperating units at NC A&T include the College of Arts & Sciences, the College of Engineering and the School of Graduate Studies.



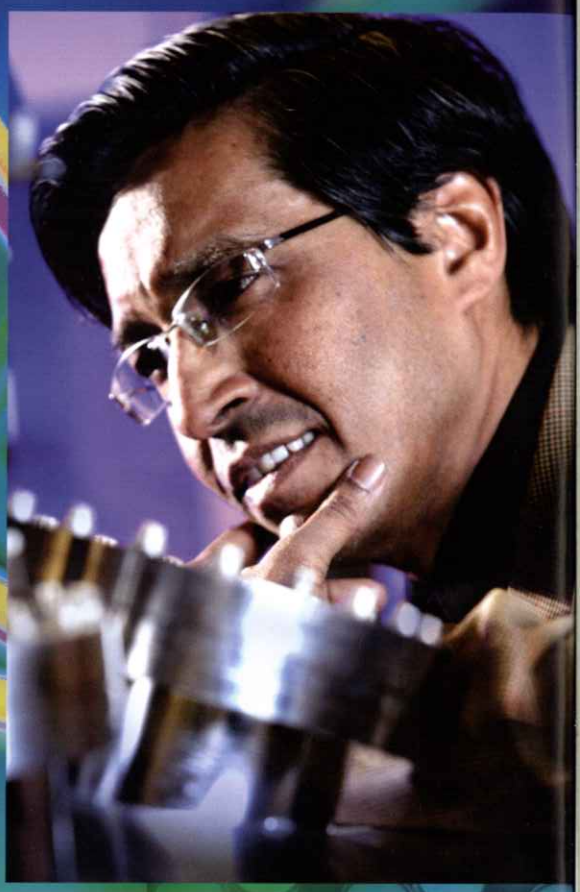
GEARUP PROGRAM ROLLS ON

NOW IN ITS SIXTH YEAR, the Gaining Early Awareness and Readiness for Undergraduate Programs (GEARUP) project at NC A&T continues to have a great impact on low-income, "at-risk" students in Guilford County. The mission of GEARUP is to prepare these students for college by providing support for the students, parents, and educators. GEARUP currently works with 473 eleventh-graders.

"GEARUP is a godsend," says Dr. Miriam Wagner, associate professor in the School of Education and coordinator of the project. "The neediest students as well as the least needy students are recipients of intervention strategies. It is our college students, who serve as tutors, mentors, and counselors, that are the cornerstone of this project."

GEARUP emphasizes courses that prepare students for college, coupled with greater parental involvement and stronger support networks. It also provides intervention strategies that focus on tutoring, mentoring, counseling, financial assistance sessions, dissemination of college information, cultural enrichment, and development workshops for teachers and guidance counselors. Furthermore, greater emphasis is placed on reading and writing to address the essay portion of the SAT and recent data reflecting reading deficiencies among high school students. |E|

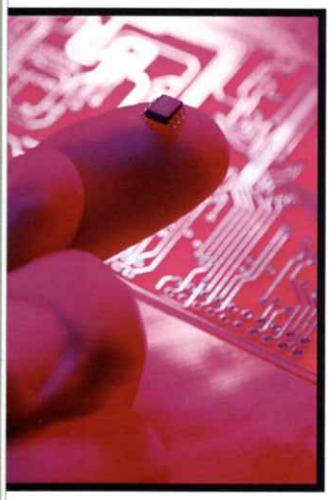
BY SHENA L. CRITTENDON



LITTLE WONDER

Nanotechnology Research at A&T

ONE WORD WITH LARGE IMPLICATIONS has the research world buzzing about future possibilities. That word — nanotechnology — is a hot topic in the state of North Carolina and worldwide. But for researchers at NC A&T, the buzz is nothing new. "Nanotechnology is what we're known for," says Dr. Jagannathan Sankar, professor of mechanical engineering and director of the center for advanced materials and smart structures (CAMSS) at the university. "We have transformed ourselves into well-recognized players in the field."



Nanotechnology provides new tools to engineer materials and devices at the nanoscale. It applies biology, chemistry, physics, and mathematical principles to many areas, including but not limited to mechanical and electrical engineering, technology, agriculture, and medicine. Nanotechnology is an extension of traditional disciplines which, in turn, can be reinterpreted as specific applications of nanotechnology. This dynamic reciprocation of ideas and concepts contributes to the understanding and enhancement of future technological advancements.

What is nanotechnology? Broadly speaking, it is the synthesis and application of ideas from science and engineering toward the understanding and production of novel materials and devices. More specifically, it is a technology that creates small materials at the scale of molecules by manipulating single atoms. "Nano" comes from the size of the molecules inside atoms that are measured in nanometers — or one billionth of a meter — which is 10,000 times narrower than a human hair. The molecular processes of life, particularly the activity of proteins (enzymes) and the self-organizing behavior of many biological molecules, have greatly inspired nanotechnology and can be considered the result of nature's nanotechnology.

Major technological revolutions, including the industrial revolution and the dawn of the information era, have revealed how new discoveries can drastically change our lives. In the case of nanotechnology, manufactured products are made from atoms. The properties of those products depend on how their atoms are arranged. If the atoms in a lump of coal were rearranged, the result would be a diamond. If the atoms in sand were rearranged (and a few additional trace elements were added), scientists could produce computer chips. If the atoms in dirt, water, and air were rearranged, they could make potatoes.

Materials reduced to the nanoscale exhibit very different properties than those on a macroscale, enabling unique applications. Opaque substances become transparent (copper); inert materials become catalysts (platinum); stable materials turn combustible (aluminum);

solids turn into liquids at room temperature (gold); and insulators become conductors (silicon).

So what does all this mean at NC A&T? According to N. Radhakrishnan (Radha), Vice Chancellor for Research & Economic Development, it means the possibilities are endless. "The new concepts of nanotechnology are so broad and so pervasive that they will influence every area of technology and science in completely unpredictable ways," says Radhakrishnan. "Great advances from nanotechnology are inevitable. We are just scratching the surface in terms of our research and the many amazing results we can get."

Explosive growth in research and development and the commercialization of advanced materials and nanotechnology are impacting almost every existing industrial sector worldwide. Advanced materials and nanotechnology provide stepping stones to technical advancements that positively impact the economy, workforce, existing industries, and society in general.

At the NC A&T Center for Advanced Materials and Smart Structures (CAMSS), Dr. Sankar and his co-workers are investigating surface engineering and energy applications via nanotechnologies. Surface engineered materials contain specialty coatings used to improve thermal barriers resisting corrosion, as well as the design, friction, wear, and lubrication of interacting surfaces in relative motion. The specialty coatings are used as biomaterials to deliver improved healthcare products such as orthopedic and dental implants. The coatings can also be used as low-cost, high-performance parts for textile machinery and for the automotive industry. CAMSS is funded with almost $8 million dollars in federal money and houses the National Science Foundation (NSF) Center for Research Excellence in Science and Technology (CREST); the Center for Composite Materials Research (CCMR); the Department of Defense Center for Nanoscience, Nanomaterials, and Multifunctional Materials (CNN); the NSF Nanoscale Science and Engineering Center; and the NSF Interdisciplinary Research Teams.

GREAT ADVANCES FROM NANOTECHNOLOGY ARE INEVITABLE. WE ARE JUST SCRATCHING THE SURFACE IN TERMS OF OUR RESEARCH AND IN TERMS OF THE AMAZING RESULTS WE CAN GET.

— N. RADHAKRISHNAN, PH.D., P.E.

Equipment in the Center of Advanced Materials and Nanotechnology is used to investigate surface engineering and energy applications via nanotechnologies.

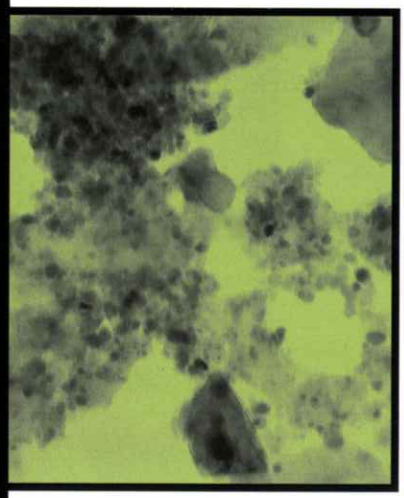
Another CAMSS project involves the application of nanocomposite materials as a catalyst in energy production. These materials consist of a large variety of systems, including one-dimensional, two-dimensional, three-dimensional, and amorphous materials made of distinctly dissimilar components and mixed at the nanometer scale. Specifically, the work involves removing carbon monoxide from exhaust gases emitted from internal combustion engines. Currently, a portion of carbon monoxide is removed by catalytic converters that are equipped with catalysts containing palladium, platinum, rhodium, copper chloride, etc. These catalysts are efficient in removing carbon monoxide when the catalyst bed has attained a specific high temperature. However, during a cold start the catalytic converter fails to remove the carbon monoxide, and the exhaust gas contains substantial amounts of contaminant.

For the past five years, research involving the fabrication and processing of reinforced polymer nanocomposites has grown exponentially. Under the leadership of Dr. Ajit Kelkar, professor of mechanical engineering and director of the computational sciences and engineering program, these new materials are helping in the discovery, development, and incorporation of improved organic matrix nanocomposite materials with ease of manufacturing methodologies for several defense and industrial applications. These materials eventually will enable the United States to fully utilize nanocomposites in not only reinforcing applications, but also in multifunctional applications where sensing and the unique optical, thermal, electrical, and magnetic properties of nanoparticles can be combined with mechanical reinforcement to offer the greatest opportunities for significant advances in material design and function.

The term "nano" comes from the size of the molecules inside atoms that are measured in nanometers or one-billionth of a meter.

Dr. Salil Desai, a junior faculty member in the College of Engineering, is customizing inkjet systems so that they are capable of developing nanoparticulate coatings on microcapsules for time-released therapies. The result is that doctors will be able to apply drugs directly to a specific malignancy in the body. Given the stringent sterility requirements for drug delivery and bio-devices, a noncontact technique such as jetting is an ideal solution.

The solid state electronics laboratory in the department of electrical & computer engineering, under the direction of Dr. Shanthi Iyer and Dr. Ward Collis, houses state-of-the-art semiconductor material growth equipment, a molecular beam epitaxy (MBE) system, and related characterization equipment and device processing tools. The MBE system is compatible for the synthesis of nanostructures with unusual electronic and optoelectronic properties. The lab has focused in recent years on the synthesis of novel material systems and their study, and the fabrication of light-emitting sources operating at wavelengths that are not easily obtainable in other materials systems. This research in novel semiconductors and related



nanostructures has been the basis for various Department of Defense-funded projects. With student assistance, Drs. Iyer and Collis have been successful in fabricating light-emitting diodes in the near-infrared region of the light spectrum — a wavelength of importance for optical communication. The devices are comprised of quantum well structures of semiconductors that contain extremely small amounts of nitrogen, typically about 1%. This minute amount of nitrogen is adequate to drastically alter the optoelectronic properties of the material.

The electronics lab is also carrying out cutting-edge research in partnership with Research Triangle Institute, on novel hybrid inorganic/organic light-emitting devices that can be utilized in flexible panel display technology. The MBE system will be augmented with a scanning tunneling microscope, a unique and powerful tool that will provide information on the position of the individual atoms at the surface of a material and allow the manipulation of their positions. This will facilitate the synthesis of nano-dots of these novel material systems. The addition of this equipment to the MBE system will provide a natural entry for researchers at NC A&T into nano-dot engineering. Shrinking atoms to the size to nano-dots provides another degree of freedom to the synthesis of the devices with properties that have not previously been envisaged. Benefits include new types of LEDs and diode lasers, which increase the operating frequency of transistors, novel type of sensors, and optical computing.

According to Dr. Radha, even with all the amazing advances being made at the molecular level, today's methods are still somewhat crude. "Casting, grinding, milling, and even lithography move atoms in great thundering statistical herds," says Radha. "It's like trying to make things out of LEGO blocks with boxing gloves on your hands. You can push the LEGO blocks into great heaps and pile them up, but you can't really snap them together the way you'd like. We're working on that. In the future, nanotechnology will let us take off the boxing gloves. We'll be able to snap together the fundamental building blocks of nature easily, inexpensively, and in most of the ways permitted by the laws of physics."

Scientists estimate that the total societal impact of nanotechnology will be greater than the combined influences of the silicon-integrated circuit, medical imaging, computer-aided engineering, and man-made polymers. Scientists also think that significant improvements in performance and changes in manufacturing paradigms will lead to several industrial revolutions in the 21st century. Nanotechnology will change the nature of almost every human-made object.

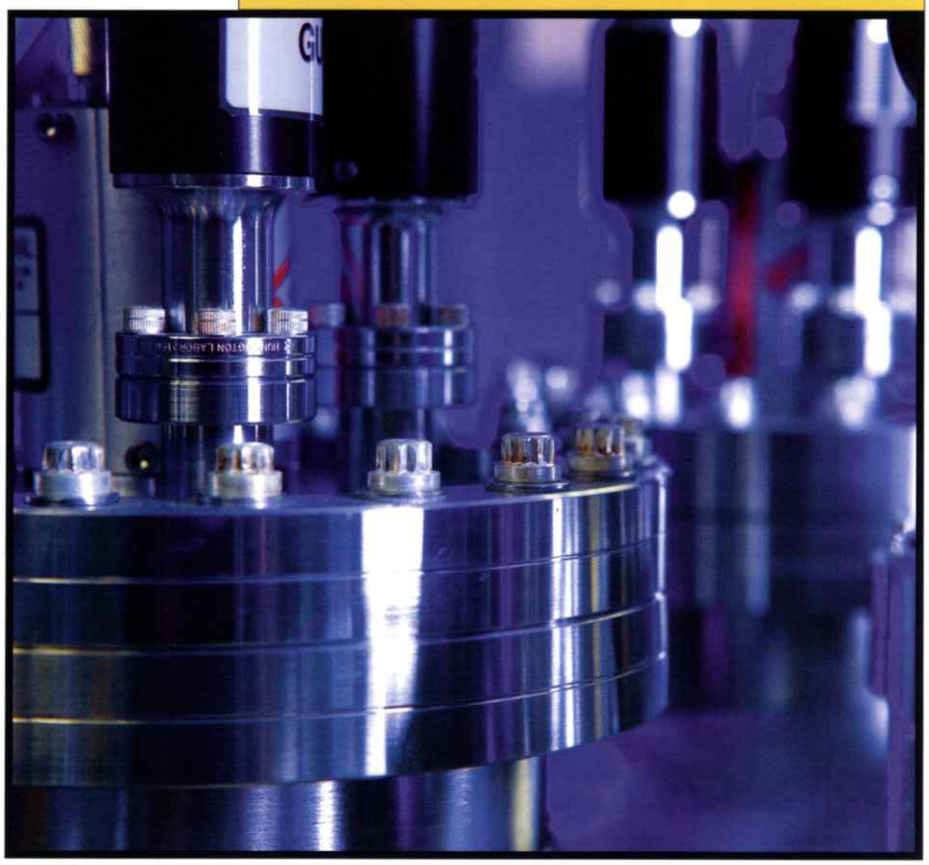
Who will benefit the most? While the answer may be unclear, it is abundantly clear that researchers at NC A&T will play a major part in the revolution.

Says Dr. Sankar, "We're not following any path, we're blazing a trail." |E|

FOR MORE INFORMATION ABOUT NANOTECHNOLOGY AT NORTH CAROLINA A&T STATE UNIVERSITY, CONTACT THE DIVISION OF RESEARCH & ECONOMIC DEVELOPMENT (336) 334-7995 OR VISIT OUR WEBSITE: HTTP://RESEARCH.NCAT.EDU

WE'RE NOT FOLLOWING ANY PATH, WE'RE BLAZING A TRAIL.

— DR. JAGANNATHAN SANKAR



The Magnetron Sputtering System located in the Center for Advanced Materials and Smart Structures (CAMSS) is one of several pieces of equipment under the CAMSS umbrella.

A RESEARCH UNIVERSITY FOR THE GLOBAL ECONOMY

By Chris Gigley

SCIENTIFIC RESEARCH is an increasingly precious asset in the United States. In the Triad, North Carolina A&T is producing research with economic implications locally and globally. The university is licensing new technology, spinning off new research-based companies, and providing valuable expertise to existing companies.

WITH GLOBALIZATION TRENDS ACCELERATING, competition in scientific research is increasing and can come from virtually anywhere in the world. In his book *The World is Flat*, New York Times columnist Thomas L. Friedman spends several chapters chronicling China's and India's rise in the areas of research and development.

M. Douglas Speight, assistant vice chancellor of Outreach & Economic Development at A&T, has witnessed this trend firsthand.

"I spent some time in Beijing, Shanghai, and Hong Kong last year, and their research and development programs are slowly but surely taking shape," says Speight. "The premier schools there have been doing primarily basic research, but their work is becoming more and more applied."

Speight believes these emerging programs pose a direct challenge to A&T and other research universities in the United States, and he says A&T isn't waiting for Asia to catch up. A&T has organized its core competencies in research into eight clusters. This streamlined approach allows the university to focus its research and marketing efforts on the most compelling areas of exploration.

THE EIGHT CLUSTERS ARE Advanced Materials and Nanotechnology, Information Sciences and Technology, Computational Science and Engineering, Logistics and Transportation Systems, Energy and Environment, Biotechnology and Bio Sciences, Public Health and Leadership, and Community Development.

Each cluster pools a variety of university resources, involving several schools and/or colleges and tying into a graduate program or academic institute. The Logistics and Transportation Systems cluster, for instance, includes the College of Arts and Sciences, the School of Business and Economics, the College of Engineering, and the School of Technology. Two or three research faculty members lead a cluster, applying their extensive expertise in the respective area and rounding up appropriate staff.

Speight says most of the university's economic activity is drawn from five of the eight clusters, beginning with Advanced Materials and Nanotechnology. This truly cutting-edge cluster has major research and academic areas that include the Ph.D. program in mechanical engineering; surface engineering materials; and composite processing, testing, and modeling. Proving its real-world relevance and capabilities, this cluster has won business from a number of large companies, including Caterpillar, Boeing, and United Technologies.

The Logistics and Transportation Systems cluster, meanwhile, focuses on small urban and rural transportation system design. Efforts here have led to collaborations and partnerships with General Motors, Lockheed Martin, and Proctor & Gamble, among others.

The Energy and Environment cluster includes projects covering bio-energy and bio-based products, ship-and space-based power system design, and fuel cells. Collaborators and partners include the Institute of Energy Security and Independence and the EPA Air Pollution Laboratory.

A&T has collaborated with a number of universities, including Alcorn State, Florida A&M, and Alabama A&M, on projects within the Biotechnology and Bio Sciences cluster. Its major research and academic areas include the proposed biotechnology graduate degree program, plant tissue culture and transformation, and bio-pharmaceuticals and neutriceuticals.

Finally, A&T has generated significant economic activity within the Information Sciences and Technology cluster. Collaborators and partners include the Defense Information Services Industry and the NASA Space Technology Development and Utilization Program. Among this cluster's areas of focus are electronic book technology, statistical and mathematical modeling, and algorithms for scientific computation.

The research-cluster approach has helped the university draw new business on several fronts. First, it has helped A&T maximize spinout opportunities, which involve licensing new technology developed by A&T researchers. Speight says the university licenses technology to businesses ranging from start-ups to Fortune 500 companies.

One example is the relationship with Materials Monitoring Technology Inc. (MMTI), a small start-up company that develops sensor systems to monitor the strength of a given structure. Dr. Mannur Sundaresan, a researcher in A&T's mechanical engineering department, developed a system capable of monitoring the airframe of an aircraft for structural fatigue or damage. Such a system would have warned the Space Shuttle *Columbia* of its disastrous wing damage.

MMTI wanted to develop a system to monitor bridges and overpasses to comply with Federal transportation guidelines, which required that every bridge be monitored once every two years. A&T licensed two patents to the company, and MMTI has since been acquired by publicly traded Material Technologies Inc. in Los Angeles.

A&T has also had plenty of what Speight calls "spin-in" activity, which includes collaborative research. For example, Speight says government agencies produce an annual list of research topics and solicit businesses to partner with research entities to tackle those topics.

"The government is essentially outsourcing its research and development," says Speight.

The Small Business Innovative Research (SBIR) and Small Business Technology Transfer (STTR) grant program is the vehicle for government agencies to provide funding to research universities and small businesses with fewer than 500 employees to meet an agency need.

This program is operated in three successive phases. Phase 1 is proof-of-concept, with funding up to $100,000; Phase II is

development of a prototype, with funding up to $600,000; and Phase III is full commercialization, with no funding provided.

A&T has had four of these collaborations within the past two years. One of its current projects involves a company called 3Phoenix and the work of Dr. Numan Dogan, from the university's Electrical Engineering department. 3Phoenix and A&T have reached Phase II of an STTR for the Department of Defense to develop a wireless network for steel-hulled naval vessels.

Another spin-in activity is co-development.

"This is when a company comes to us with a product that's patented," explains Speight. "They recognize the research expertise at A&T and ask us to partner with them to improve upon their base technology. This is a growing portion of our portfolio. We had three such projects in fiscal year 2006, and we have another three currently in place."

One completed co-development project involved safety systems, based in High Point, North Carolina. In the wake of Dale Earnhardt's death from a racecar crash at the Daytona 500 in 2001, the company developed a retaining wall for automotive racetracks that significantly reduces G-forces the car and driver experience when they collide with the wall. Safety Systems hired A&T to help improve the wall, and researchers worked to better the wall's performance and lower production costs.

"We started working with several different departments at A&T, and we eventually settled on Dr. Ajit D. Kelkar's department," says Tim Smith, chairman of Safety Systems. "We liked the fact that he had contacts with various government agencies, which we thought would help our cause. We were also pleased to find out that Dr. Kelkar was so highly regarded in his field."

Smith says he enjoyed working with Dr. Kelkar and his staff throughout their collaboration. He enjoyed the results even more.

"Kelkar's research saved us valuable time and effort, especially in fine-tuning our prototypes," says Smith.

Not surprisingly, interest level from other companies has increased dramatically over the past two years.

"The only limits to adding more co-development projects are the availability of our researchers, because they have agendas and teaching schedules, and there being a direct connection to our research expertise," says Speight.

A&T is doing its part to match its research expertise with the right business opportunities by marketing its technology and research services globally, as any modern-day Fortune 500 company would. When A&T researchers developed a higher-yielding manufacturing process for probiotics, it found a licensee, Jarrow Formulas, in Los Angeles.

"We have a much wider footprint than just North Carolina, although we do try to utilize all our resources here," says Speight.

Meanwhile, the university is involved in efforts to increase the pool of local resources. A&T participates in several regional economic development initiatives through its involvement with organizations such as the Piedmont Triad Partnership (PTP) and Piedmont Triad Entrepreneurs Network.

Don Kirkman is president and CEO of the PTP, which markets the region domestically and internationally to spur new business investment and job creation. He says A&T is vital to those endeavors as the Piedmont economy continues to expand beyond its traditional manufacturing base.

"The advantage of A&T is that its research mission has an applied purpose," says Kirkman. "We are collaborating on regional initiatives in areas like biotechnology, in which we have an ongoing dialogue with A&T. Certainly, their research in the area of nanotechnology and applied materials will have a significant impact on the development of nanotechnology and its application of goods manufactured here."

Kirkman says the Triad is still relatively insulated from global competition. The region's central location along the Eastern seaboard is a big reason why a number of companies have relocated here.

"But we are seeing an increasing number of projects where companies are looking both within the United States and in other locations around the world," he adds. "A&T is uniquely positioned to bring its research to bear on the development of new goods and services and to assist companies, all of which helps us be more competitive in the global economy."

The university also works with venture-capital investors in two funds headquartered in the Triad. But even more directly, A&T spins off new companies based on technologies developed in its labs.

"We are in the formation stages for five companies to emerge from the university right now," says Speight. "One is in nanotechnology and another is in biotechnology. We also have two IT companies and a firm that produces renewable fuel equipment. There's a pretty good chance four of them will stay within the region."

Whether or not these companies remain local, A&T will stay involved and help the businesses prosper. The university has been lauded for structuring licensing deals that are actually doable for start-up companies.

"Our terms take advantage of growth downstream rather than upfront," explains Speight. "We understand that start-ups are cash-strapped. If they pay everything up-front, they won't have the funding they need to survive. We want to help start-ups meet their milestones so we have a greater chance of recouping our investment down the road."

Speight says A&T has also won praise for making its licensing process more amenable to the real-world market.

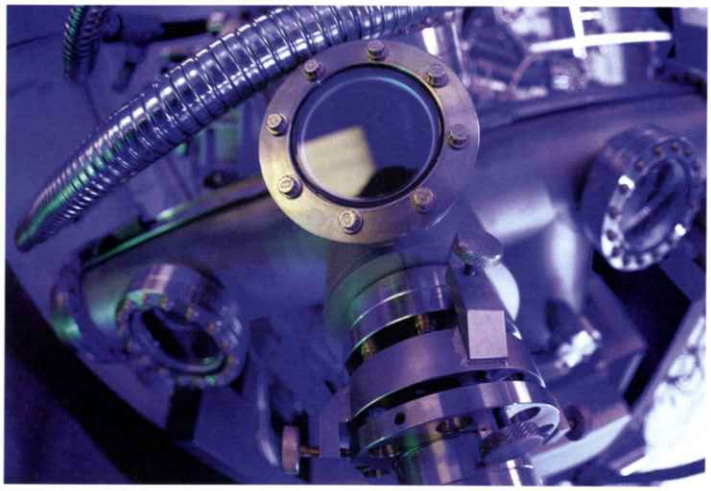
"We focus on extracting the most value out of all of our intellectual property rather than going for the big home-run deals," he says. "We focus on efficiency in negotiation and deal structuring to get more deals done faster. We recently completed a deal in two weeks, which is unheard of. More often, it takes six months to a year."

Speight is confident that North Carolina A&T will continue to evolve its research capabilities as well as sensible economic strategies to best develop and market this research. Acknowledging that the global economy will only become more and more competitive, Speight says the university can be an effective, multifaceted partner to U.S. companies wanting to better their position for the dynamic world stage. |E|

SEEK

STRENGTHENING ECONOMIES BY EXPANDING KNOWLEDGE

IN EACH ISSUE OF ***EVOLUTION***, we highlight current endeavors of the eight research clusters at NC A&T. With a commitment to viable and relevant research, these areas help strengthen local, regional, national, and global economies by discovering innovative solutions and marketable platforms.



The Molecular Beam Epitaxy Machine is located in the Center of Excellence for Battlefield Capability Enhancements: Environmentally Stable Flexible Displays, under the direction of Dr. Shanthi Iyer.

ADVANCED MATERIALS & NANOTECHNOLOGY

THE ADVANCED MATERIALS AND NANOTECHNOLOGY (AMN) research cluster at NC A&T is a resource of excellence in education and research for both the state of North Carolina and the nation in the field of smart, multifunctional, and other advanced materials. Through the collaboration of academe, government agencies, and private industry, the research cluster develops basic and applied research programs and commercially relevant technological innovations while maintaining a focus on student participation and learning.

AMN promotes a collaborative culture that encourages interdisciplinary research of both advanced materials and nanotechnology. The AMN research cluster benefits from various disciplines, including:

> materials science and materials engineering;
> chemical science and chemical engineering;
> physical and computer sciences;
> electrical, industrial, and bioenvironmental engineering; and
> processing and manufacturing.

Research on nanoscale and other advanced materials generates the fundamental scientific understanding of the inorganic, organic and biological properties of materials. It also generates the engineering and technology that enable breakthroughs to the next generation of applications, ranging from structural materials to smart structures and from microelectronics to medicine.

MAJOR RESEARCH AND ACADEMIC AREAS

> mechanical engineering
> surface engineering materials
> composite processing, testing, and modeling
> nanocomposites and other innovative composites
> electronic and smart materials
> polymer engineering
> structural health monitoring
> solid oxide fuel cells
> computational imaging
> catalysis in energy production and consumption
> nanochemistry and nanophysics

FACILITIES

> Nano-Processing and Fabrication Laboratory – HIPping, Fuel Cell Materials
> Composite Processing Laboratory – VARTM, Autoclaves, Pressing, SCRIM Processing
> Electronic Materials and Devices Laboratory – Thermal Evaporator
> Mechanical Testing Laboratory – MTS, Instron, Fiber Testing, Nano Tester, Tribometer
> Micro-Structural Characterization Laboratory – SEM, TEM, AFM, XRD
> Health Monitoring and Smart Structures Laboratory
> Polymer and Biochemical Engineering Laboratory – Synthesis
> Computational Laboratory – Unix/Linux Platforms, Mixed Vendor Hardware, Staff Support

SCHOOLS AND COLLEGES INVOLVED

> School of Agriculture & Environmental Sciences
> College of Arts & Sciences
> College of Engineering
> School of Technology

COLLABORATIONS AND PARTNERSHIPS

> NSF – Center for Research Excellence in Science and Technology
> DoD – Center for Nanoscience and Nanomaterials
> NSF – Nanoscale Science and Engineering Center
> NSF – Nanoscale Interdisciplinary Research Team
> Department of Energy
> Oak Ridge National Laboratory
> NASA
> National Science Foundation
> Army Research Laboratory
> Office of Naval Research
> Air Force Research Laboratory
> Federal Aviation Administration
> Naval Undersea Warfare Command
> Southwest Research Institute
> Caterpillar
> Boeing
> United Technologies

COMPUTATIONAL SCIENCE & ENGINEERING

THE COMPUTATIONAL SCIENCE & ENGINEERING cluster at NC A&T promotes research, education, and information technology resulting in high-performance, scalable computing and visualization resources. The cluster includes the College of Arts & Sciences, College of Engineering, School of Agriculture & Environmental Sciences, and the School of Technology.

OBJECTIVES OF CSE:

> create and maintain a campus-wide advanced computing environment
> form a CSE faculty core
> develop high-performance computing tools
> enhance and expand CSE research capability and productivity
> educate, train, and graduate CSE professionals (especially African Americans) in computational science and engineering
> help meet the increased human-resource needs in several areas of computational science, engineering, and technology
> develop and grow upon the existing and emerging research strengths in computational science and engineering
> increase the distinction of NC A&T in this highly competitive technological area

The CSE cluster also assists faculty in developing research, education, and outreach programs in computational science and engineering.

Computational modeling and simulation have become important components of education and research in many academic disciplines — replacing experiments and investigations that have traditionally been performed in the laboratory or field. Researchers can now model weather and climate; design engines, vehicles, and aircraft; develop new materials and drugs; automate electronic designs; and simulate fossil fuel combustion.

NC A&T is addressing the growing demand for computational scientists, engineers, and technologists through programs such as the Computational Science & Engineering master's degree. This master's program is the first in the University of North Carolina system and first in the nation among historically black colleges and universities. The program requires practitioners to be proficient in their own technical field, computer science, and mathematical science.

The CSE graduate program serves the needs of undergraduate and graduate students in engineering, physical and life sciences, technology, and business. The program also attracts practicing professionals and individuals who seek continuous learning opportunities. The program is interdisciplinary and draws expertise and resources from various disciplines throughout the university.

The CSE cluster and the graduate programs promote computational research in critical areas such as multi-scale, multi-physics modeling; nanotechnology; and computational biology. Other fields include bioinformatics; genomics; epidemiology; biostatistics; computational chemistry; climate, weather and ocean modeling; environmental quality modeling and simulation; computational finance; remote sensing; and information systems.

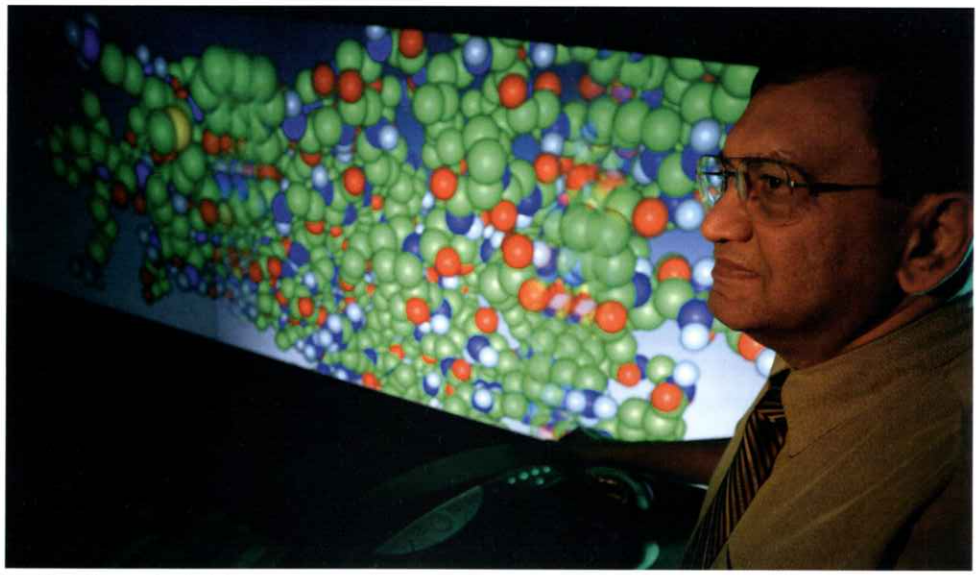
"The CSE research cluster is brand-new and extremely exciting," says Dr. Ajit Kelkar, professor in the College of Engineering. "There are a lot of challenges, but the growth of computational science and engineering is moving parallel with the new generation of computers."

With funding from the National Science Foundation (NSF) and other resources, NC A&T has acquired a high-performance computing system that has resulted in several new research projects. In July 2006, the Department of Defense conducted a CSE-HPC workshop at NC A&T for faculty from underrepresented universities and minority institutions — bringing faculty from across the country to the campus of NC A&T.

BIOSCIENCES & BIOTECHNOLOGY

THE BIOTECHNOLOGY & BIO SCIENCES (BBS) cluster is a partnership among the School of Agriculture & Environmental Sciences, School of Technology, College of Arts & Sciences and the College of Engineering. BBS's highly productive interdisciplinary research teams study microbial, plant, and animal systems and genetics as they relate to human health.

With four areas of concentration — biotechnology & biodiversity, biomedicine, bioengineering, and biotechnology in electronics — BBS strives to:



Dr. Ajit Kelkar, co-lead of the Computational Science and Engineering cluster, demonstrates molecular modeling in the Scientific Visualization Center.

> create a research-driven infrastructure that will stimulate innovation
> cultivate creativity and discovery; support the land-grant university mission of teaching, research, and extension
> seek new partnerships with state, federal, private, and international researchers
> establish a self-sustaining center of interdisciplinary research in biotechnology, biology, and food sciences.

Researchers in the Biotechnology and Bio Sciences cluster are genetically modifying plants in the quest to reduce world hunger and malnutrition.

BBS APPLIES RESEARCH EXPERTISE

> plant tissue culture transformation
> bioremediation, phytoremediation
> fermentation, bioreaction, bioenergy
> food safety
> molecular biology
> genomics and bioinformatics
> evolutionary biology
> value-added utilization of agricultural and food industry by-products

An example of the advanced technology research underway at BBS is work of Dr. Guochen Yang, assistant professor in the Department of Natural Resources and Environmental Design, who has successfully mastered plant tissue culture transformation by genetically copying African violets. "I call them test-tube babies," says Yang. "This is plant-based medicine. We use the plant tissue to produce pharmaceuticals and neutraceuticals."

According to Yang, plant transformation, which is the stable incorporation and expression of foreign genes into plants, produces a higher yield and improved quality of antibiotics. It also creates valuable bio-defense, bio-sensing, bio-energy and bio-molecular materials that will help ensure homeland security. Says Yang, "If we can use the technology gene from the plants to sense what is taking place in the air, we will know if and when something goes wrong."

This technology has also opened the door to molecular farming, a novel system for genetic research and crop development. Micropropagation is a valuable and efficient way to mass-produce plants with unique characteristics and values, and it serves as a prerequisite for genetic transformation. Generally, it is difficult to multiply plants with unique qualities or genetic characteristics using conventional methods, but micropropagation can preserve the germplasm and maintain the genetic diversity by rapid multiplication of the identified resource plants. Genetically modified plants have the potential to drastically reduce world hunger and malnutrition, as well as protect and preserve the environment.

Since 2002, Dr. Yang has sponsored an interdisciplinary biotechnology seminar series that draws attendees from granting agencies, other funding agencies, industries, and academia. Says Yang, "Since arriving in November 1994, I have wanted to create a seminar to better familiarize the public with the activities here at NC A&T. These seminars not only introduce the public to what is happening at NC A&T, but they also provide professional development and networking opportunities."

Since 2002, BBS has offered $500 to $1500 scholarships to qualified undergraduate students with a minimum 3.0 grade point average and graduate students with a minimum 3.5 grade point average. Scholarship recipients must have an interest in biotechnology and they must complete an independent study within the program.

Says Yang, "We will continue to make discoveries and produce students and professors committed to changing the world through research."

ENERGY & ENVIRONMENT

THE ENERGY & ENVIRONMENT (EE)

cluster is working to reduce waste and replace nondegradable material with biodegradable material. Partnering with community, state, national, and international leaders, EE researchers are discovering ways to reduce environmental pollution, improve air and water quality, and promote clean and renewable energy.

Researchers use physics, biology, and other sciences, as well as engineering techniques, to develop economical solutions to environmental concerns such as water and air quality, wastewater treatment, water management, remediation, and the development of alternative energy sources.

THE PROGRAM EMPHASIZES:

> soil and water engineering and modeling
> environmental engineering and management
> bio-process engineering and fermentation
> renewable energy (bio-fuels, bio-diesel, and bio-power)
> solar energy, fuel cell, and hydrogen fuel technology

EE strives to be a self-sustaining center of excellence in sustainable energy and the environment by promoting interdisciplinary research projects addressing energy and environmental issues relevant to North Carolina residents and to the nation.

Dr. Abolghasem Shahbazi, professor in the department of natural resources and environmental design, has developed a process that decomposes waste using lactic acid. Dr. Jianzhong Lou, associate professor in

the department of chemical engineering, has discovered a way for lactic acid to create a biodegradable material that will decompose in six months compared to the typical 80 years that it takes a nondegradable material to decompose. Dr. Shahbazi explains, "Our goal is to utilize waste that is contaminating the environment while also creating jobs through new technologies and processes."

THE EE RESEARCH CLUSTER HAS SUCCESSFULLY:

> created solutions to energy and environmental problems relevant to stakeholders
> enhanced energy and environmental research capabilities at NC A&T
> enhanced visibility and competitiveness of NC A&T in research-cluster focus areas
> contributed to local community development
> trained qualified graduates with research experience
> addressed state and national research needs

EE encourages collaboration with researchers from other disciplines — agriculture, engineering, business and education — to reach the full potential of each project. Says Shahbazi, "With everyone working together, we can do a lot more than one person doing one thing." Through the EE research cluster, NC A&T contributes the necessary intellect, energy, and research to make a cleaner, safer environment for future generations.

"With everyone working together, we can do a lot more than one person doing one thing," says Dr. Abolghasem Shahbazi, co-lead of the Energy and Environment Cluster.

LOGISTICS & TRANSPORTATION SYSTEMS

NORTH CAROLINA A&T School of Business & Economics, School of Technology, College of Engineering, and College of Arts & Sciences are collaborating to develop and promote interdisciplinary research through the Logistics and Transportation (LTS) cluster.

THE LTS CLUSTER HAS THREE REGIONAL AND NATIONAL OBJECTIVES:

> conduct high-quality, human-centered, applied logistics, and transportation systems research
> develop the workforce in logistics and transportation, with particular emphasis on military operations and regional logistics and transportation
> build mutually beneficial, long-term partnerships with federal sponsors, other academic institutions, and private corporations

LTS is uniquely positioned to develop logistics and transportation professionals from underrepresented populations through research that supports education, outreach and workforce development.

Transportation systems researchers identify ways to economically and equitably create a variety of transportation methods. Logistics systems researchers study how transportation systems can more efficiently move, transform, and store products. Logistics and transportation are intricately linked. By merging them into this research cluster, students and faculty at NC A&T will be able to focus on the design and operation of systems to more efficiently move products and people.

According to the 1997 economic census, the logistics and transportation industry generates an estimated $318.2 billion in annual revenue, creates 3 million jobs, and supports 200,000 establishments nationwide. This estimate is extremely moderate because it does not include logistics and transportation professionals in in other industry sectors.

LTS RESEARCH AREAS

> small urban/rural transportation systems – create economically attractive, secure, and equitable policy for transportation system design and traffic management
> human enterprise systems – design enterprise systems for logistics integration and visibility with appropriate interface, enabling human interaction
> supply chain management – use operations research and simulation as well as superior business practices and information technology to enhance supply chain systems
> military logistics – improve military logistics agility, visibility, integration, and human-computer interface.
> product reuse – devise economically attractive and environmentally responsible operational policies for recycling, recovery, repair, and remanufacturing

The Logistics and Transportation Systems Cluster is uniquely positioned to develop logistics and transportation professionals from underrepresented populations.

Under the leadership of Dr. Paul Stanfield, department of industrial engineering, the LTS cluster is currently developing the Radio Frequency Identification (RFID) tag which properly labels aircraft parts. The RFID tag communicates with the reader, as well as storing, sending, writing, and

erasing information. The RFID tag offers the following advantages:

> no interference with line of sight (wireless)
> no trigger necessary (automated)
> allows data transport
> provides security
> allows simultaneous reading
> functional in harsh environments
> reusable
> requires less IT infrastructure

"I feel like people aren't aware of the research capabilities at NC A&T," says Stanfield. "Collaborative projects such as the RFID tag allow students and faculty from diverse academic disciplines to learn from each other. The result is stronger research and better outcomes."

The Logistics and Transportation Systems cluster is unique in many ways. The Ph.D. program in industrial engineering is the only one of its kind at a historically black university. Faculty members have logistics and human-machine interface expertise. The School of Business and Economics provides an undergraduate program and graduate specialization in transportation logistics. A number of highly qualified logistics researchers also contribute to technological advances that continue to improve the quality of life.

PUBLIC HEALTH

RESEARCHERS AT NORTH CAROLINA A&T'S PUBLIC HEALTH (PH) cluster are discovering new ways to prevent disease, prolong life, promote physical health and efficiency, and protect and promote the collective health of the community through preventative medicine and health education.

The development and growth of the PH cluster is fostered by the Institute of Public Health (IPH). The IPH facilitates and coordinates current and anticipated future interdisciplinary and multidisciplinary public health research projects, as well as health and wellness programs.

The PH cluster affects public health issues in municipalities, the state of North Carolina, the nation, and the world through discovery, key learning, education, advocacy, and communication. The collective research of faculty and staff at NC A&T have contributed to new diagnostic advances, more effective treatment options, and better ways to prevent and delay diseases and disabilities.

Researchers in A&T's Public Health Cluster are discovering new ways to prevent disease and prolong life.

Social, cultural, and economic factors all contribute to the overall health of a community. Public health experts, practitioners, and researchers explore the context of people's lives in order to fully diagnose and evaluate issues that impact community wellness. By identifying and monitoring health concerns that affect communities, public health providers are uniquely qualified to advocate policies, promote behavioral change, and change practices to ensure community health.

Faculty and staff at NC A&T understand the role that medical and public health research plays in improving the health of the American public. Through funded research projects and programs, faculty and staff have been actively engaged in various public health research projects and health and wellness programs.

In the report *Healthy People 2010*, the United States Department of Health and Human Services establishes two primary public health goals: (1) increase quality and years of healthy life; and (2) eliminate health disparities among different segments of the population. The PH cluster is playing a vital role in addressing and easing racial and ethnic disparities regarding the treatment of cancer, cardiovascular disease, stroke, diabetes, HIV/AIDS, immunizations, infant mortality, and many other acute and chronic diseases.

NC A&T has established strategic partnerships with government and community organizations, foundations, universities, health care providers, medical centers, and public health and research institutions that have helped to facilitate quality research efforts. The university is well positioned to expand its public health research capacity because of its many academic disciplines, specialties, and degree programs, as well as the high number of faculty and staff engaged in public health programs and research projects.

The PH cluster will continue to seek outside grants, allocate additional research time for faculty, and expand research facilities. "The collective resources at NC A&T enable us to better address present and emerging health care needs in our community and across the country," says Dr. James Gooch, director of the Institute for Public Health.

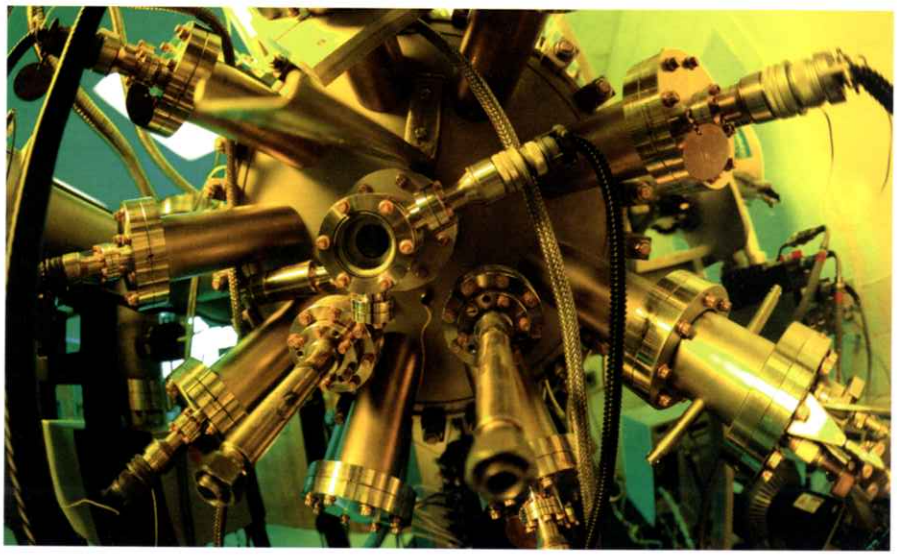
INFORMATION SCIENCES & TECHNOLOGY

THE INFORMATION SCIENCES & TECHNOLOGY (IST) cluster promotes interdisciplinary research and education to ensure that information technology serves human needs, is productive for society, and is sustainable over the long term. The IST cluster includes the College of Engineering, the College of Arts and Sciences, and the School of Technology.

Technologies developed and advanced in IST impact education, health care, workplace productivity, the environment, and the military. From calculators and learner-paced tutorials to diagnostic tools and complex communication systems, IST works to produce technology that will transform how people live, work, learn, communicate, and conduct business.

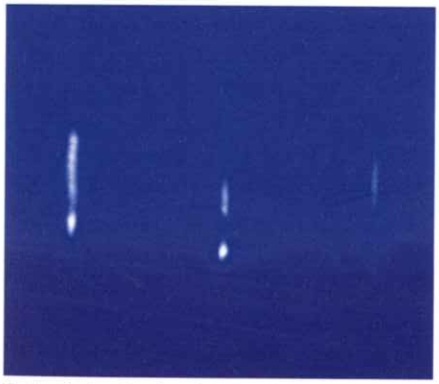
IST encompasses a broad range of fundamental and applied research. Researchers have developed algorithms, architectures, materials, devices, systems, and protocols in areas that reflect current national research needs in IST such as:

> electronic book technology, formal software methods, software quality



> statistical and mathematical modeling, data mining, machine learning
> algorithms for scientific computation, experimental design
> natural language and speech processing, intelligent systems evaluation
> quantum computing and communication, virtual reality, accessibility
> cryptography, information security, biometrics for computer access and security
> pervasive, wireless, and multimedia computing; advanced networking

Research often involves processing and analyzing large amounts of data. Governments and organizations are particularly interested in data mining and visualization, and they are supporting and funding the type of research that IST is conducting. According to Dr. Numan Dogan, co-lead of the IST cluster and professor in the department of electrical engineering, NC A&T is uniquely able to pool the talent and experience of excellent faculty, research assistants, associates, and colleagues across many disciplines in order to fulfill the university's tremendous research potential.



Technologies developed in the IST cluster impact education, healthcare, workplace productivity, the environment, and the military.

LEADERSHIP & COMMUNITY DEVELOPMENT

THE LEADERSHIP & COMMUNITY DEVELOPMENT (LCD) research cluster brings together faculty and staff from all academic units at North Carolina A&T to engage in research activities that focus on building and strengthening the community.

LCD designs, plans, conducts, and implements research that improves the feasibility of communities that NC A&T serves. Building strong communities and developing leadership capacity involves many segments of the community, so LCD partners with representatives from government, educational institutions, economic development agencies, government extension agencies, churches and heritage institutions, civic groups, foundations, public and private organizations, local media, and families. Combining the expertise of various academic disciplines and the experiences of community organizations and individuals, LCD identifies research needs and educates citizens on how to become leaders.

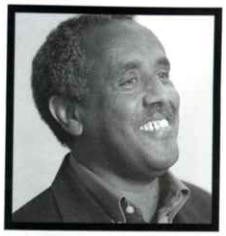
THE LONG-TERM GOALS OF LCD ARE TO:

> facilitate the development of citizens who are educated about the decision-making process
> facilitate the development of community leaders
> establish entrepreneurial programs and partnerships that foster opportunities for long-term funding initiatives
> provide access to technical job training and employment opportunities
> promote higher literacy and greater personal enrichment
> encourage active use of available community resources
> help marginalized citizens become productive in community life
> secure more than adequate local health and service delivery

New technologies show promise for changing power dynamics and providing new opportunities in distressed communities. LCD impacts communities by (1) increasing access to distance learning, telecommuting and e-commerce; (2) studying the impact of telecommunications technologies on communities and schools, on social structures, and on power relationships; (3) constructing case studies of communities where both new and appropriate technologies have been used; and (4) conducting research on the use of future technologies in distressed communities.

LCD projects have the ability to enhance current research and educational activities at NC A&T. In addition, they contribute to the university's development as a premier research institution in the areas of leadership and community development for underserved and underrepresented populations. |E|

IN EACH ISSUE OF ***EVOLUTION***, we highlight faculty members who are producing exceptional research in a variety of disciplines campus-wide.



DR. SOLOMON BILILIGN PHYSICS

GROWING UP IN ETHIOPIA AS THE CHILD OF TWO TEACHERS AND THE OLDEST OF NINE CHILDREN, DR. SOLOMON BILILIGN LEARNED A THING OR TWO ABOUT DEDICATION AND DETERMINATION.

He completed both his undergraduate and M.S. degrees at Addis Ababa University in Ethiopia. In 1987, he received a certificate from the International Center for Theoretical Physics in Trieste, Italy. He then received his Ph.D. in 1991 from the University of Iowa. Following graduation, he worked as a postdoctoral research associate at the University of Utah.

In the fall of 1993, Bililign moved to Greensboro and joined NC A&T as an assistant professor in the department of physics. Says Bililign, "The NC A&T physics department was attractive because of the opportunity to work under a terrific department chairperson who wanted to build the department. I also had the additional challenge of building my own research program where none had been and where the research culture was under-developed."

In 1998, Bililign established NC A&T's first laser lab, Spectroscopy of Transition State Dynamics, located in the Fort IRC building. "I started everything from scratch. It took persistence and fight," he says.

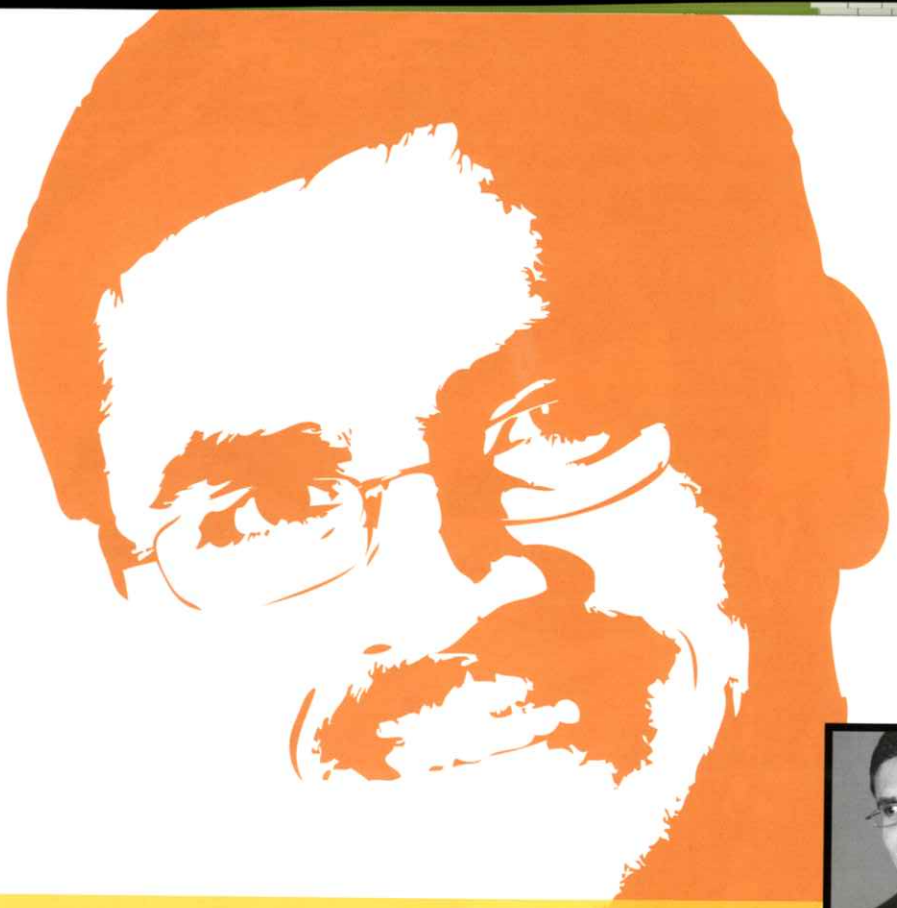
Bililign's research includes the study of laser-induced chemical reactions within molecules and laser-induced energy transfer collisions between atoms and molecules. He explains, "We mix different atoms together and excite them with the laser to establish the reaction." The lab now has lasers and spectrometers worth over $300,000 and a $350,000 custom-made reflectron time-of-flight mass spectrometer. The laser lab has graduated seven master's students.

In addition to the development of the laser lab, Bililign has collaborated with theoretical groups in France on quantum chemistry research, and he has built a local computational facility in the department of physics. Other collaborations include information technology research on biological systems with Duke, UNC-Chapel Hill, and Stanford Universities.

Bililign was named Outstanding Faculty Mentor (NCAMP) in 1998, Outstanding Senior Researcher in 2001-2002 and Teacher of the Year in 2006. He attributes his success as a teacher to his research: "I can be a good teacher if I stay current in my field, which means I must do research. This university position is attractive to me because I have the chance to design my own research based on ideas that interest me."

Despite his success, Bililign has not forgotten his roots. "As I have grown older, I have felt more of a responsibility to give back to the community that raised me and gave me my initial education." Bililign has pursued international research collaborations with African universities that have resulted in two grants from the National Science Foundation. The Addis Ababa University International Research Experience for Students in Atmospheric, Earth, and Space Sciences allows four students per year to travel to Ethiopia for five weeks beginning in the summer of 2007. The Partnership for International Research and Education Award — a collaboration between NC A&T, Penn State University, and the South African government — provides opportunities for five NC A&T students to travel to South Africa each summer for the next five years. Bililign has also received grants from the Alfred P. Sloan Foundation providing scholarship support for African-American students to pursue doctoral degrees in the sciences.

Bililign's goals are to sustain and diversify his research, and to educate, train, and cultivate future researchers.



DR. SALIL DESAI

INDUSTRIAL ENGINEERING

DR. SALIL DESAI HAS AN INNATE ABILITY TO SEE THE EXTRAORDINARY. WHAT MAKES HIS STORY SO EXCITING IS THAT IT IS ONLY THE BEGINNING.

Desai was born in Mumbai, India (formerly known as Bombay), the country's commercial and entertainment capital. His experiences during his formative years played a key role in his decision to choose engineering as a career path. Desai's parents were a major influence as well. His mother was a high-school teacher, and his father led the Special-Purpose Machine Design Group at one of India's largest engineering corporations. "I was fortunate to have many opportunities to achieve the highest level," Desai says.

As the younger of two children, Desai used his gift of extraordinary creativity to swiftly climb the ladder of success. "My mind had a mechanical bent," says Desai, "and I studied in a technically oriented high school where I had access to tools and machines." Desai graduated at the top of his class.

After receiving his bachelor of science degree in mechanical engineering in 1998 from the University of Bombay (VJTI – Veermata Jijabai Technological Institute), Desai worked as a research engineer at the Industrial Design Center at the Indian Institute of Technology in Mumbai. He developed rapid prototypes for new product designs, designed a nuclear diagnostic device using Technetium-99 for soft tissue X-ray detection, and collaborated with medical doctors to develop prototypes used for mock surgeries in the areas of prosthesis, maxillofacial, and craniofacial surgery.

In 1999, Desai moved to Pittsburgh, where he acquired his master's degree in industrial engineering at the University of Pittsburgh in 2001. He received his Ph.D. in 2004 and soon after accepted a faculty position at NC A&T.

Desai still remembers the warm reception when he arrived at A&T for his interview. And he loves living in Greensboro. "I like being able to spend quality time with my wife, Yogeeta, and my one-year-old daughter, Roma," he says. "Since I arrived, it has been a worthwhile journey with a close-knit and enthusiastic family in the department of industrial engineering."

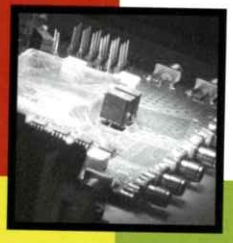
With a background in micro and nano manufacturing, Desai was excited to be a part of the elite materials group in the Center for Advanced Materials & Smart Structures (CAMSS) under the direction of Dr. Jag Sankar. He was particularly impressed with the multidisciplinary faculty involvement and the state-of-the-art infrastructure within CAMSS. Desai says, "CAMSS has opened up new vistas of interdepartmental collaborations where young faculty like me can leverage resources that will enable NC A&T to move to the next level."

Since joining NC A&T, Desai has been awarded several federal awards, including the Department of Defense Young Faculty Development Award and the Ralph E. Powe Junior Faculty Development Award by Oak Ridge Associated Universities. For demonstrating outstanding promise as a researcher, Desai was awarded the 2006 Rookie of the Year award at NC A&T. Currently, he is investigating innovate methods for drug delivery, regenerative tissue engineering, and synthetic implants.

Desai looks forward to a productive and rewarding career at NC A&T. "My goal is to make a landmark contribution to manufacturing — something beyond the regular domain of traditional manufacturing. In spite of all the good happening here at A&T, it is still a sleeping giant. I intend to change that."

DR. NUMAN DOGAN

ELECTRICAL AND COMPUTER ENGINEERING



NUMAN DOGAN, PROFESSOR IN THE DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING, KNOWS HOW IMPORTANT IT IS FOR FACULTY MEMBERS AND RESEARCHERS TO STAY UP-TO-DATE ON CUTTING-EDGE TECHNOLOGY. HE BELIEVES IT HELPS DEFINE A UNIVERSITY AND ITS COMMITMENT TO STUDENTS.

"We do not want to teach the same thing over and over," says Dogan. "That is boring for students, and it does not adequately prepare them as researchers. Technology changes very fast, and to keep up with these changes we have to be involved in research."

Dogan should know. A researcher for over two decades, he is currently working on several exciting and innovative projects, including a $2 million project for NASA to improve deep-space communication. Dogan and several NC A&T graduate students are collaborating with North Carolina State University to develop silicon-on-insulator Complementary Metal Oxide Semiconductor chip transceivers for distributed sensor networks. He and his team are hoping to design a single chip receiver that requires relatively low power consumption. If successful, the project will allow NASA's communication systems to withstand radiation and extreme temperatures on explorations to Mars. Dogan has spent the past four years on the project.

He has also teamed with his alma mater, the University of Michigan in Ann Arbor, to develop ultra-low power medical transceivers for medical implant devices. The results will help people with severe cases of Alzheimer's and epilepsy, and medical engineers will also be able to use the transceivers to develop better heart defibrillators, enhanced deep-brain stimulators, and superior cochlear prostheses.

Dogan is also working with a research company in Raleigh to develop wireless communication for older Navy ships.

Dogan values research because of its far-reaching impact, and he is passionate about projects with direct application. One project that he has particularly enjoyed is the medical project. Says Dogan, "We are helping fellow human beings, and the end result is very tangible."

Dogan is a relaxed professor who at first might appear reserved. But when he talks about research and students, he is engaged and animated. "Although we are not these students' parents, it gives us pride to see them succeed," he says. "And our research at NC A&T brings recognition and respect from around the world."

DR. IPEK GOKTEPE

HUMAN ENVIRONMENT AND FAMILY SCIENCES

IN 1993, IPEK GOKTEPE LEFT HER NATIVE TURKEY TO ATTEND A GRADUATE PROGRAM IN AMERICA. SHE RECENTLY RETURNED AS AN AWARD-WINNING PROFESSOR AND RESEARCHER WORKING TO FIND CURES FOR DISEASES THAT WILL IMPROVE THE LIVES OF PEOPLE THROUGHOUT THE WORLD.

After graduating from the University of Istanbul with an undergraduate degree in fisheries (specializing in aquaculture engineering), she accepted a position as a fishery manager in the mountainous region of Turkey. "It took only a few months for me to realize I wanted to learn more in my chosen field," Goktepe recalls. "So I applied for a scholarship to study in the United States."

In 1996, Goktepe received her master's degree from Louisiana State University. She later earned a doctorate in food science, as well as an additional master of science degree in environmental science.

As an assistant professor in the department of human environment and family sciences in the School of Agriculture and Environmental Sciences, Goktepe combines her long-time interests in fisheries and preservation techniques with her research on how organic plant materials modify the growth patterns of diseases.

Goktepe gained recognition for her research involving the extraction of chemical components from native North Carolina plants and testing the chemicals against breast cancer and prostate cancer cells. She is also investigating natural ways to extend the shelf life of mushrooms. According to Goktepe, "We are growing an increasing number of mushrooms in North Carolina, and my research is designed to isolate certain plant compounds to preserve the mushrooms and protect them from salmonella, E. coli, and other disease-producing organisms."

In the six years she has been at NC A&T, Goktepe has secured more than $2 million of funding from various agencies and has more than $800,000 in grants pending. She is the inventor and co-inventor of two patents, has published nine papers in scholarly journals, and has presented more than fifty papers at local and national scientific meetings. Her first book, *Probiotics in Food Safety and Human Health*, was published in October 2005.

In 2005, NC A&T recognized Goktepe's accomplishments by naming her Outstanding Young Investigator, honoring her "outstanding capability and exceptional promise for significant future achievement and unlimited potential for new discoveries."

DR. MARGARET KANIPES CHEMISTRY

MARGARET KANIPES COULD HAVE GONE ANYWHERE SHE WANTED AFTER FINISHING GRADUATE SCHOOL. WITH A PH.D. IN BIOLOGICAL SCIENCE FROM CARNEGIE MELLON UNIVERSITY AND A POSTDOCTORAL FELLOWSHIP IN BIOCHEMISTRY FROM DUKE UNIVERSITY, KANIPES COULD HAVE LANDED A JOB AT A HIGH-PAYING CORPORATE RESEARCH CENTER OR A LARGE UNIVERSITY.

Instead, the North Carolina A&T alumna chose to work for a historically black university. "I want to affect change here," she says. "This is where I belong. I like to train and mentor women and minority scientists who want to become doctors or researchers. It's an awesome opportunity."

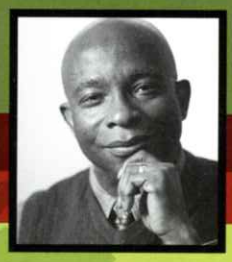
Kanipes, an associate professor of chemistry in the School of Arts and Sciences, hopes to expose students to valuable research opportunities starting with her latest research project. Supported by a $290,460 grant from the Army Research Laboratory, Kanipes, two graduates, and three undergraduates are developing a vaccine for lipooligosaccharide (LOS) in Campylobacter jejuni 81-176, a virus that causes human gastroenteritis (diarrhea).

Humans are exposed to Campylobacter by ingesting uncooked or infected poultry, contaminated water, or nonpasteurized milk. Symptoms are high fever, severe stomach cramps, headache, joint pains, and severe cases of diarrhea. In extreme circumstances, Campylobacter develops into Guillain-Barre Syndrome (GBS), a rare and debilitating disorder that afflicts one in 100,000 people, according to the National Institute of Allergy and Infectious Disease. In some cases, GBS can cause neuromuscular paralysis or even death. The disease is prevalent in Southeast Asia, Egypt, and the Philippines, and some strains are resistant to antibiotics. Military troops stationed in high-risk areas are especially vulnerable. "When the virus spreads, it takes troops out of action," says Kanipes. "And because troops are very mobile, the virus could spread to other areas of the world that have not yet been particularly affected."

Kanipes believes strongly in NC A&T's research initiatives, and she is proud that her research is exposing students to new areas of science. "I want to give students the opportunity to see if research is for them," says Kanipes. "It was my exposure to research at NC A&T as an undergraduate that influenced my decision to become a research scientist."

INDUSTRIAL ENGINEERING

DR. CELSTINE NTUEN



WHEN CELESTINE NTUEN WAS YOUNGER, HIS FRIENDS CALLED HIM "PROFESSOR" BECAUSE HE WAS ALWAYS WILLING TO HELP ANY STUDENT STRUGGLING WITH ALGEBRA AND CHEMISTRY. "I GUESS MY FRIENDS WERE PROPHETIC," HE SAYS WITH A LAUGH. "NOW, WHENEVER I VISIT HOME, THEY ALL SAY, "SEE, WE TOLD YOU YOU WERE A PROFESSOR.'"

Now in his twenty-second year at NC A&T, Dr. Ntuen specializes in cognitive modeling and simulation. For the past year, he has conducted extensive research on sensemaking, a complex organizational theory that examines the way people make decisions, negotiate meaning, and compartmentalize complicated information.

Since 1972, cognitive scientists, psychologists, and computer scientists have studied this theoretical framework. Ntuen chose modeling and simulation because of his longtime interest in cognitive processing. He is collaborating with the Department of Psychology, Bennett College, Fayetteville State University, Virginia Tech University, and Evidence Based Research Inc. in Vienna, VA. "These are the kinds of things that excite me," says Ntuen. "We are making sense out of isolated pieces of information."

In 2006, the Department of Defense awarded a $2.3 million, five-year multi-institutional grant to study how military personnel make decisions in combat and how to enhance emergency response to natural disasters and other potentially dangerous events. Ntuen is using NC A&T's funding to develop decision-aiding models that will help the military improve its training and leadership development. He is also developing dangerous-weather preparation models for the military using data from two of the most powerful hurricanes to hit the United States in recent years: Katrina and Wilma.

The books on Dr. Ntuen's bookcase run the gamut from engineering textbooks to psychology manuals. There are even a few Tom Clancy novels. "He is one of my favorites," says Ntuen. "I read his novels to learn about the military."

When discussing research, Ntuen talks with passion, and he wants to pass along that same passion to his students. "I see this as my life's calling," he says. "I want to engage students and give them the practical experience that research provides."

The Division of Research & Economic Development has developed programs for the last few years to encourage undergraduate participation in research. The creation of these programs will spur students on to pursue graduate education, especially in areas traditionally underrepresented by African Americans. In each issue of ***EVOLUTION***, we will highlight a student researcher.

KIARA WALTERS

JUNIOR MARKETING MAJOR/
RESEARCH INTERN

LAST SUMMER, KIARA WALTERS WAS A RESEARCH INTERN WITH THE OFFICE OF OUTREACH AND TECHNOLOGY TRANSFER IN THE DIVISION OF RESEARCH & ECONOMIC DEVELOPMENT (DORED). WALTERS HAS SINCE TRANSFORMED THAT INTERNSHIP INTO A PART-TIME POSITION AND A POTENTIAL CAREER PATH.

One of eight students who was selected to participate in the DORED's Undergraduate Student Research Internship program, Walters, a junior marketing major with a 3.7 grade point average, was matched with the Technology Transfer office to expose her to the role of marketing in research.

Other students who participated in the program were matched with faculty mentors who engaged them in a research project for 10 weeks.

According to Dr. N. Radhakrishnan, Vice Chancellor for Research & Economic Development, "The summer student research program is designed to foster an interest and excitement about research in undergraduates. The primary purpose is to expose students to research and attract them to pursue graduate education — hopefully at NC A&T. Students learn the research process, the specifics of their mentors' on-going research project, and related laboratory procedures. At the end of the program, they produce their own interpretation of the research through the development of an oral presentation."

The pool of applicants for the summer program is drawn from the University's Honors Program. Honor students must maintain a GPA of 3.5 and are "highly talented students who are given a chance to step beyond the norm."

For Walters, the program offered a chance for her to be fully immersed in a different aspect of marketing. "It was really rewarding to meet other students in the program, learn about their research, and be able to see how marketing strategies could be implemented to move that research to the next level," said Walters.

Undergraduate student research internships are offered each summer to rising sophomores, juniors, and seniors in the Honors Program and provide a great opportunity for undergraduate students to strengthen their research abilities and work with experienced researchers.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