WINTER 2005

GeorgiaTech Alumni Magazine

Viewing Cancer in a New Light

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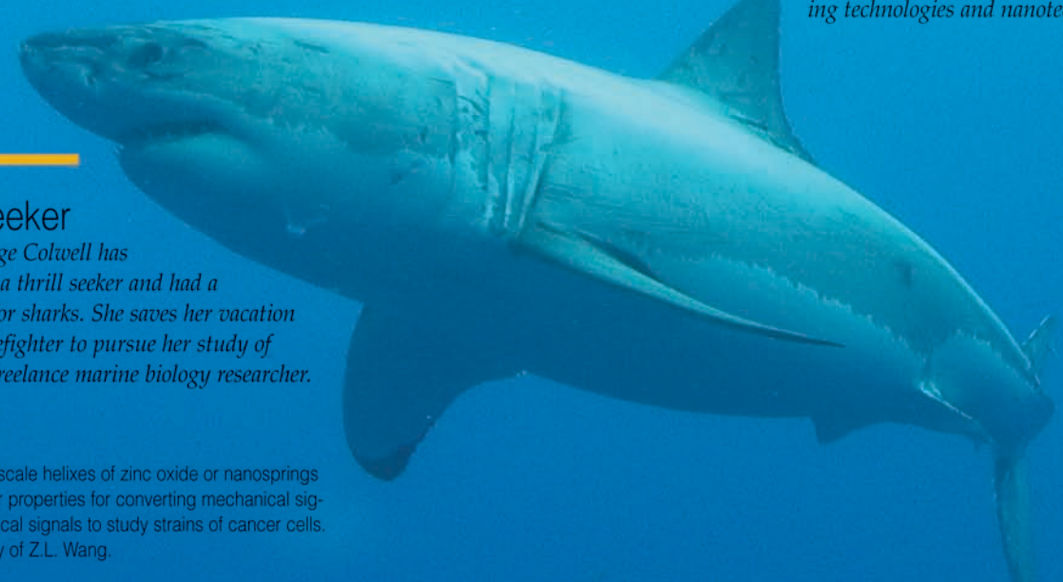

Cover: Nanoscale helixes of zinc oxide or nanosprings exhibit superior properties for converting mechanical signals into electrical signals to study strains of cancer cells. Image courtesy of Z.L. Wang.

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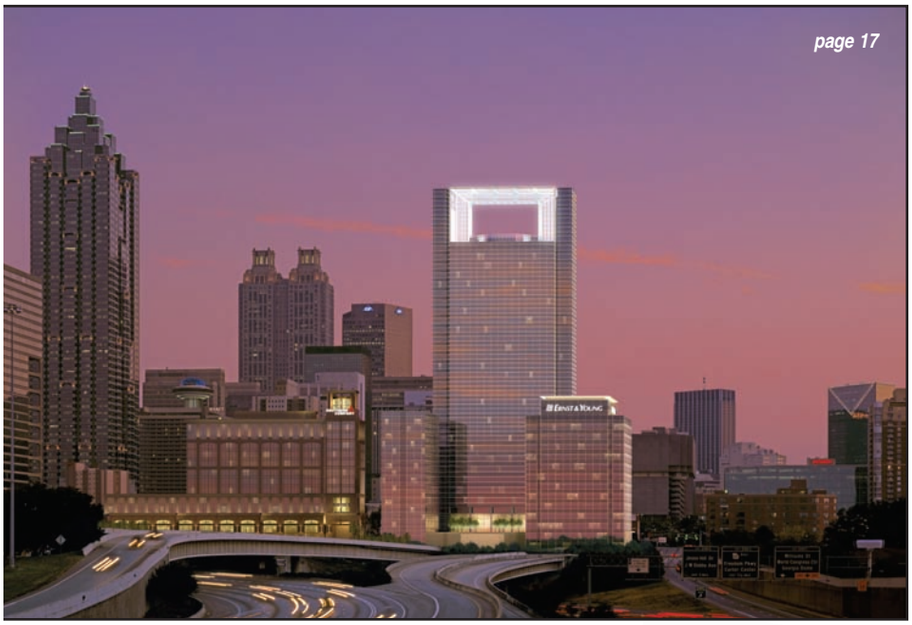
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GeorgiaTech
Alumni Magazine

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Tyler Brown Gave Sacrifice an Identity

Seth Gannon, a senior at Woodward Academy in Atlanta, wrote this essay on Tyler Brown as an English class assignment for a contest entry and oral presentation for the Veterans of Foreign Wars.

By Seth Gannon

A Woodward Academy alumnus died in Iraq on Sept. 14 and the first I heard of him was his death. Tyler Brown graduated from Woodward. Tyler Brown graduated from Georgia Tech. Tyler Brown died a first lieutenant outside of Baghdad. Everyone in my homeroom was suddenly sullen and alone as the plans for his funeral poured forth from the ceiling speaker.

We all felt Tyler Brown's death that morning. We had never met Tyler Brown, let alone studied with him or shared memories with him. I for one had never heard of Tyler Brown until that morning, but I felt this deep, numbing sense of loss that came not from having known Tyler Brown but rather from finally having a name for the sacrifice he and all the others have made.

Tyler Brown, the name and the service and the death, entered my life that morning, but he quickly became a poignant and recurring theme. My dad read a story outlining the well-liked and successful Tech graduate's life and death. My father lost a brother to southeast Asia and takes such stories to heart. He mentioned Tyler Brown to a friend while golfing. My dad's friend, however, was intimately familiar: He knew the parents — Carey and Sally Brown — and attended the funeral.

Days later, a friend of mine pulled into a gas station. He was wearing a Woodward Academy T-shirt and found, thanks to his shirt, that the woman fueling the car ahead of him had graduated from

Tyler Brown during his term as SGA president at Georgia Tech.

Woodward. This woman, my friend discovered, was Tyler Brown's girlfriend for most of their senior year of high school.

I began to realize that Tyler Brown's recurrence was no anomaly. We are hard-pressed to recognize the incredible and tightly knit

We Welcome Letters

The Alumni Magazine welcomes letters. Please include your full name, address and telephone number. Letters may be edited for clarity, space and content.

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Advancing Technology

My wife has one mailing address, two phone numbers and two e-mail addresses. My son has two mailing addresses, three e-mail addresses and one phone number. My daughter has one mailing address, one e-mail address and one phone number. I have two mailing addresses, three phone numbers, one fax number and two e-mail addresses. And I'm probably missing some.

I can type faster than I can write by hand. In fact when I write by hand I can't even read it (although that's been true since first grade). At home, if the Net is down, my kids go from patience to annoyance in about a nanosecond. We've gone from no electronic communication (except the good old telephone) to dial-in to cable modem to DSL in five years.

And guess what? This is probably normal.

Technology is ubiquitous. Our dependence on these modern day tools is immeasurable and, for the most part, very positive. Great increases in American productivity have been due in large part to technological advances. Wonderful enhancements to our lives have been made possible by new technologies.

This is a place of confluences — between science and engineering, between computing and science, between architecture and liberal arts, between management and engineering and so on. It's the sort of place that reflects the state of our world today.

Georgia Tech is at the leading edge in the advancement of many new and existing technologies. These technologies will continue to change our lives in ways that we can't even imagine now. That's why investing in Georgia Tech is a very good thing.

Joseph P. Irwin, President
Georgia Tech Alumni Association

web in which we live until a powerful ripple goes through it. Tyler Brown's death was such a ripple, one of our web's threads snapping tragically and reminding the other threads by its impact how closely connected they are. Tyler Brown gave his life for his country and we realized it — the Woodward student body, the Tech student body, the readers of the *Atlanta Journal-Constitution*, his family, his friends, his family's friends, his friends' families and all the hundreds of incidental contacts he developed in his years. We realized Tyler Brown's sacrifices.

What is truly overwhelming is the very number and magnitude of these sacrifices and their ripples throughout communities and cities and nations. America has given more than 1,000 souls to the sands of Iraq. America gave more than 58,000 lives to the jungles of Vietnam, 33,000 on the Korean peninsula and left hundreds of thousands on the plains of Europe and the seas and atolls of the Pacific. To think how many lives these men and women have changed forever by their sacrifice, to realize how large those numbers are, to even imagine giving everyone a name and a story and a life, is mind-numbing.

It is incomprehensible to me that this many living and breathing and loving and thinking and dying American soldiers — who each grew up and went to school and had friends and disappointed their parents and delighted their parents and went to war and died — could have rendered such a dramatic effect on those around them. But they certainly did, and they always will.

In the end, of course, when the history books are proofed and sent to press, the wars are about the shifting fronts and surrenders and final borders and reparations and reconstructions. To the generation that fought these wars, however, or even to the generation that watches them fought, wars are about the men and women who never come home, the soldiers who leave themselves and everything America has invested in them on the field of battle. This sacrifice is what these Americans give their country, and the ripple they create, these chance encounters on golf courses and at gas stations, is their too brief memory.

All this seems like bleak cause for celebration and war, no matter how glamorized or antiseptic, is no celebratory event. We must celebrate, but we need not celebrate the first lieutenant who fell in the desert of the Middle East. We need celebrate the Tyler Brown who lived, the Tyler Brown who studied at Woodward and Tech, who presided over the student government at both, the Tyler Brown with the world ahead of him. We need celebrate the Tyler Brown who in the end sacrificed everything and himself to serve his country, to defend his nation wherever he was asked to defend it. We need celebrate the Tyler Brown who will never return home but who, in a very meaningful way, never left.

Absolutely Awesome

The photos taken by Bill Goodhew, IM 61, in the Fall 2004 issue of the GEORGIA TECH ALUMNI MAGAZINE were absolutely awesome. He is certainly a talented photographer. The article stated that Mr. Goodhew now takes his photos entirely using a digital camera and the camera he mentioned was a Canon 10D. There was no mention of the type of lens he uses or whether or not he uses various lenses.

I have, in the past, messed around with photography as an amateur using slide film and print film. After seeing these marvelous pictures taken with a digital camera, I am thinking of getting a digital-type camera and I wondered if Mr. Goodhew gave the magazine any particulars about the photos that were just not published in the issue.

Arthur W. Davis, ME 48
Seattle

Bill Goodhew responds: I do use a Canon 10D. I picked Canon because I had several Canon lenses and because Canon seems to be a leader in digital camera technology, at least in the high and medium-high lines. There is a newer and vastly better model out — the Canon 20D. Almost all of the shots were done with a Canon 100-400 mm IS lens. One reason is because wildlife photography needs that telephoto capability.

If budget (both dollars and weight) is no object, it would be better to have the 80-200 IS and a longer and faster telephoto such as the 500 and 600 mm lenses. The IS means inertial stabilization — there is actually a tiny two-axis gyroscope in the lens (same as in several video cameras), and it permits hand-holding at slower speeds.

But, aside from cost and weight, there is one major problem with interchangeable lenses on digital bodies and that is the problem of getting subvisual dust in the camera when changing lenses. Dust is attracted to the sensor, is difficult to see and clean and will appear on every shot thereafter. So I try to avoid changing lenses, especially in dusty places like Africa.

I hesitate to recommend a camera without knowing the photographer's intended uses and budget. There are some good Web sites with reviews: http://reviews.cnet.com/, http://www.dpreview.com/ and http://www.photofocus.com/. If you have the money to spend, the 20D with the special dedicated 18-55 mm lens would be great. If the budget is more like $800, the Konica-Minolta Dimage A2 would be my choice.

Bill Goodhew

Marvelous Photos

The photographs by Bill Goodhew, IM 61, published in Fall 2004 ALUMNI MAGAZINE, were marvelous. I admire them very much.

I graduated from Tech in the Navy V-12 program. My class was actually 1945, but because of the accelerated schedules during World War II, my graduation was Oct. 20, 1944, in chemical engineering. After release from active duty, I worked for Union Bag in Savannah for a few years, then went to Richmond with a job change to DuPont in 1954. They transferred me in 1960 to Florence, S.C., where I still live, having retired from DuPont (and also the Navy Reserve) in 1985.

I took up the hobby of digital photography a few years ago. Most of my nature photography is limited to birds and a few animals, all in the South. I began with an interest in "digiscoping," and found that a Swarovski AT-80-HD spotting scope suited me. Because of the adapter I fabricated to fit my first Nikon CP-950 camera, I've stayed with Nikons through several more models. I note from the article he used a Canon 10D for most of those shots, and I've heard lots of great stories about that camera. The Canon 20D now seems to be the "newest and greatest." I wonder what sort of telephoto lenses he used with the 10D.

Again, this is a part-time hobby for me, and no safaris, but it's been fun. Some of my earlier stuff is posted at: http://home.mindspring.com/~omc-daniel/Index.htm

My wife and I are close to having to move to an assisted living facility now that we are both hitting 80, so I don't know how much more of this I can enjoy, but I've enjoyed it greatly to date and admire those like you who still "push the envelope."

Olin McDaniel Jr., ChE 44
Florence, S.C.

Rhodes Scholar

Jeremy Farris strives to understand how the world works

For Jeremy Farris, going to college wasn't about getting good grades and a job. College was about the experience of education and the opportunity to expand the mind.

"The purpose of an education is to change you, to make you sufficiently human," says Farris, who in November was named one of 32 Rhodes Scholars for 2005.

In December, Farris received a bachelor's degree in international affairs at Tech. He plans to spend the summer as associate professor Kirk Bowman's teaching assistant in the Argentina study abroad program and begin a two-year master's of philosophy program in political theory at Oxford University in England next October.

Before coming to Tech in 2000, the Bonaire, Ga., native won a best of category award at the Intel International Science and Engineering Fair for his discovery of a new pathogen that can control kudzu. As a result of that award, Farris was chosen to become an American delegate to the 2000 Asia-Pacific Economic Cooperation Science Forum in Singapore.

The trip inspired him to travel the following summer on a study abroad trip to Argentina, where he produced a documentary on the indigenous people of that country. Farris' travel experiences led to a change in major from biology to international affairs.

Since then Farris has conducted research on the possibilities for post-Castro democratization in Cuba and traveled to Guatemala to work on reforestation projects and collect footage for a documentary on illegal immigration networks.

"The thing about Jeremy that is really amazing is his desire to understand how the world works," says Bowman, an associate professor of international affairs and director of Tech's study abroad programs in Latin America. "He studies international affairs, but he feels the need to know science and philosophy so he can understand how the pieces fit together."

Farris credits Bowman and two other Ivan Allen College professors, Jon Johnston and Ken Knoespel, with changing his life.

"Bowman introduced me to democratization. Knoespel and Johnston really stimulated the life of the mind for me," Farris says.

Upon entering Tech, Farris became the recipient of the Roe Stamps President's Scholarship, which, along with the HOPE scholarship, paid for his college education. "Had I not gotten that, I don't know that I could have to come to Tech," he says. "I'm absolutely thankful for the opportunity."

Farris is the third Georgia Tech alumnus to win a Rhodes Scholarship. The first was S. Alton Brown, who won the honor in 1951. The second was Will Roper in 2002.

The Rhodes Scholarships pay for two or three years of study at Oxford. The oldest international fellowships in the world, the scholarships were established after the death of British statesman Cecil Rhodes in 1902. For 2005, 32 Americans and 22 students from other countries were chosen for their academic achievements, personal integrity and the potential for leadership.

Farris' career goals are just as broad as his education. Aside from conducting research and teaching public policy, he would like to work with the American Civil Liberties Union and the White House — should newly elected Sen. Barak Obama from Illinois run for president.

"Jeremy's level of expertise is just stunning," Bowman says. "As a professor I spent a lot of time with him in a lot of different countries. I have learned more from Jeremy than he has ever learned from me."

Log in to the Jacket Community

Georgia Tech alumni are being given the online equivalent of a red carpet welcome to the Jacket Community.

The Alumni Association is distributing user names and passwords that provide access to the Jacket Community's new set of online services and allow alumni to update their biographical information and search for fellow alumni using a variety of different fields. Alumni can also make a secure, online gift to Roll Call.

To access the Jacket Community, alumni need an Alumni Association-assigned user name and password.

More than 30,000 user names and passwords have been distributed to alumni who have provided the Alumni Association with an e-mail address.

Alumni who have contributed to Roll Call during the past two years are being notified of their user names and passwords via a letter.

Bill Moore, Success Center Benefactor, Dies

William E. Moore, IM 38, of Woodside, Calif., whose $5 million gift made the Student Success Center at Georgia Tech a reality, died Nov. 21.

Raised in a small Arkansas town, he spent most of his childhood helping his family make ends meet. According to a 1993 TECH TOPICS article, he became fascinated with tennis after watching a match during a visit to his grandmother's home in Oklahoma. Because the closest tennis courts to his Arkansas home were nearly 30 miles away, he got a neighbor boy to help him convert a vacant lot into a rough, dusty court, where the few spare hours they had were spent playing tennis. The two small town tennis buffs played their way to the Arkansas doubles championship.

Mr. Moore arrived at Georgia Tech on a tennis scholarship in October 1934 and earned his living expenses performing a variety of campus jobs. An *Atlanta Journal* article in 1937 spotlighted the "Yellow Jacket busy as a bee" and reported that Mr. Moore's student jobs included babysitting professors' children, delivering mail to the dorms, selling tickets at

football games, waiting tables in the dining hall and working as a soda jerk at the Robbery.

He teamed with Russell Bobbit to win the Southeastern Conference doubles crown in 1938 and help the Yellow Jackets capture the team title. Inducted into the Tech Hall of Fame in 1972, he lost only one singles match during his collegiate career.

Mr. Moore was elected to Omicron Delta Kappa and was on the staffs of the *Yellow Jacket* magazine, the *Technique* newspaper and the *Blueprint* yearbook.

He worked for W.H. Kelley in the lab at Glidden Paint Co. in San Francisco before joining the Navy during World War II and serving two years in the South Pacific as an officer on a destroyer.

After his discharge, he convinced his former Glidden boss, who had retired, to join him in business, the Kelly-Moore Paint Co. After six years of growth, Kelly retired again and Mr. Moore bought him out.

The business became the largest privately held company in the United States. Mr. Moore also developed the Broken O Ranch, the largest irrigated acreage in Montana, and was chairman of Calmutual Insurance Co.

In addition to the Bill Moore Student Success Center, his generosity is apparent at the Bill Moore Tennis Center, dedicated in October 1988, and through an endowed scholarship for tennis players.

The *San Francisco Chronicle* reported that in 1993 Mr. Moore told Tech students who would benefit from his contributions, "May each find the foundation for a successful life, a positive balance of mind, body and spirit."

Researchers Develop Organic Solar Cell

Researchers at Georgia Tech have developed a new approach to creating lightweight organic solar cells. By using pentacene, they have been able to convert sunlight to electricity with efficiency.

Bernard Kippelen, a professor in Tech's Center for Organic Photonics and Electronics and the School of Electrical and Computer Engineering, says, "We've been able to convert solar energy into electricity with 2.7 percent efficiency. Since then, we've been able to demonstrate power conversion efficiencies of 3.4 percent and believe that we should reach 5 percent in the near future."

What makes pentacene such a good material for organic solar cells, Kippelen explains, is that, unlike many of the other materials being studied for use in these cells, it's a crystal. The crystal structure of atoms joined together in a regular pattern makes it easier for electricity to move through it than some other organic materials, which are more amorphous.

The research group, made up

of Kippelen and research scientists Seunghyup Yoo and Benoit Domercq, used pentacene and C60, a form of carbon more popularly known as "buckyballs," in the cells.

Forty-one Clubs Join TEAM Buzz Effort

Patty Oades

More than 450 alumni and friends from 41 Georgia Tech clubs and thousands of Tech students participated in community service projects for the annual TEAM Buzz Day.

Volunteers helped build homes with Habitat for Humanity, assisted at food banks, cleaned parks and spent time at elder care facilities in their respective communities.

"This was a great gathering for a good cause," Jerry Abbott, CE 55, says of the Birmingham, Ala., club's Habitat for Humanity experience. "Some alumni brought their high school-age children to work with us. Now that the school in Athens has an alumni club here in Birmingham, we plan to challenge them in the spring to a Habitat hassle. We are sure that we engineers can outbuild them without trouble."

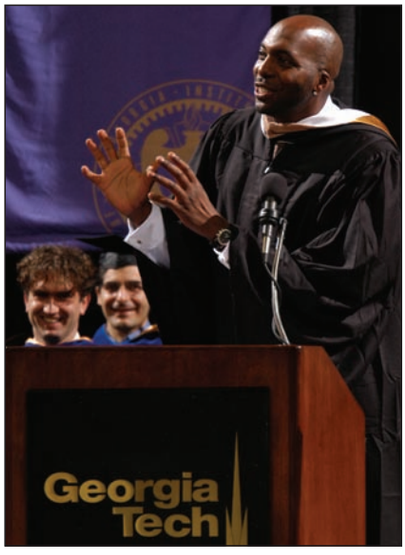
Alumni Association trustee Tony Chan, IE 94, MS IE 98, started TEAM Buzz in 1997 as a way for the Tech community to work with metro Atlanta service organizations in community service projects.

"TEAM Buzz has grown in scope and participation each year and has expanded to clubs throughout the United States," says Jeff Colburn, director of alumni clubs.

Top: Working with the Palm Beaches Georgia Tech Club on a Habitat for Humanity project are Troy Rice, left, club president, and Jan Rogers.
Above: The Houston Georgia Tech Club worked with students in the Aspiring Youth of Houston on a public service project to repair and paint a house for a low-income, elderly person as part of TEAM Buzz Day. The home was chosen by a local nonprofit organization, PSI HomeSavers. The top photo shows the house before and the bottom after the job was completed.

Stanley Leary

Standing Ovation



Alumnus John Salley, right, who played 12 years in the NBA and is co-host of "The Best Damn Sports Show Period," received a standing ovation after delivering a commencement address that was continually punctuated by laughter. Salley, Mgt 88, told graduates it was time to get a job and then suggested they pursue graduate degrees and, gesturing to the faculty behind him, get their jobs. Above, two seniors from last season's basketball team, Clarence Moore, left, and Robert Brooks received their management degrees. Brooks, a reserve forward, has enlisted in the Marine Corps and was scheduled to report for duty two days after Christmas. About 600 undergraduates received degrees during Tech's 220th commencement ceremony Dec. 11.

Astronaut John Young Retires

John W. Young, the longest-serving astronaut in history, retired from NASA on Dec. 31 after a 42-year career.

Young, AE 52, flew twice to the moon and was one of only a dozen astronauts to have walked on the lunar surface. He inaugurated modern space travel as commander of the first shuttle mission. He was the first person to fly in space six times and the only astronaut to pilot four different spacecraft.

He piloted the first Gemini manned flight in 1965, commanded Gemini 10 in 1966 and orbited the moon in the Apollo command module in 1969. Young returned to the moon in 1972 and in 1981 commanded the Columbia shuttle.

Almanac

75 Years Ago

Brittain Dining Hall was featured as the "best dining hall in the South" by *The School Board Journal*, which devoted five pages to a photo essay about Georgia Tech's dining facility. "The Tech dining hall is the only place in the city of Atlanta which requires its cooks and waitresses, in fact all help, to be inspected by a doctor. Everything possible in the preparation of a meal is done by machinery," the January issue of the alumni magazine said.

50 Years Ago

Two youngsters share looks of wonder and disbelief as they get a glimpse into the future at an exhibit by Georgia Tech electrical engineers in the March 1955 alumni magazine. In a Hall of Engineering competition, electrical engineering students created a telephone-television setup that was a forerunner of the video-chat technology of today.

25 Years Ago

After a 10-year career in professional football, including playing in three Super Bowls and a three-year stint as an assistant coach for the Green Bay Packers, Bill Curry, IM 65, was named head football coach of the Yellow Jackets.

Tech Square Wins Urban Land Institute Award

Technology Square received a 2004 Award for Excellence from the Urban Land Institute — the land use industry's most prestigious recognition.

The award citation describes Technology Square as a "formerly blighted and vacant three-block area of Midtown Atlanta where security was a constant concern and pedestrian activity was nonexistent."

"The Georgia Institute of Technology has overcome physical and psychological barriers to reconnect the university with the Midtown neighborhood by developing a vibrant 24/7 urban campus," the citation says.

Tech President Wayne Clough says, "This project allowed Georgia Tech to reconnect to Midtown by bridging the divide created by the construction of the I-75/85 freeway. Technology Square is important not only because of its symbolic value, but also because its role as an anchor has energized others to participate in the Midtown renaissance, creating a visible technology corridor for Atlanta."

Established in 1979 the award recognizes the full development of a project, not just architecture or design. Projects are evaluated on the basis of financial viability, resourceful use of land, design, relevance to contemporary issues and sensitivity to the community and environment.

Polymer Defense

Danger-sensing technologies target weapons of terrorists

New sensing technologies being developed at Georgia Tech could help detect chemical or biological weapons intended for a terrorist attack.

Chemical sensors in buildings could detect a release of gas and trigger a shutdown of the ventilation system, says optical sensor developer Dan Campbell, a senior research scientist at the Georgia Tech Research Institute.

He says chemical sensors could be mounted on an unmanned aerial vehicle to track a chemical plume and help determine evacuation plans. Rapid biological sensors also could be incorporated into handheld devices to investigate a suspicious package.

Campbell and his GTRI colleagues have been developing an integrated-optics sensor that can detect the presence of biological agents in minutes and chemical agents in seconds. They are tuning the sensor for detection of industrial pollutants, food-borne pathogens and agents associated with terrorist attacks.

Researchers have successfully and rapidly detected numerous agents — including salmonella and campylobacter bacteria, anthrax, ricin, chlorine and ammonia — in laboratory tests, as well as groundwater contaminants such as chlorinated hydrocarbons in field tests.

GTRI is exploring several opportunities for its sensor. The U.S. Naval Research Laboratory and the Marine Corps Warfighting Laboratory are seeking applications for their Dragon Eye miniature unmanned aerial vehicle. The reconnaissance device can be launched by hand or with a bungee cord and fly one-hour missions within a six-mile radius. GTRI researchers are testing the chemical sensor when mounted in the vehicle's nose cone.

Gary Meek

Chemistry and biochemistry professor Uwe Bunz uses highly fluorescent polymers to detect pathogens and toxins that might be used in a bioterrorism attack.

Campbell successfully demonstrated the idea at a recent defense technologies conference. But he wants to shrink the sensor from its current half-pound size to about an ounce.

GTRI's David Gottfried is collaborating with the University of Georgia's Center for Food Safety to develop the sensing chemistry to detect infectious disease agents — including potential bio-weapons — in water, fruit juice, milk, food and the environment.

Researchers from several universities, including Georgia Tech, are collaborating on the development of integrated micro-optical sensors for chemical and biological agents of national security concern. The goal is to merge optical-sensing technology with highly integrated electrical circuits into a fully integrated sensing system on a silicon chip.

A type of highly fluorescent polymers called PPEs could be the basis for a chemical-sensing system that would detect pathogens and toxins that might be used in a bioterrorism attack. The agents of concern include cholera, anthrax and ricin.

"Fluorescence is very sensitive to the chemical environment," says Uwe Bunz, a professor of chemistry and biochemistry. "So it's a very good tool to report changes."

With a one-year, proof-of-concept grant from the National Institutes of Health, Bunz is exploring the feasibility of detecting changes in the fluorescence or color of PPEs when they interact with a pathogen or toxin.

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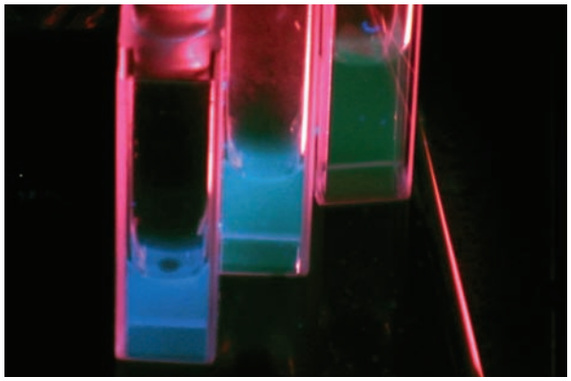


Gold Quantum Dots

A new class of water-soluble quantum dots made from small numbers of gold atoms could be the basis for a new biological labeling system with narrower excitation spectra, smaller particle size and fluorescence comparable to systems based on semiconductor quantum dots, according to Robert Dickson, associate professor in the School of Chemistry and Biochemistry. Providing the missing link between atomic and nanoparticle behavior in noble metals, these multi-electron artificial atoms also could serve as light-emitting sources in nanoscale optoelectronics and in energy transfer pairs. "Their potential applications are really complementary to those of semiconductor quantum dots," Dickson says.

ATDC Graduate Firm Makes *Inc.* 500 List

A Georgia company that graduated from Georgia Tech's Advanced Technology Development Center in 2002 made the 23rd-annual *Inc.* 500 ranking of the fastest-growing private companies in the United States.

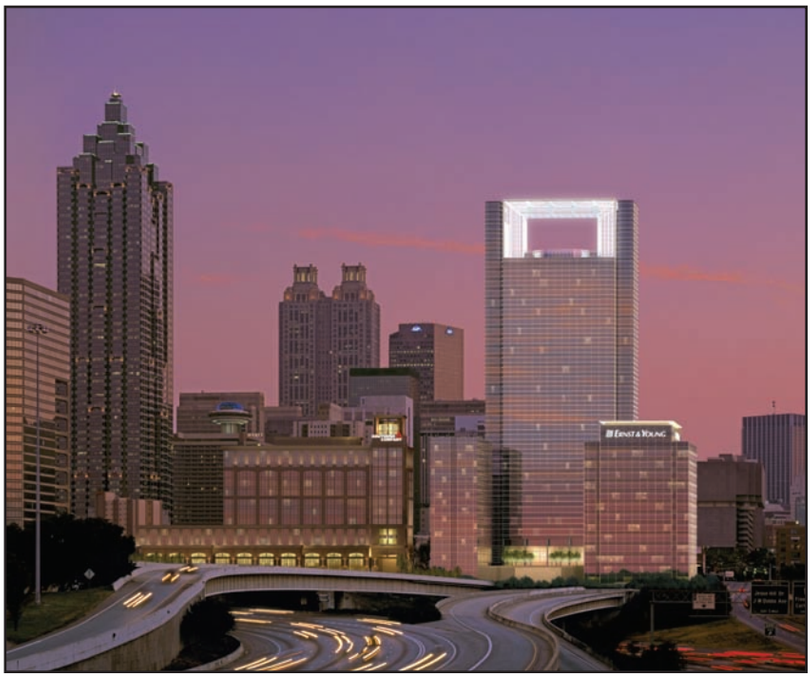
The magazine called Star Software Systems Corp. "a premier technology solutions provider and large world-class interactive Web-based software applications development expert."

Star Software ranked No. 142 on the list, with a four-year average annual sales growth of 220.1 percent. The company has 73 employees and 2003 revenues of $4.9 million. It also was selected as Georgia's Small Business Administration's Small Business of the Year Runner-up for 2004.

Inc. said that Tom Eaves, Star Software's founder and CEO, began his career as a crack computer programmer for hire. But things really got going at Warner Robins Air Force Base, where he built an inventory management process that helped locate misplaced aerospace parts and saved the government millions of dollars.

Allen Plaza

Project honors former mayor



A proposed $300 million development in downtown Atlanta will honor the memory of former mayor Ivan Allen Jr., the Georgia Tech alumnus credited with guiding the city through the often-tumultuous civil rights movement of the 1960s.

Allen Plaza will feature a 34-story skyscraper, the tallest structure to be built in downtown in nearly 20 years. A smaller tower and a hotel are also planned for the project, which is expected to begin in 2006 about one-half mile south of Tech near Williams Street and Interstate 75.

The accounting firm Ernst & Young will be the anchor tenant and money from the naming rights will go to the Ivan Allen College of Liberal Arts at Georgia Tech and the Ivan Allen Society of Atlanta's United Way.

Allen, Com 33, supported the civil rights movement at a time when few Southern whites did. When he took office in January 1962, he immediately ordered the "white" and "colored" signs in City Hall removed and the cafeteria desegregated. During his two terms as mayor the city he described as "too busy to hate" boomed as both corporations and residents relocated to Atlanta. Under Allen's watch, 50 major buildings were built in downtown, the Interstate 75/85 connector was finished and MARTA, Atlanta's subway system, was created. He died in 2003 at age 92.

Inman Allen, the late mayor's son, told the *Atlanta Journal-Constitution* that his family is honored to have the development named for his father. "My father was a forward thinker who believed in Atlanta, its people, its purpose and its future," Allen said. "He would embrace the vision of this project and would especially like the fact the location is downtown, where he devoted much of his attention as an Atlanta mayor, businessman and citizen."

One-stop Economic Development

Technology Square partnership pays tribute to the late Governor George Busbee

The creation of the Busbee Center for Global Economic Development & Innovation in Technology Square and its partnership with Georgia Tech tie into the Institute's mission to help shape the state's economic future.

"Economic development is at the core of what we do and what we are trying to do," says President Wayne Clough. "Innovation is very important to that because in this day and age it is vital not only to do basic economic development and create jobs, but to create the jobs of the future."

Named in honor of the late Georgia Gov. George D. Busbee, the center represents a new partnership among the state's economic development agencies, intellectual resources and training facilities.

It is designed to promote coordination, communication and cooperation among the state's governmental entities, academic institutions and private industries engaged in the development of Georgia's businesses and work force.

Clough says the center furthers the Institute's focus on developing successful industry and creating a global business network.

"Technology Square is a key element in Georgia Tech's progress toward defining the technological university of the 21st century," he says. "By marrying academic research and development with the government and private agencies that can help them grow, Georgia will be able to lead the world in the knowledge industries that will breed success."

Members of the center from Georgia Tech are the Advanced Technology Development Center, the Economic Development Institute, VentureLab, the Center for Quality Growth and Regional Development, the College of Management and the Global Learning Center. **GT**

Caroline Joe

Healthy Outlook

Moseley sees bright future

By Gary Goettling

Charles D. "Charlie" Moseley makes his living by anticipating the future, so his forecast for metro Atlanta 10 years forward merits attention. It can be summed up in two words: biomedical technology.

With cheap, unskilled labor no longer providing the Southeast with an economic advantage for industry, something new has to come along, says the 1965 Georgia Tech industrial engineering graduate.

"Tech and Emory University have joined hands successfully in creating and promoting engineered medical products and services," says Moseley, who also earned an MBA from Harvard Business School. "It's a natural fit, with Emory on the medical side and Tech on the engineering side. I think you'll see big dividends come out of that partnership during the next decade or so."

Moseley knows a thing or two about investments too. In 1983 he founded Noro-Moseley Partners, the first venture capital firm in Georgia. He serves as general partner for the company, which focuses its investments on small to medium-size private growth companies engaged in new technology, communications and health care. Most of Noro-Moseley's business is in the Southeast, primarily Georgia, Florida and North Carolina.

Noro-Moseley is investing from its fifth fund, which was started in 2000 and is aimed at investing in early-stage companies and providing support to established entrepreneurs.

Prior to going into business for himself, Moseley was a senior vice president and director of Robinson-Humphrey in Atlanta. He joined the corporate finance department in 1968 and became director in 1976. His corporate finance activities included managing public offerings of debt and equity, private placements of debt and venture capital, mergers and acquisitions, valuations and financial consulting.

Moseley's financial acumen is on loan to the Georgia Tech Foundation, where he has served on the finance committee since 2000. In 2003, he was named the panel's chair.

"We're involved with budgeting disbursements to Georgia Tech from restricted and unrestricted funds," he says. "Restricted funds are just what they sound like — money given for a specified purpose. For unrestricted funds like Roll Call we have to decide how much to give out and for what purposes.

"Fortunately we have a very good staff that's been doing this for some time. That enables volunteers like me to get our jobs done efficiently, without a lot of problems trying to pull together information."

Moseley has served on a number of Georgia Tech boards, including the Alumni Association Board of Trustees, the Georgia Tech Advisory Board, the ISyE Alumni Advisory Board and the Advanced Technology Development Center board.

The considerable amount of time and talent he donates to Tech is itself a good investment, Moseley says.

"While I've pared back my involvement with some nonprofits — your time can get over-allocated to the point where you don't do a very good job with any of them — and decided to concentrate on just a few, including Georgia Tech," he explains.

"Tech is a great institution and has done a lot for me and the large number of students that has come through there over the years," he adds. "I appreciate the boost, the head start, the energy that it gave me as a young man launching off into a career."

Part of the appeal of working with the Foundation is that it shares Moseley's long-term outlook.

"It has to be able to provide financial resources for scores of decades, not just four years. The things we do now will have some bearing on what's going to be done at Tech 50, even 100 years from now."

Facilities such as Technology Square will play a key role in driving the region's high-tech economy in the coming years, Moseley says. Another important factor will be the emergence of a second generation of successful entrepreneurs.

As Atlanta's economy becomes more high-tech oriented, comparisons with Silicon Valley inevitably follow. But that area has a 30-year head start, Moseley points out.

"They've had time to develop a couple of generations of successful, capable entrepreneurs," he says. "We're beginning to see that here. The last four or five investments we've made have been with experienced, previously very successful entrepreneurial managers. It takes a while for the cycle to run, but that's what attracts money and talent." **GT**

Jed Jacobsohn/Getty Images

BEATING THE CURSE

'This guy is everything you can ask for in a catcher,' says manager Terry Francona of Jason Varitek, who led the Boston Red Sox to a world championship.

Alumnus Jason Varitek, catcher for the Boston Red Sox, celebrates with teammate Keith Foulke after winning the 2004 World Series.

By Neil B. McGahee

Boston Red Sox catcher Jason Varitek held his breath as he watched pitcher Keith Foulke field a slow grounder and flip it to first base for the final out of the 2004 World Series.

"As soon as he caught the ball, I knew we had it but all I could do was wait and watch. It couldn't have lasted more than a second," Varitek says, "but it was the longest second I've ever endured. I just kept thinking, 'Please, hold on to the ball.'"

In that second, 86 years of Beantown angst were washed away — sweet redemption for all the old Red Sox players who'd been victims of the so-called "curse of the Bambino" and the long-suffering fans whose mantra was always: "Wait until next year."

Woodrow Wilson was president when Boston last won the World Series in 1918. The United States was embroiled in the "war to end all wars" and an influenza epidemic had killed more than a half-million Americans. The Red Sox were chasing an unprecedented fifth World Series title, relying on the arm and bat of a pitcher named George Herman "Babe" Ruth, aka "the Bambino."

Red Sox owner Harry Frazee, desperate for cash, sold Ruth's contract to the New York Yankees for $100,000 and a bank loan. The Yankees, a team that had never won a world championship before the Babe arrived, went on to win the Series 26 times, while the Red Sox made only four World Series appearances, los-

ing each one in Game 7. Thus was born the curse.

"I never believed in that curse business," says Varitek, Mgt 95. "I just think we got outplayed at the right times, but the longer you're in Boston, the more everything is blamed on it. It's nice to just finally be able to dismiss all that.

"Anyone who has ever played in Boston knows what winning a championship means, not only to the players but also to the city," he says. "All those old great players — Ted Williams, Johnny Pesky, Jim Rice, Dwight Evans, Luis Tiant — they agonized right along with everyone else."

Varitek had come close to winning world championships before. His Altamonte Springs, Fla., Little League team won the U.S. championship, but lost to Korea when he played in the finals of the 1984 World Series. Ten years later, he played for Georgia Tech in the 1994 College World Series, losing to Oklahoma in the championship round.

Several colleges recruited Varitek, including the University of Georgia, "But Tech wanted me to play catcher, plus Atlanta was far enough from home. Really, the reputation of the school and the program sold itself," he says.

Varitek is the only player in Tech history to have his number retired. The three-time All-American still holds nine offensive records for the most home runs, runs batted in, hits, doubles, total bases, runs scored and walks. He was selected as one of the 50 greatest Georgia Tech athletes of the 20th century and was recently inducted into the Tech Athletic Hall of Fame.

Transition to the Majors

Varitek was a first-round pick of the Seattle Mariners in 1994, but they were unable to come to terms on a contract. Varitek came back to Tech and finished his degree, then signed a contract with the St. Paul Saints, a minor league club in the independent Northern League. He finally came to terms with the Mariners in 1995.

"I had a hard time at the minor league level because it emphasizes individual development more than winning," he says. "Even though the game is a lot faster, playing college baseball is very similar to playing in the major leagues because the goal is winning a championship. The other big change is that you are responsible for yourself. You are completely on your own."

Varitek was inducted into Georgia Tech's Hall of Fame in November.

Varitek says the self-discipline he learned at Tech helped him overcome those hurdles.

"At Tech, you have to discipline yourself to excel at sports while also performing well academically. You can't do one without the other," he says. "I think college provides a maturity that allows you to gradually get out on your own instead of coming out of high school with a ton of money and blowing it right away."

Unheralded Leader

Although the Red Sox haven't elected a captain since Jim Rice retired in 1989, the team anointed Varitek as their leader. Not only did he superbly direct the flow of the games, calming nervous pitchers or shifting defensive coverage, he also made big plays when they mattered most.

Trailing in the second game of the division series against the California Angels, Varitek hit a two-run homer and the Sox went on to win 8-3. He drove in the first run in Boston's 4-2 victory over the Yankees in Game 6 of the American League Championship Series and his two-run triple in the second game of the World Series continued the momentum for the Sox's four-game sweep of the St. Louis Cardinals.

"This guy is the heart and soul of our team," manager Terry Francona told the *Boston Globe*. "He never quits. Nothing he does is average. Every time he runs a drill, he runs it perfect. This guy is everything you can ask for in a catcher."

In post-World Series interviews, pitcher Curt Schilling pulled a reluctant Varitek to the television cameras and, as he showered him with champagne, said, "Ladies and gentlemen, this is the leader of the 2004 Boston Red Sox."

Varitek says, "The respect of your teammates is the greatest honor you can have, but this is not my team. That's why we were so good — there's no one person that was bigger than this team."

The Business of Baseball

Varitek was traded to the Red Sox in 1997, joining former Tech teammate Nomar Garciaparra. They played together for seven years until a trade in the middle of the 2004 season sent Garciaparra to the Chicago Cubs.

"That was a tough one for me to deal with," Varitek says. "Nomar is one of the best in the game and I've had the opportunity to play with him at two different levels.

"Nomar is such a great player and he meant so much to Boston. For him to be on the team half a year and then be gone and we win the championship has been very difficult. Still, he was one of the first to call to wish me luck in the Series."

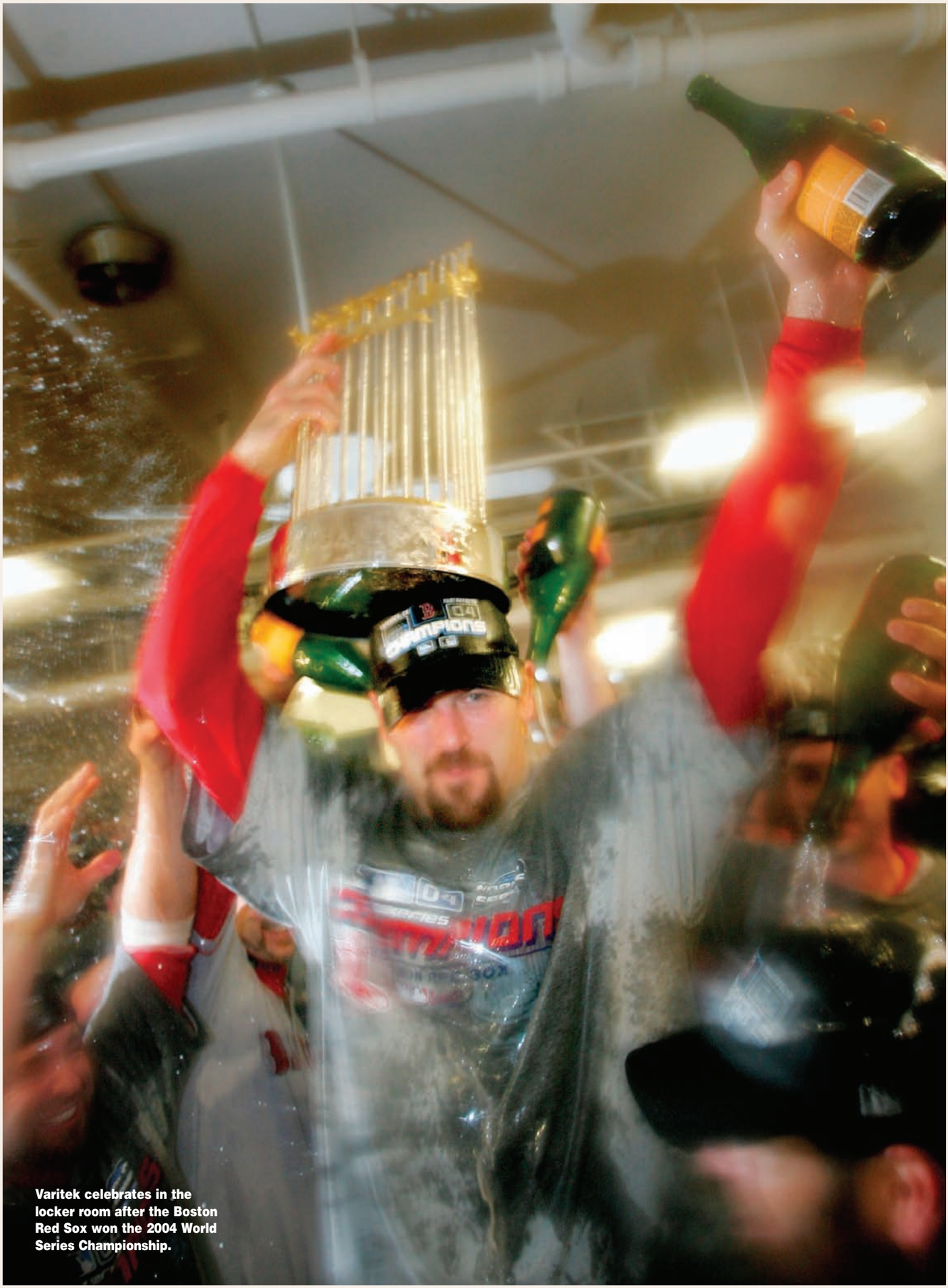
The World Series celebration was barely over when Varitek was no longer a Red Sock either, joining Pedro Martinez, Derek Lowe, Orlando Cabrera and 13 other teammates on the free agency list.

If he has his way the 32-year-old catcher will remain in a Boston uniform, but the Red Sox must compete with 29 other teams to keep his skills.

Money is part of the negotiation, but Varitek also wants the stability of a no-trade clause for his family, wife Karen and daughters Alexandra and Kendall.

"My heart's in Boston, so we'll see," Varitek says. "I'm not going to sell myself short. I just want to take care of my family, that's the important part." **GT**

Ezra Shaw/Getty Images



Varitek celebrates in the locker room after the Boston Red Sox won the 2004 World Series Championship.

Rick Hudson is a hard-driving, type-A businessman who has earned the respect of his employees as well as his customers. He may have been the only one surprised when he was named Oklahoma's Small Business Person of the Year.

self-made man

By John Dunn

Employees at R.L. Hudson & Co. respect their boss so much they secretly nominated him for Tulsa's Small Business Person of the Year in 2003.

Nobody but Rick Hudson, IM 67, was surprised that he won.

"We did it behind his back," says Chris Owen, director of marketing for the firm that designs, engineers and supplies custom-molded rubber and plastic components.

"He didn't know about it until the week of the luncheon when it was going to be announced. We had to let him know so he would keep his schedule open that day," Owen says. "We didn't tell him he was going to win, we just told him he had to be there. He was actually rather surprised."

The Metropolitan Tulsa Chamber of Commerce and the Small Business Administration sponsor the award presented to the owner of a company with less than 100 employees.

Hudson is "a remarkable person to work for," says Owen, who has been with the company for seven years. "He's an entrepreneur and a hard-driving, type-A guy, but he has a very compassionate side and he really cares about the people who work for him. Everybody who works here just loves him."

The Tulsa award automatically made Hudson a candidate for statewide recognition and last April 1 he was named Oklahoma's 2004 Small Business Person of the Year.

"The timing of the news gave me pause," Hudson says. "It was April Fool's Day, right?"

Since 1980, when Hudson started as an independent dis-

tributor of seals and O-rings operating out of his Tulsa home, R.L. Hudson & Co. has become global, with locations in Arkansas, Ohio, South Carolina and Taiwan. The company designs and supplies products to some well-known brands and *Fortune* 500 companies, including Kohler, TRW, Coleman, DitchWitch, Jacuzzi, Mercruiser, Poulan, Rubbermaid and WeedEater.

Hudson has 80 employees and he says he tries to treat them well.

"We have beautiful offices," Hudson says. "Everybody has their own individual office. We have a profit-sharing plan, we contribute to their 401k plan and we pay all of their health insurance.

"In all honesty, since the business has grown, I derive more pleasure seeing my employees have a nice life than I do in my personal comfort. A lot of my competitors have vacation homes and airplanes. I get my kicks out of seeing my employees send their kids to college."

Employee morale is high, Owen says. "People don't generally quit from here. People don't leave voluntarily very often."

Hudson, 61, is founder, owner and chief executive officer of the company. Roger Stair, who has been with the organization for 17 years, is president.

Tulsa was the oil capital of the world in 1980 and many oil field equipment manufacturers were located there, Hudson says. They started out as the company's primary customer base.

"The business actually did fairly well the first year, we broke even," he says. "Then in 1981 we made a profit and we've made a profit ever since."

With the exception of the first year, the company has averaged 15 percent growth every year.

"We grew 37 percent in 2004," Hudson says. "At our sales meeting in 2003, we predicted we would grow from $19 million to $22 million. We actually hit $25.5 million. In 2005, we're projecting about $31 million."

The company has just outgrown a new 36,000-square-foot building in Broken Arrow, one of Tulsa's largest suburbs.

"We thought it would last us five years," Hudson says. "It lasted us one year. We're going to add another 35,000 square feet this year."

A native of Chamblee, Ga., Hudson grew up a Yellow Jackets fan, although his athletic ability as a football player earned him a scholarship to Vanderbilt University. "But they decided they didn't need a skinny, slow, 160-pound end who couldn't jump," he says with a laugh. Hudson transferred to Georgia Tech.

After graduating from Tech, Hudson joined Parker Seals in Culver City, Calif. By the end of his first day on the job, Hudson knew where he wanted his career to go.

Hudson explains that after work he was taken to dinner with some of the company's distributors who were in town. "They were all well-dressed and driving big cars and I said, 'These are obviously the successful guys. This is what I want to be.'"

Hudson spent the next 13 years working toward that goal.

After five years with Parker Seals, Hudson ventured into a partnership in San Francisco.

"I was a distributor, but I was a partner. I didn't have full control and I didn't like being in partnership," Hudson says. He left for a job with a division of Disogrin called Freudenberg, the largest seal manufacturer in Europe, and stayed with them until founding R.L. Hudson & Co.

"I had to learn my business," says Hudson, who became an expert on the properties and capabilities of synthetic rubber materials used in the sealing industry.

"When I started out I never thought that it would turn into what it has turned into. I had two young children and I was just hoping to make a good living." He and his wife of 33 years, Diane, have two sons, Jason and Blake. Two years ago, Jason joined R.L. Hudson as a territory manager.

Hudson began his company in June 1980 and by August it was growing fast enough for Hudson to lease a 2,500-square-foot building that had two offices and a warehouse.

But in 1982, Hudson says, "the oil industry went in the tank." Oil field equipment manufacturers began moving out of Tulsa to Houston and other cities. Hudson liked Tulsa and decided to stay.

"We had to redefine our business or go outside of Oklahoma and we were primarily an Oklahoma-based company," he says. The firm gradually expanded its territory into surrounding states.

The company's national expansion was triggered in 1987. Hudson says a company salesman knowledgeable about the organization's customers and operations left to start his own business in Tulsa.

"He went into competition with us," Hudson says. "It made us go completely out of Oklahoma into areas like Chicago and Cleveland and the South. And that's when our business really took off."

Hudson's aggressive sales ventures landed major accounts with Eaton Corp., Electrolux and Case/New Holland.

Several years ago Hudson observed that some of the large companies had begun to scale back their engineering departments. He decided to build up his department, which now has 10 engineers.

"We began positioning ourselves to fill the void left in those major corporations," Hudson says. "I've spent a lot of money on technology. Our engineers have whatever they need."

Hudson & Co. has the ability to perform elaborate CAD system designs and finite element analysis, allowing engineers to test models of component parts on a computer without having to create a prototype.

"It gives us a pretty good idea of how a part will function in an application," Hudson says. "Finite element analysis is something that many big companies don't have."

As a result, some major companies now turn to R.L. Hudson as their engineering arm, he says. "What this has done for us is we don't have to compete for commodity products, we get in on the design stage. This allows us to get in on the ground floor on many projects.

"We've been positioning ourselves to become technically the best company of our kind available and that has opened up the markets for us. And business is really booming — manufacturing is booming," Hudson says.

While the company designs and engineers component parts, it does not manufacture them. During the past 10 years, Hudson says, he has established business ties with five key factories in Taiwan and China to manufacture products for the firm.

Hudson says the company has introduced American and Japanese quality systems to the Chinese factories, significantly improving quality production. "We have taught our factories how to do process controls, capability studies and failure analysis," he says.

The company plans to enter into a partnership with a manufacturer in Guang Zhou, China, to supply products for some of its corporate customers that have moved operations to that country.

"Instead of buying it in China, bringing it over here and then sending it back to China, we have enough business that we can actually make the investment in rubber-molding equipment to make our first major step over there," Hudson says. In the future, the company may establish a Hong Kong distribution center that will open the door to European markets.

R.L. Hudson has invested more than $1 million in equipment to inspect and verify product quality of incoming goods.

"You cannot inspect quality into a product," Hudson says. "We test the parts and then we work with our suppliers in the early stages and correct the process so that the parts coming in are of high quality. We verify the materials. It's reduced our defective parts coming out of Asia from almost 30 percent to less than 5 percent return goods. We have less than 1 percent returned goods from our customers back to us. We have almost eliminated quality problems going out of here."

Hudson anticipates an obvious question: Why would someone want to buy from a company that buys products in China?

The answer to that he calls the Hudson advantages: technical and design expertise, high quality, competitive pricing, excellent supply chain management capabilities — 98.6 percent on-time delivery — wide product range and outstanding technical literature.

"Our O-ring design and materials guide is considered to be the best seal materials publication ever put on the market," Hudson says. "We publish great technical materials."

Hudson has surpassed his initial ambition to become a distributor.

"We don't consider ourselves a middleman or distributor anymore. We consider ourselves to be a design firm and a supply chain management firm," Hudson says.

He points out that supply chain management is a top priority of the company.

Oklahoma's Small Business Person for the Year is not known for resting on his laurels.

As far as customers are concerned, Hudson tells his staff, "You're only as good as your last time at bat." GT

Gift of the Generations

Moulthrop family carves art prized in major collections

By Kimberly Link-Wills • Photographs by Stanley Leary

Philip Moulthrop and his son, Matt, MBA 04, display a turned-wood bowl, a craft that has driven and supported three generations of the family.

Three generations of Moulthrop men have been able to look at a log and see the potential for a magnificent work of art. They have been inspired to produce incredibly beautiful wood-turned bowls. The family progression of distinctive handcrafted Moulthrop bowls are being showcased in some of the world's finest collections.

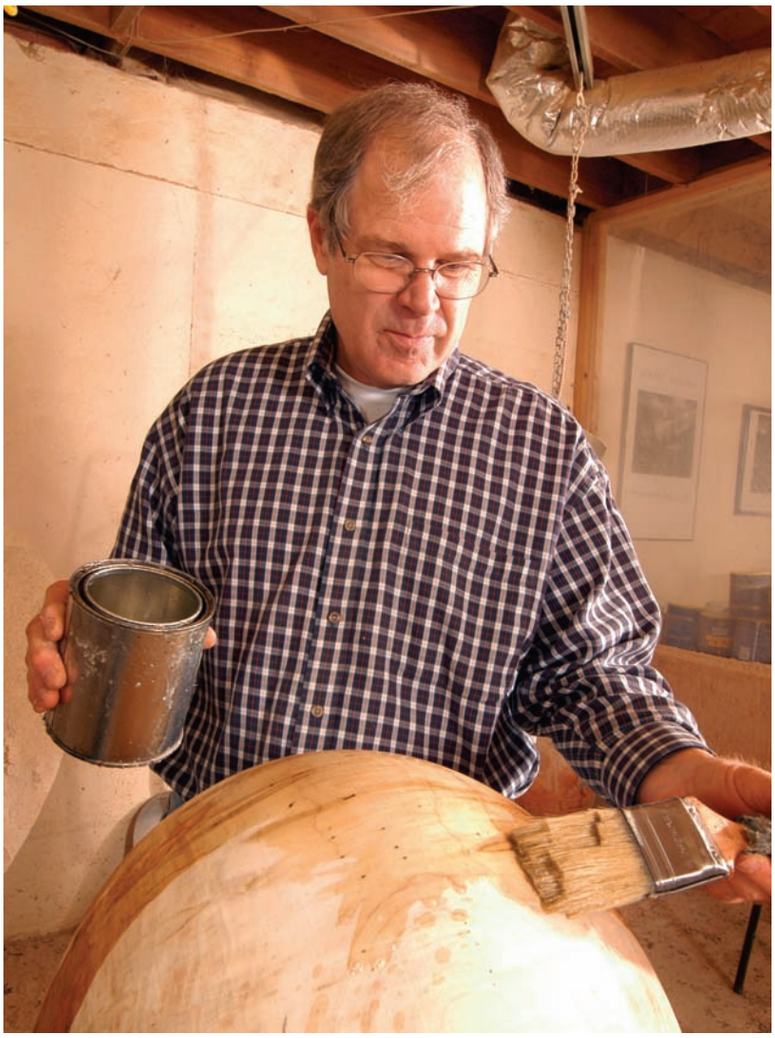
It started with Edward Moulthrop, who taught architecture and physics at Tech in the 1940s and was a self-taught wood turner. His son, Philip Moulthrop, a Marietta, Ga., attorney, also caught the passion. Philip's son, Matt Moulthrop, MBA 04, inherited the artistic talent and is now crafting his own turned-wood bowls that are being sold around the country.

Edward Moulthrop taught at Tech before moving on to private practice as an Atlanta architect. In his spare time, he painted watercolors and sculpted — until he discovered wood turning. Some of his most famous bowls, turned on a lathe with a tool drawn against the wood, reached up to 40 inches in diameter and four feet tall.

"It can be said that each bowl already exists in the trunk of the tree and one's job is simply to uncover it and somehow chip away the excess wood, much as you would chip away the surrounding stone to uncover a perfect fossil entombed in the stone," Edward Moulthrop once said.

By the early 1970s, Edward Moulthrop had left architecture to devote himself full time to his passion and his work became increasingly collectable. At the time of his death in 2003 at age 87, he was nationally renown as a pioneer and inspiration to others, including his son.

Philip Moulthrop began turning wood under his father's tutelage in the late 1970s. Within six months, he had set up his own basement studio and began taking a day off work here and there to fine-tune his craft. While his following grew, he worked



part time over the next eight years before leaving the courtroom behind completely.

While following in his father's path, Philip Moulthrop has established his own distinct style that includes a composite technique that results in a mosaic look in the wood.

"The mosaics actually make up a very small percentage of my work," Philip Moulthrop says. "But that's what people know me for — that and the ash leaf maples with a bright red pattern. My father's bowls were more symmetrical vertically and horizontally, more spherical. The big ones fascinated him."

Like his father, Philip Moulthrop has bowls displayed in prominent collections, including the Smithsonian American Art Museum in Washington, D.C., and the Museum of Deisgn in New York City. His work also is profiled in a book, *The White House Collection of American Crafts*.

Philip Moulthrop visited the White House during the Clinton administration when one of his bowls was displayed there. Over the past decade, the bowl has been part of a tour around the country and recently he went to view it during a stop at the Carter Center in Atlanta.

He works in various types of wood, but the trees are exclusively from the Southeast. He doesn't cut down the trees to feed his need to create. About half a dozen tree cutters know to call him when they find an interesting piece of a log that might make a beautiful bowl. At any given time, he will have about 70 logs outside his home waiting for him to picture the perfect pattern.

Depending on their size, Philip Moulthrop's bowls can take between two and eight months to complete. For a particularly large piece, he will first sketch the design he's looking for on paper or a big chalkboard he keeps in his studio. The completion includes a two-part polymer finish that makes the stunning pieces shine.

Because of the curing and drying of the wood and the finishing process, he can work on several pieces at once. He turns out about 150 bowls a year.

Philip Moulthrop's bowls, from the size of a baseball to 28 inches in diameter and priced between $200 and $10,000, can be found at The Signature Shop and Gallery in Buckhead as well as galleries in New York City, San Francisco, Santa Fe, N.M., Los Angeles and Scottsdale, Ariz. He usually leaves his basement studio to attend the show openings and meet the people who buy and appreciate his work.

He says for a person who is used to working with only a loud lathe as company, those crowded art shows filled with patrons jockeying for a word with the great wood turner are remarkably enjoyable. "They're a lot of fun."

Philip's son, Matt, was inspired by his grandfather in many ways, including his education.

"Some of the greatest friends that my grandfather made were from Georgia Tech," Matt says. "He always wanted one of his grandchildren to go to Tech."

Matt is the only one of the five Moulthrop grandchildren to attend the Institute and pick up his grandfather's craft, which he began learning as a child.

"He pioneered the wood-turning market in North America," Matt says. "He taught me everything I needed to know. I ended up working for him for almost 10 years."

Matt tried the 9-to-5 workaday world but was "miserable." Still, his father was concerned when Matt decided to turn wood full time. "You always want stability for your children," says Matt, who also lives and works in Marietta.

Philip says he eased into self-employment. "I got used to working by myself. It takes some adjusting. If you've been used to working around a lot of people, it takes some getting used to being by yourself and not talking to anyone all day. You have to have self-discipline and be able to schedule your time."

Calling his dad the most famous living wood turner, Matt says he learned finishing details and business skills from Philip Moulthrop and that they worked together to complete some of Edward Moulthrop's pieces when he became too ill to go into his studio.

The Edward Moulthrop bowl given to the College of Management was created in 2000. He had set it aside specifically to go to Tech after his death. The Philip Moulthrop bowl now housed at the College of Management was completed in 2002.

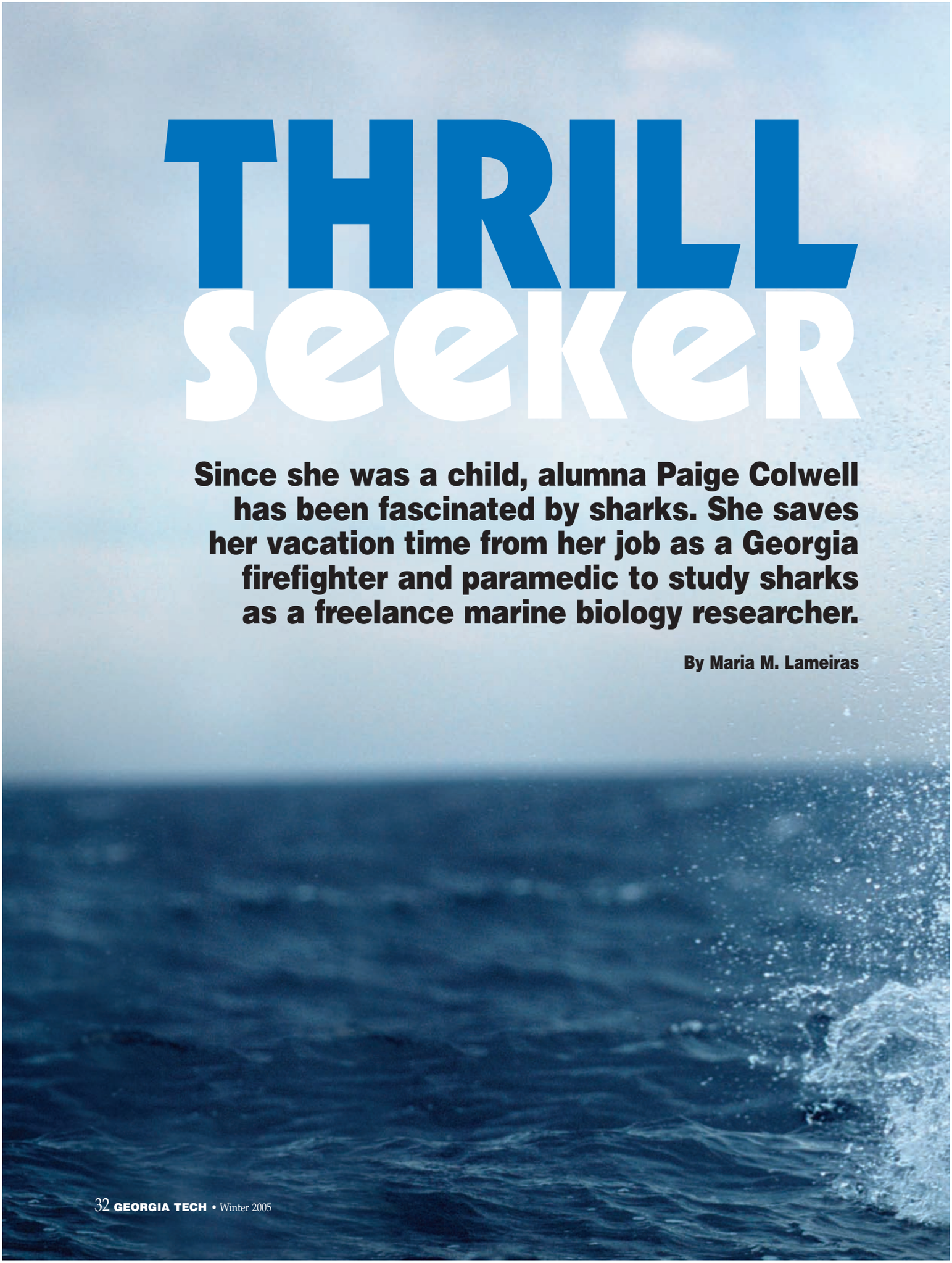
Matt Moulthrop currently is at work on a bowl that he plans to set next to those of his father and grandfather at Georgia Tech. **GT**

"He pioneered the wood-turning market in North America. He taught me everything I needed to know. I ended up working for him for almost 10 years."

THRILL seeker

Since she was a child, alumna Paige Colwell has been fascinated by sharks. She saves her vacation time from her job as a Georgia firefighter and paramedic to study sharks as a freelance marine biology researcher.

By Maria M. Lameiras



Chris Fallows

Caroline Joe

Paige Colwell could do anything she wants, and she does. As a firefighter and paramedic, Colwell is living "every kid's dream."

The sight of a great white shark swimming at her gives Paige Colwell a thrill. Colwell, Math 90, is a firefighter/paramedic and leader of the dive rescue team for the Forsyth County Fire Department in Georgia. She is also a dive instructor who carefully hoards her vacation time so she can pursue her lifelong passion for sharks as a freelance marine biology researcher.

"I'm never happier than when I see a shark. Nothing can put a smile on my face faster or keep it there longer than a shark. People ask if I am ever scared when I see a shark, but all I can think of is getting closer," Colwell says.

"I remember being in grade school and getting all A's because I knew my mom would take me to the bookstore and I always got a shark book. I carried them everywhere," she says with a laugh. "I guess I was fascinated because nobody knew much about them and because they were perfect in terms of what they were put on Earth to do. Also, to most people, they are scary and I've always had a thrill-seeking thing. It's just a kid's fascination that has stayed with me all my life. I wanted to know everything I could about every kind of shark and I still do."

Colwell's quest for knowledge about sharks has turned into advocacy as she discovered that virtually all species — particularly great whites — are becoming endangered by a combination of international commercial fishing and a bad reputation.

"We know next to nothing about great whites, and they are being slaughtered by the thousands every year" along with dozens of other species, Colwell says.

Fishing of white sharks and other species is illegal in many places, and the great white has been placed on the endangered species list, but enforcement is sporadic.

"Even if we have laws to protect the species, how can you enforce that? A lot of it is up to the scientific community," says Colwell, adding that while on a research trip to Seal Island in South Africa fishermen were trying to hook the sharks the researchers were baiting for recording purposes.

"We surrounded their boat with ours and harassed them until we chased them off. People catch these sharks for their fins — shark fin soup is considered a delicacy in many places and is very expensive. These fishermen cut the fins and tail off and they throw the sharks back in the water to die," Colwell says. "Sharks also die as bycatch in nets and from long line fishing. Fishermen put out these long lines that extend for up to 60 miles. Almost a third of the catch is bycatch, including sharks, turtles and dolphins."

A smaller part of the danger to sharks comes from sport fishermen out to catch what they view as a killer, she says.

"In recent years we saw all of the news reports of shark attacks, but that was sensationalized. Shark attacks were statistically down during that time. Sharks don't like to eat people, they really don't. In October, we were diving off Isla de Guadalupe, Mexico. We were outside the cages with three or four sharks circling around and bait in the water and they didn't bother us," Colwell says.

In Guadalupe, Colwell and her colleagues saw no sharks larger than 15 feet, just into the mature range for great whites.

"Great white sharks take 12 years to reach sexual maturity and they are very slow to reproduce, that's the problem," she says. "There are many species found off the U.S. coast whose numbers are 80 percent depleted."

According to trade publications, 533 tons of shark fins were exported from Costa Rica in 2003. Estimating that a shark's fins account for 5 percent of its weight, that equates

"I teach scuba classes and I give an hour-long talk on sharks and diving. Whenever you broach the subject, the first question I always get asked is: 'Aren't you afraid they'll eat you?'"

to 533,000 sharks killed by commercial fishermen in Costa Rica alone, according to the data.

"Fishermen are also seeing a decline in bycatch of sharks in nets and that also indicates that numbers are down," she says.

Colwell pays for the expeditions she goes on and shares the information she collects on data sheets she has devised with the Shark Research Institute and other researchers, including Scott Davis, a University of California PhD student who has received grants from the National Geographic Society to track the movements of great white sharks.

In addition to Guadalupe, Colwell has traveled to the Galapagos Islands, South Africa and Costa Rica. In April, she will make a trip to Thailand with a Shark Research Institute expedition to study whale sharks and leopard sharks.

The exploitation of sharks as vicious, man-eating monsters irritates Colwell.

"That isn't how sharks are," Colwell says. "On our dives in Guadalupe, we hardly ever used the cages and the sharks were swimming 10 to 20 feet away from us. We began to recognize the sharks' unique personalities. Most of them were very laid-back. They moved very slowly and stayed at a distance, they were very tentative. Then there was one we nicknamed Psycho. He had no fear. He was in your face all the time, wanting to know more about you."

Colwell and other researchers hope to change the killer image of sharks and spearhead preservation efforts to convince shark-hunting nations that the economy would benefit more from ecotourism.

"Sharks definitely suffer from an image problem. The Shark Research Institute has been somewhat successful with that in a few countries. With the fascination people have for sharks, they can actually get a lot more money over the long run by building the tourism economy around shark diving rather than killing sharks," Colwell says.

"I teach scuba classes and I give an hour-long talk on sharks and diving. Whenever you broach the subject, the first question I always get asked is: 'Aren't you afraid they'll eat you?'" she says, sighing and throwing her head back. "I have to tell them that when I'm diving I have to be very careful not to scare the sharks away. Everyone is nervous, but once they have dived and seen a shark, there is a 100 percent turnaround in how they feel about it."

In the shark dives she has been on, Colwell has rarely used a shark cage, preferring the clear view of open water to film and photograph sharks for identification purposes. Among the data Colwell records are the distinct markings of each shark.

"Great white sharks are dark on the top and lighter underneath and where those colors meet is like a fingerprint on a

Courtesy of Paige Colwell


Chris Fallows

person. The pattern is unique on every shark and you can use it to identify them by just looking at them. We can use this information to see if sharks are a migratory species or whether they stay in one area. All of the data collected is used for behavior research and tracking," she says.

"What kind of information you are tracking is different depending on what you are going for. In South Africa we wanted to identify individual sharks so that over a period of years you can say, 'OK, shark A always shows up this time of year with sharks B and C. Are they traveling in loose groups or are they loners? What are the shark populations doing? If we are seeing the same sharks coming in together, where do they go from there?'"

The main focus of the research, however, is sustainability of shark species.

"What is the importance of that? Sharks are at the top of the food chain. Sharks feed on sea lions. What happens if we don't have sharks? Sea lions have then lost a major predator. Sea lions eat fish and other marine animals. What happens then? Will the fishermen then not catch as much fish because of sea lion overpopulation? We don't know," Colwell says.

When not on expeditions around the world, Colwell often gets questions about her chosen profession as a paramedic and firefighter.

In addition to her math degree, Colwell has earned a certificate in health and performance science from Tech and has completed the entire course of basic organic chemistry and premedical classes available from the Institute.

In 1998, she enrolled at Emory University medical school to become a physician's assistant, but dropped out of classes after contracting Lyme disease and never returned. In 2000 she received a PhD fellowship in ecology, evolution and behavior at Tech but chose not to pursue it.

"I can't see myself working a five-day schedule right now," says Colwell, who works a 24-hour shift at the fire department, then is off for 48 hours. On her "off" days, she works at an emergency clinic, teaches classes in emergency medicine at Lanier Tech in Cumming, Ga., teaches dive classes and does guest lectures on emergency medicine for Tech physiology professors Phillip Sparling and Mindy Millard Stafford.

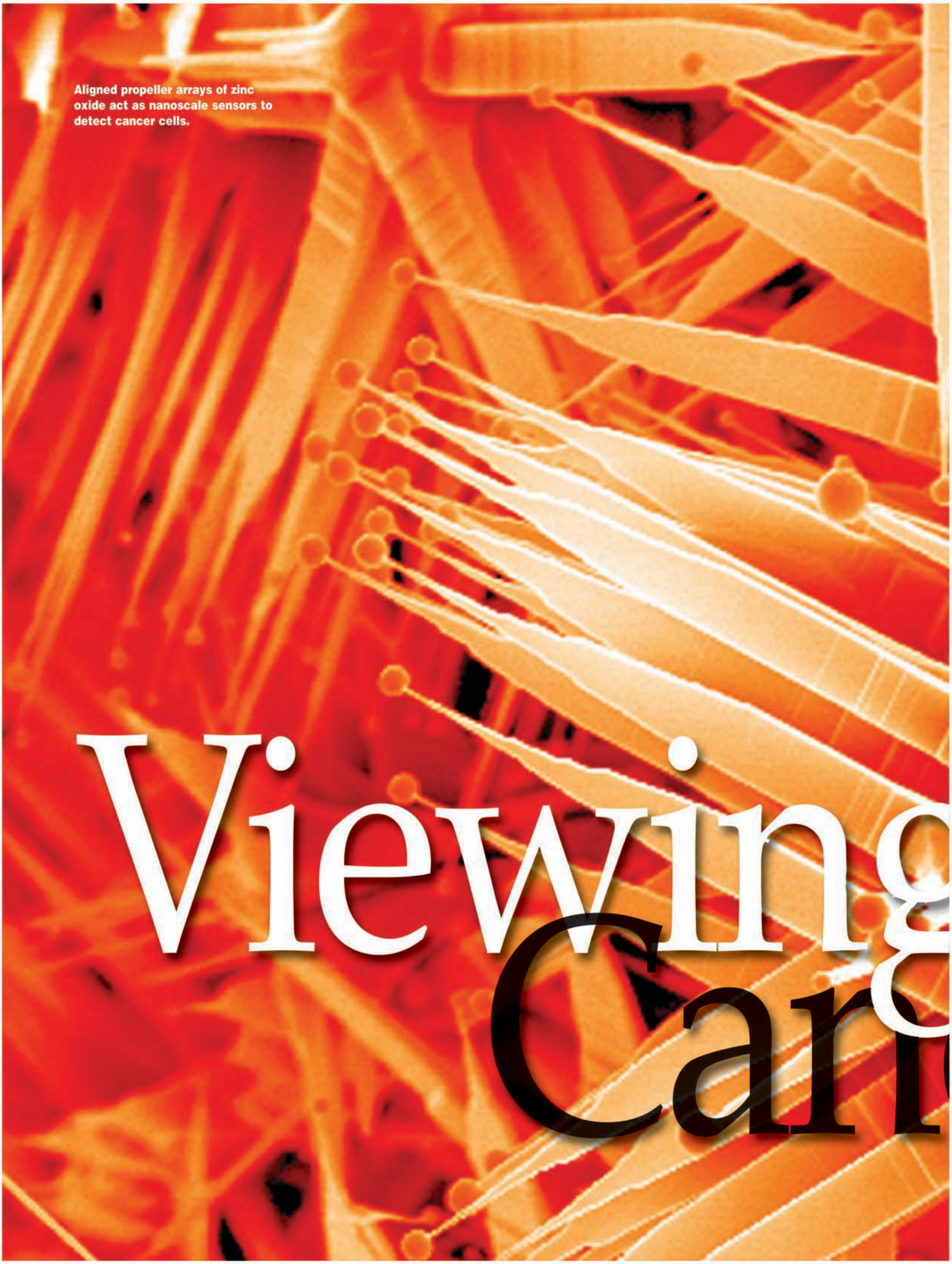
In the spare time she doesn't spend on sharks, Colwell enjoys rappelling and spelunking and rides motorcycles and dirt bikes.

Photos on a Web site created by Colwell's friend and fellow firefighter Lewis Puckett (http://www.lewispuckett.com/paige.html) show Colwell rappelling into Neversink Pit, a 165-foot-deep, open-air pit located in Alabama.

"Well, what can I say, this girl never slows down," Puckett writes about Colwell on his Web site. "She can hang with the best of them as far as stamina in running, caving or adventure sports."

When someone, inevitably, asks Colwell why she's "just a paramedic," she has an answer ready.

"I spent a long time trying to tell myself I had to do something that's not 'just a paramedic,' then I realized it doesn't matter what credentials I have behind my name," says Colwell. "It's about whether I love going to work every day and I do. And I get to ride a big, red fire truck every single shift. That's every kid's dream." **GT**



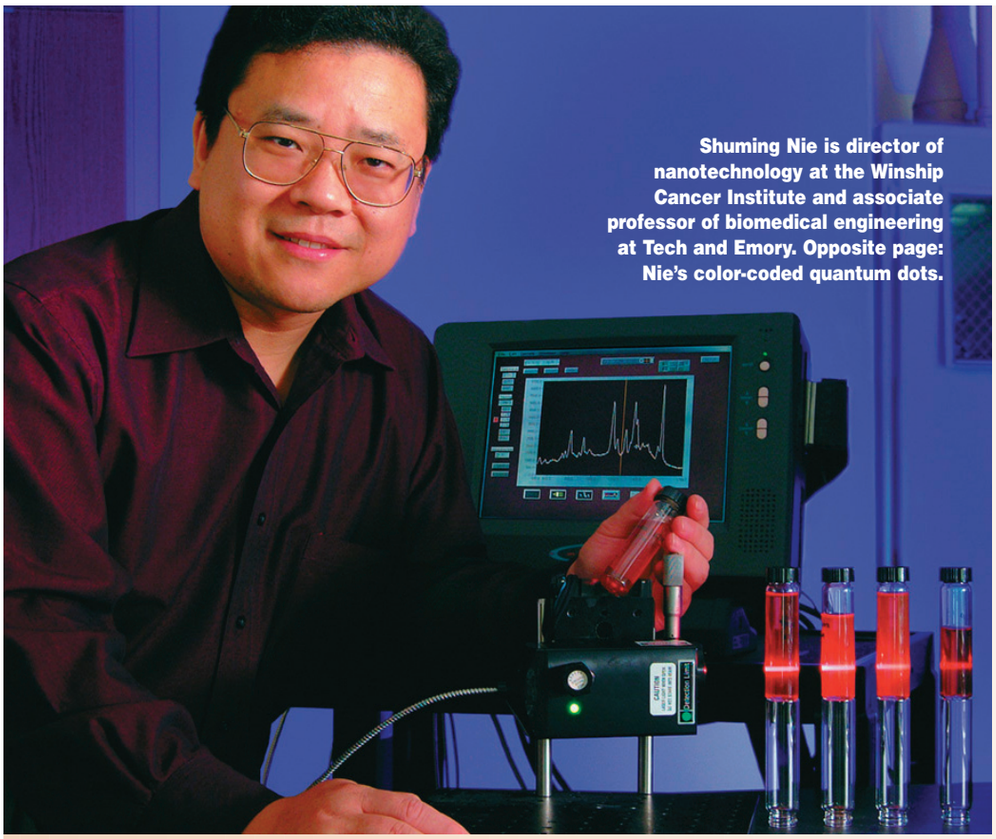
Aligned propeller arrays of zinc oxide act as nanoscale sensors to detect cancer cells.

Viewing Can

Courtesy of Z.L. Wang

Advances in molecular biology, nanotechnology, computer imaging, tissue engineering and other technologies are enabling researchers to develop new molecular-based approaches in the understanding and treatment of cancer.

Cancer in a New Light



Shuming Nie is director of nanotechnology at the Winship Cancer Institute and associate professor of biomedical engineering at Tech and Emory. Opposite page: Nie's color-coded quantum dots.

By Gary Goettling

Shuming Nie has a headache. He knows from past experience that Tylenol won't help, but Excedrin's different ingredients will provide immediate relief. The intriguing question is why. More to the point, why does a similar inconsistency exist in treatment for other illnesses, specifically cancer?

"The idea that one medicine does not cure all patients has been known for more than 100 years," says Nie, an associate professor in the Department of Biomedical Engineering at Georgia Tech and Emory University. "There has to be a molecular difference among people that causes them to respond to therapeutics in different ways, whether you're talking about a common headache or cancer."

Advances in molecular biology, nanotechnology, computer imaging, tissue engineering and other technologies are enabling researchers to develop new molecular-based approaches in the understanding and treatment of cancer.

"If we can use nanotechnology to figure out the molecular differences between people," Nie explains, citing his specialty as an example, "we can diagnose the disease more effectively and administer treatment tailored to an individual's molecular profile."

A molecular approach

Nie's comments reflect an important shift in cancer research in recent years.

"In the past, cancers were largely treated based upon the tissue type," says Terri Battle, Biol 93, a postdoctoral research scientist with the Dana Farber Cancer Institute in Boston. "If you had breast cancer you were treated in a certain way; if you had colon cancer you were treated in a different way. It was clear that some people responded better than others.

"With the advent of new molecular and cell biology tools," she notes, "we've come to appreciate that these seemingly unrelated cancers may have similar molecular mutations. The goal today is to discover the mutation driving the cancer and then treat that mutation."

Cancer research at Georgia Tech embraces a spectrum of technologies, from improvements in traditional therapies to studies of cancer's development in molecular detail. Much of the work involves collaboration with Emory University scientists through the joint Department of Biomedical Engineering.

Innovations at the nanoscale

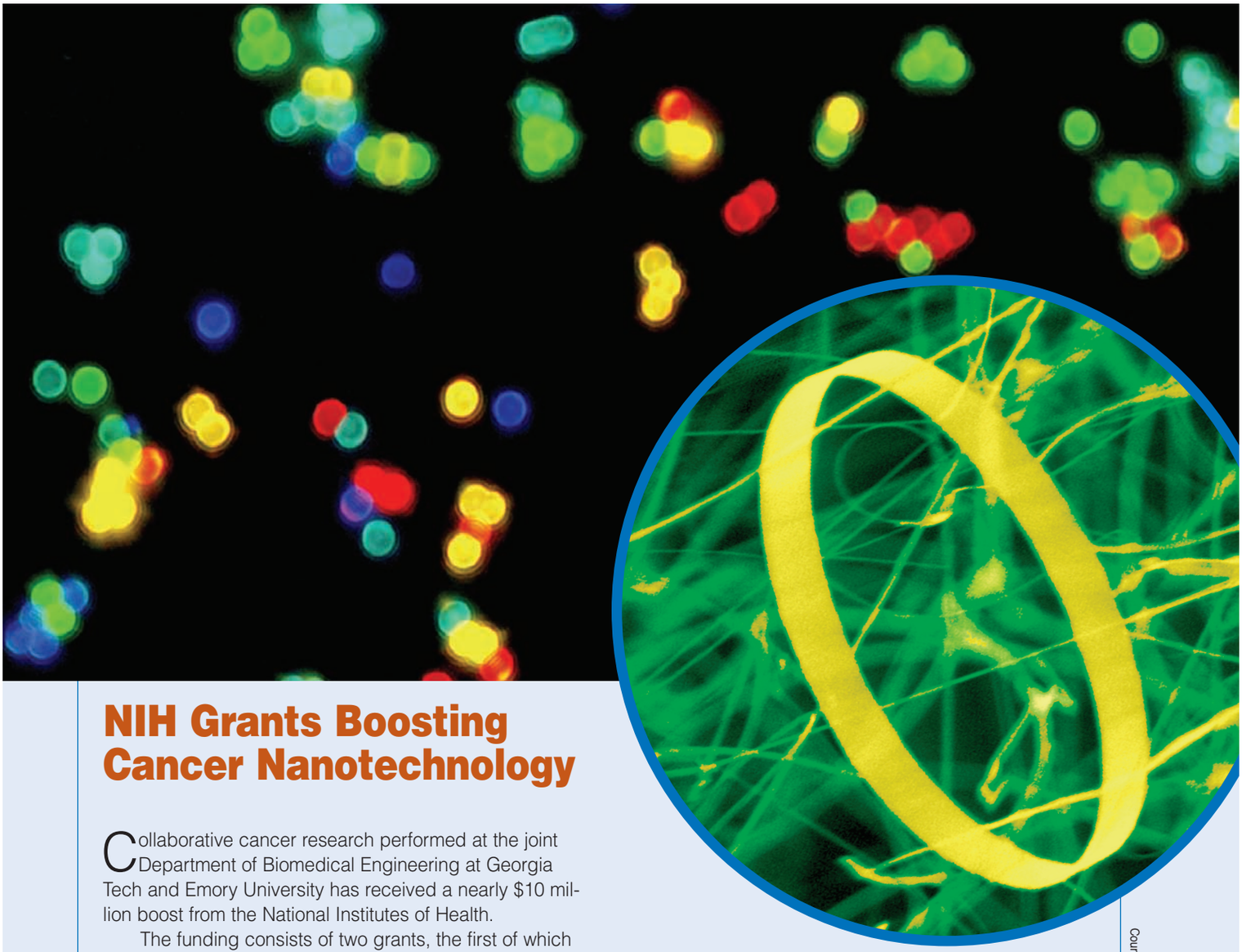
Nie's quantum dots may one day aid in the early detection, diagnosis and treatment of cancer. The dots are multicolored, fluorescent nanoparticles that can be injected into tissue and programmed to attach to specific biological molecules such as genes and proteins. The technique allows doctors to view a spectrographic profile of an individual's unique body chemistry as well as the location and distribution of selected molecules or markers associated with cancer.

After the markers are labeled with color-coded quantum dots, Nie's computer-based algorithm converts the optical information into biological data. He then knows which markers are and are not present, as well as their distribution over the surface of a cell. He also knows when enough markers converge to indicate the presence of cancer.

The quantum dot technology could also prove useful for delivering more-effective, targeted cancer drugs. Nie notes that doctors have long been puzzled by variation in the performance of medicines and believes the interaction between a drug and an individual's body chemistry may hold the answer.

With molecular profiles and testing, pharmaceutical companies could match drugs with specific profiles to achieve the optimal therapeutic benefit.

"If we can use nanotechnology to figure out the molecular differences between people, we can diagnose the disease more effectively and administer treatment tailored to an individual's molecular profile."



NIH Grants Boosting Cancer Nanotechnology

Collaborative cancer research performed at the joint Department of Biomedical Engineering at Georgia Tech and Emory University has received a nearly $10 million boost from the National Institutes of Health.

The funding consists of two grants, the first of which is a five-year, $7.1 million award earmarked to establish a bioengineering research partnership in cancer nanotechnology.

The second grant provides $2.7 million over four years to develop nanoparticle probes for molecular and cellular imaging of cancer. It was awarded by the National Institute of General Medical Sciences, an NIH unit.

"It will be exciting to help support some of the very interesting project applications we've received," says Al Merrill, a biology professor who chairs the Cancer Research Council at Georgia Tech. The council was formed in 2002 to facilitate cancer research at Tech and foster collaboration with Emory and other universities.

Tech and Emory scientists involved in the bioengineering research partnership will develop advanced nanoparticle technologies for extremely sensitive profiling of biomarkers on cancer cells and tissue specimens.

The scientists' multidisciplinary work will combine traditional pathology and cancer biology with highly sensitive molecular analysis and incorporate expertise in bioengineering, bioinformatics, tumor biology, bioanalytical chemistry, systems biology, hematology, oncology, pathology and urology.

Nanoscale rings of zinc oxide can convert a mechanical signal into an electrical signal to detect single cancer cells.

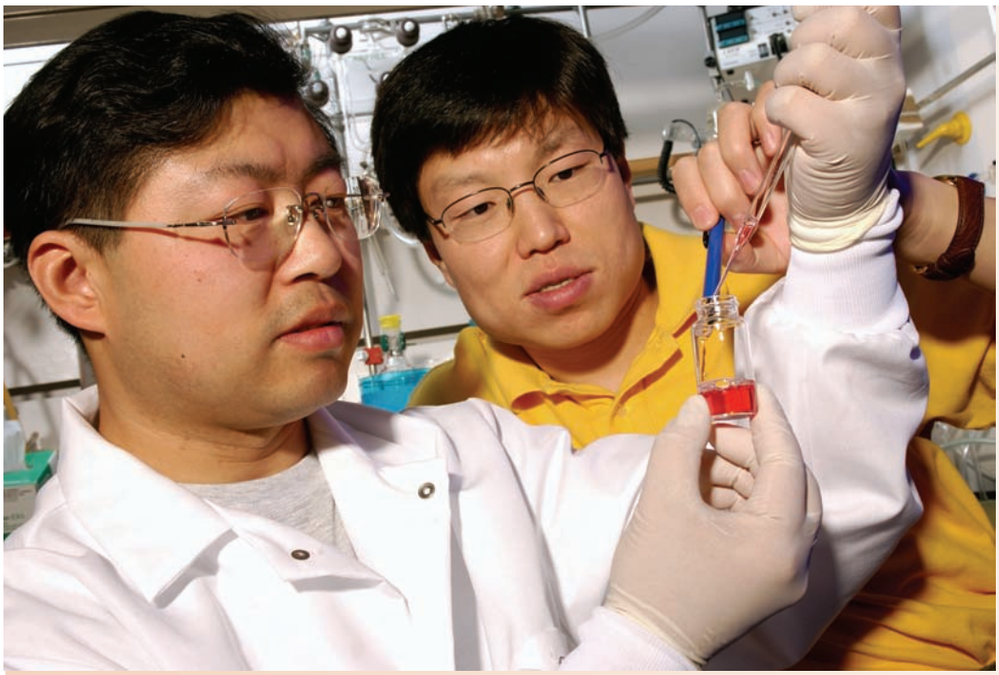
Courtesy of Z.L. Wang

In addition to basic knowledge on cancer biology and biomarkers, the partnership is expected to produce a database linking molecular signatures with clinical outcome, a new class of nanoparticles for molecular profiling of cancer, and imaging microscopes and software integrated with the advances in nanotechnology.

The second, exploratory center grant will support development of advanced nanoparticle quantum dot probes for molecular and cellular imaging. Quantum dots are nanoscale, luminescent semiconducting crystals with unique electronic and optical properties due to their small size and their highly compact structure.

"The goal of this exploratory program is to develop a new class of bioconjugated quantum dots that can both image and target single-molecule processes in single living cells," says Shuming Nie, an associate professor in the Department of Biomedical Engineering at Tech and Emory and inventor of the quantum dot technology.

— Gary Goettling



Gary Meek

Gary Meek

Yadong Wang, right, and his research team, including Jin Gao, use three-dimensional modeling to study cancer biology in a controlled fashion.

For all the progress in cancer detection and treatment over the past 30 years, much remains unknown about the incredibly complex molecular-level processes that cause and sustain cancer. But one thing seems certain: Every type of cancer has a molecular basis.

An assistant professor in the Department of Biomedical Engineering, May D. Wang's long-term research interest is to identify cancer-specific molecular profiles, the biopathways that guide their function and interaction and then incorporate the information into an "-omic" (genomic, proteomic, metabolomic) data-analysis system that can help uncover the fundamental mechanism of cancer. Her overall goal is to aid doctors and researchers in early detection of cancer and provide a tool for cancer drug-target screening.

The profiling task is aided by algorithms designed by Wang and her collaborators to analyze gene-level, protein-level and organ-level data obtained from microarray, protein array, imaging mass spectrometry, nanoscale optical imaging and 3-D medical imaging.

Reconstructing molecular biopathways involves a new modeling framework developed specifically for the project by Wang that focuses on metabolic and signaling pathways.

Once the molecular profiles and pathways have been identified, she plans to archive the data in a comprehensive bioinformatics system that will make the information accessible to the medical community and other researchers. In addition, the system will be able to support clinical practice and biomedical training by presenting the signature genes, proteomic molecular profiles, biopathways and molecular- to organ-level imaging data in a real-time, 3-D immersive visualization system.

Molecular profiles in treatment

Ovarian cancer has earned its deadly reputation by exhibiting virtually no symptoms in the beginning. Even later-stage symptoms such as weight loss and digestive problems are frequently misdiagnosed, but by then it's often too late to stem the disease's relentless advance into other organs.

An early-detection program could save thousands of lives, and it's high on the research agenda of John McDonald, chair of the School of Biology.

McDonald joined the Tech faculty this past summer and quickly established a laboratory on campus as part of the Ovarian Cancer Institute, a medical practice and research group he heads along with Dr. Benedict Benigno, a gynecological oncologist.

OCI was formed three years ago to develop a simple, early-diagnostic test to detect ovarian cancer and also to develop effective nonsurgical therapies for the disease. Ovarian cancer strikes about 27,000 women in the United States each year. Only about a third live more than five years after their initial diagnosis, but the survival rate for patients whose cancer is found early is 85 percent.

The nonprofit OCI promotes collaborative efforts by scientists from Tech, Emory University, the University of Georgia, Georgia State University, Clark Atlanta University and the Medical College of Georgia.

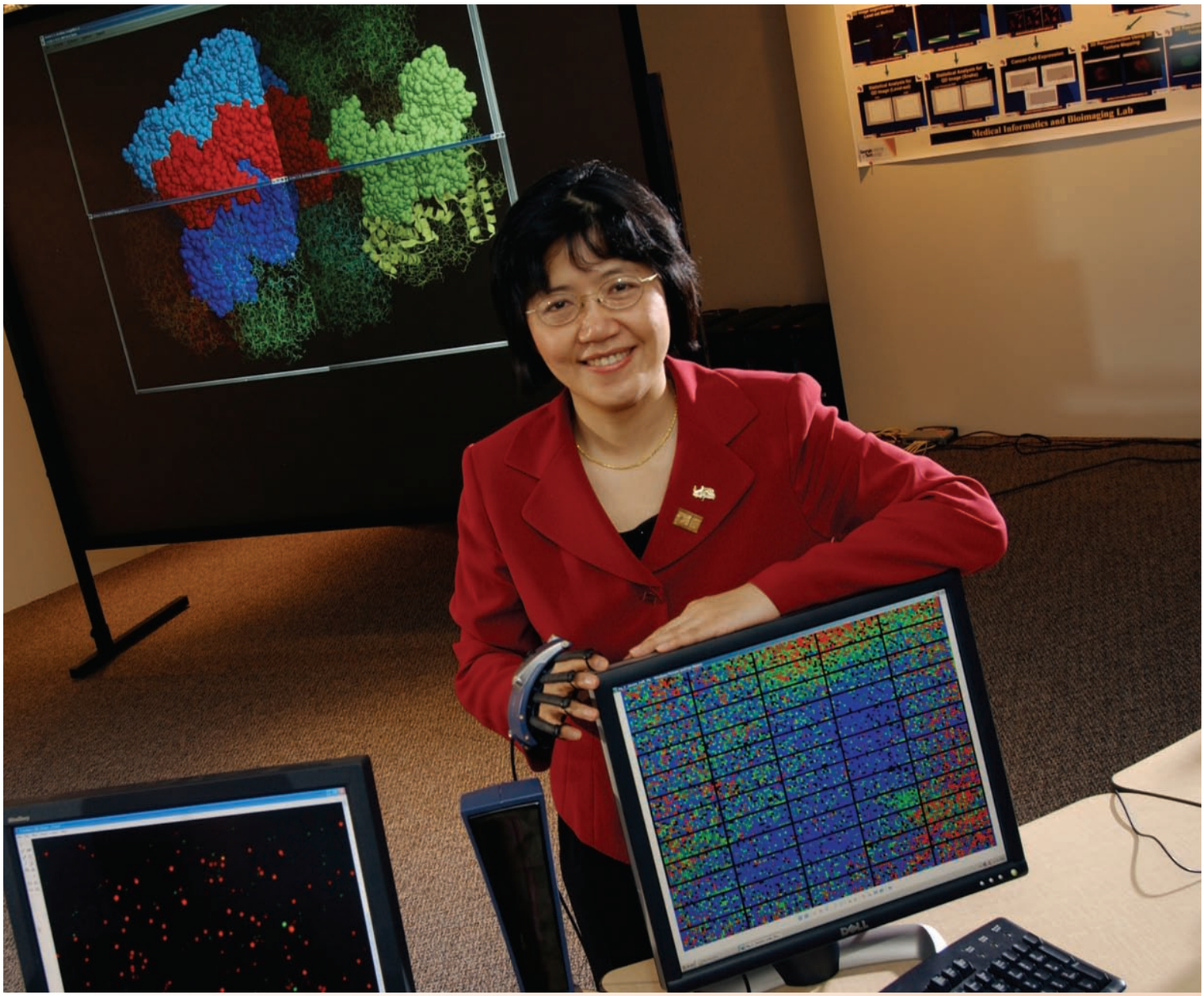
One concept under investigation at OCI is that abnormal adult stem cells play a major role in the establishment and propagation of ovarian tumors and that chemotherapy fails to destroy these regenerative cells, according to McDonald.

Isolating the stem cells and evaluating their response to chemotherapeutic drugs would test the hypothesis and, if correct, point to a new treatment regimen, he adds.

In another project, McDonald and his research team are creating molecular profiles of ovarian tumors to identify cancer subtypes. The idea is that by classifying cancer with greater precision, doctors can prescribe the most effective treatment by matching a particular cancer subtype with a specific chemotherapeutic drug.

"A lot of anticancer drugs work brilliantly in the animal model, but fail in human clinical trials. On the other hand, some drugs fail in animal tests, but that doesn't mean they won't work in humans."

Gary Meek



May D. Wang is conducting research to identify cancer-specific molecular profiles and uncover the fundamental mechanism of cancer.

Studying cancer in 3-D

Since most cancer experiments can't be performed on humans, the next best thing would be to create a living, three-dimensional model. That's exactly what Yadong Wang is doing.

In collaboration with Leland Chung of Emory University, Wang, an assistant professor in the Tech-Emory biomedical engineering department, is working with biomaterials and tissue engineering techniques to build a model of a cancerous prostate. The structure will be comprised of a biomaterial scaffold seeded with prostate cancer cells.

"It will allow us to study cancer biology in a controlled fashion," Wang explains. "There are many parameters that can affect cancer and this will allow us to isolate them for closer study."

The model would augment the conventional venues of animal models and two-dimensional cell cultures and provide additional experiment data by virtue of its realism.

Human cancer cells behave differently in a 3-D environment than they do in Petri dishes, and the physiology of animals is often different from that of humans, Wang says.

The 3-D model idea could be adapted for other cancers such as breast, ovarian and lung. The artificial prostate could also serve as a test bed for new cancer drugs, Wang adds.

"A lot of anticancer drugs work brilliantly in the animal model, but fail in human clinical trials," he says. "On the other hand, some drugs fail in animal tests, but that doesn't mean they won't work in humans.

"If we can develop a good model that can reproduce human cancer, my hope is that pharmaceutical companies may be able to use that model to evaluate their potential drugs better," Wang says.

Down the road, he adds, it is possible to individualize the model with genetic profiles reflecting some of the molecular influences associated with prostate cancer.

Laura Sikes

Alumna Sahar Javanmard, a postdoctoral fellow at the National Cancer Institute in Frederick, Md., is working to develop chemotherapeutic drugs that will improve the effectiveness of chemotherapy.

Improving Chemotherapy

Sometimes the medicine can be as deadly as the disease. Chemotherapy is widely used to treat a variety of cancers, but there's a downside.

"It kills cells, but it doesn't differentiate between tumor cells and normal cells," says Sahar Javanmard, Chem 95, PhD 02. "We're trying to come up with a way for chemotherapeutic drugs to selectively hone in on tumor cells and improve the effectiveness of chemotherapy."

Javanmard is a postdoctoral fellow at the National Cancer Institute in Frederick, Md., where she works in the Laboratory of Comparative Carcinogenesis. The facility is part of the National Institutes of Health.

The human body is equipped with its own defenses against mutation, a protein called alkyltransferase that repairs DNA damage arising from exposure to everyday carcinogens, many of which are naturally occurring, found in the environment or in some foods, according to Javanmard.

The problem is that alkyltransferase also helps tumor cells resist chemotherapeutic treatment.

"We are developing compounds which inactivate alkyltransferase so that chemotherapeutic drugs can alkylate the DNA and inhibit tumor growth," she explains.

Her job is working with those compounds to improve their selectivity.

Javanmard says that her fascination with applied research began during her undergraduate years at Tech, where she worked in Leon Zalkow's lab and later with John Haseltine. As a graduate student, her doctoral thesis involved developing treatment agents for cocaine abuse.

After graduation, "I wasn't necessarily looking for a job in cancer research," she says. "I applied for some positions at the National Institutes of Health and happened to get this one."

The deal was sealed when her husband, Babak Nikoobakht, PhD 02, also landed a job in Maryland as a chemist at the National Institute of Standards and Technology.

"I'm very interested in medicinal chemistry — trying to synthesize drugs to address some kind of disease," Javanmard says. "It's a very rewarding way to make a living."

— Gary Goettling

Gary Meek

Probing a link to hormones

Marion Sewer, an assistant professor of biology, investigates genes that encode a particular family of hormone-producing enzymes. She is interested in identifying the molecular processes that activate these genes in response to chronic stresses.

Her pioneering work is formidable because of the nuances and complexity of the disease itself, even though its method is not.

"There's no one particular set of symptoms that describe cancer," she says. "It can manifest itself in many ways, but all cancers operate as a population of cells that grows out of control.

"With a few exceptions like the skin or the gut lining where cells are made all the time, once a cell matures it doesn't divide again."

The growth of some cancers has been linked to an overproduction of hormones. Breast cancer, for instance, is typically accompanied by higher-than-normal levels of estrogen.

Understanding why hormone-producing genes become so highly active could lead to a better understanding of the mechanics of cancer itself — and to new drugs to prevent or control it.

Sewer and her research team believe that by figuring out why the genes become overexpressed or overactive in the first place, they'll be able to find a way to maintain their normal function.

One gene family in particular, called cytochrome P450 1B1, has been linked to many cancers, but what triggers activation of this gene is not fully known, says Sewer, noting that the gene has been found to be overexpressed in about 95 percent of cancerous breast tissue.

The gene converts estrogen into a toxic compound that binds to DNA, eventually leading to cancer. Finding ways to control the gene's activity only in the affected area of the body — say, the breast — could lead to new drugs to control cancer.

Pharmaceutical payload

What's old is new again, at least in the case of a drug developed a decade ago at Georgia Tech that may have a

Jim Powers developed the drug AK295 that inhibits proteases, enzymes that figure in digestion, blood clotting and hormone activity. They are linked to metastasis in cancer and tumor growth. The compound has proven its worth in alleviating numbness and tingling.

new application mitigating a side effect of chemotherapy.

The compound called AK295 has proven its worth in alleviating numbness and tingling in the outer extremities of head injury and stroke models in animals, according to Jim Powers, a Regents' professor in chemistry and biochemistry who developed the drug. The condition also affects about 40 percent of breast cancer patients who take the drug Taxol.

AK295 inhibits proteases, enzymes that figure in digestion, blood clotting and hormone activity. They also are linked to metastasis in cancer and tumor growth.

The next step for Powers and his collaborator, Jonathan Glass of Emory University, is to test the drug in human clinical trials, which could take five years, Powers says.

L. Andrew Lyon, associate professor at Tech's School of Chemistry and Biochemistry, has helped develop nano-size particles called core/shell nanogels that can target and trick cancer cells into absorbing them, with the potential for delivering a pharmaceutical payload from within and avoiding the damage to healthy cells caused by traditional chemotherapy. Lyon is working with Purdue University chemistry professor Jean Chmielewski on the research.

Cancer cells have more receptors for folic acid and absorb more of the nutrient than healthy cells. In a Trojan horse-type approach, the researchers covered the surface of the nanogels with folic acid, disguising the particles as an essential nutrient. Once the cancer cells absorbed the particles, researchers increased the temperature of the cells, causing the particles to clump together and shrink.

This shrinking process can potentially be used to expel a drug into the cell just as one would squeeze water from a sponge, Lyon says. By applying a targeted heat source —- like ultrasound — only to the tumor, doctors should be able to avoid killing healthy cells that happen to take in the nanoparticles.

Traditional chemotherapy, by contrast, affects tumors and healthy cells alike. Nausea, vomiting, hair loss, anxiety and a reduction in red blood cells are just some of the side effects that can occur with chemotherapy. The next step is to see how the nanoparticles behave with a toxic payload.

"In the lab right now we're loading particles with anticancer agents and understanding the fundamentals of how the particles can encapsulate them, how tightly they can hold onto them and how closely we can regulate the uptake and release," Lyon says.

Enhancing the body's defenses

Like an enemy army, cancer must first neutralize the target's defenses before taking over new ground.

In the human cell, a protein called p53 plays a significant role in preventing disease by promoting growth in healthy cells. It also inhibits growth in cells with DNA damage and facilitates repair or, when the DNA is too badly damaged, triggers the cell's destruction.

"There's no one particular set of symptoms that describe cancer. It can manifest itself in many ways, but all cancers operate as a population of cells that grows out of control."

Gary Meek

Harish Radhakrishna, pictured with doctoral student Mandi Murph, is building on research that shows higher-than-normal levels of fat-like molecules called LPA can stimulate tumors caused by lung, breast, prostate and ovarian cancer.

An inactive or mutated p53 is an open door to cancer and is found in half of all human variants of the disease.

Harish Radhakrishna, an assistant professor of biology, is building upon previous research that showed higher-than-normal levels of fat-like molecules called lysophospholipids (LPA) in ovarian cancer patients. LPA, while contributing to normal physiological functions including muscle contraction and healthy cell growth, can also stimulate tumors caused by lung, breast, prostate and ovarian cancer.

Radhakrishna and his graduate students have discovered that high LPA decreases the protective functions of the p53 protein, suggesting a means that allows cancer cells to multiply unchecked.

The research could lead to LPA-controlling drugs as a way of combating cancer. In the meantime, Radhakrishna is studying the interaction between LPA's signals and cells and how those signals are interpreted to incapacitate the p53 protein.

Imaging and early detection

Imaging technology is one of Xiaoping Hu's many research interests. A Georgia Research Alliance eminent scholar and a professor in the Department of Biomedical Engineering at Georgia Tech and Emory, Hu is helping improve the quality of information provided by magnetic resonance imaging, a key tool for tracking cancer's presence through the body over time.

He is part of a team developing new contrast agents to highlight a defined target for MRI scans, thus allowing for more specific and sensitive diagnostic imaging. At present, cancer won't show up on MRI scans until it reaches a certain size. Hu's work could lower that size threshold considerably, enhancing the chances of early tumor detection.

Another project employs an external probe coupled with MRI and magnetic resonance spectroscopy to produce significantly clearer images of the prostate.

The device, though still in its early stages, would replace internal probes that are uncomfortable for the patient.

Collaboration a powerful tool

The collective experience of thousands of breast cancer patients could become a powerful new way to diagnose and treat the disease.

Chris Barnes is building a user interface and database management system of medical case histories to aid radiologists and medical researchers.

The archived database would consist of digitized mammograms from previous patients along with interpretations of the images, diagnoses, treatments and outcomes, according to Barnes, an associate professor of electrical and computer engineering with Georgia Tech's Regional Engineering Program in Savannah, Ga.

The questionable portion of a patient's digitized mammogram would serve as a query for the database, much as a word or phrase works in a text search of the Internet.

Searches conducted from a desktop

Gary Meek

computer in the doctor's office would retrieve all of the histories and mammograms matching the query pictures. Searches could also be conducted for any kind of matching text information in the records, which may even include genomic-related data.

The ability to perform comparative analysis quickly and easily could improve the accuracy of breast cancer diagnoses while reducing the high rate of unnecessary biopsies, Barnes says.

Diet may prevent cancers

Can eating ice cream help prevent colon cancer? Studies by Al Merrill, who holds the Smithgall chair in molecular cell biology in the School of Biology, suggest that a unique type of fat present in soy and dairy products plays an essential role in maintaining healthy signaling pathways among and within cells.

Sphingolipids have demonstrated cancer-suppressive effects in many types of cancer cells in culture and lab mice with either colon or prostate tumors, according to Merrill. Further investigation indicates that even the modest amounts found in some foods are effective.

"We've done experiments with sphingolipids from both dairy products and soy," he explains. "In both cases we found that by feeding these molecules to animals that had either a genetic predisposition to developing colon tumors or that were exposed to a chemical agent that would cause colon cancer, there was a significant reduction in the number of tumors."

The research, though encouraging, has not yet proven that these compounds will also suppress human cancer, he cautions, "but it does catch our attention that both dairy and soy products have been associated with a reduction in colon cancer risk by other studies. Hence, our compounds may be contributors to the beneficial effects of these foods."

Merrill adds that sphingolipids should not be confused with triglycerides, which are the fats that are used to make cream and butter. Sphingolipids are more water-soluble, and even low-fat dairy products retain their high amounts of sphingolipids.

Laura Sikes

Oncology instructor Traci Battle studies intercellular signaling pathways.

Search for Molecular Inhibitors

Traci Battle's career in cancer biology started somewhat by accident at Georgia Tech.

"I worked as a research assistant in Terry Snell's lab for a couple of years," says Battle, Biol 93. "Although his lab focuses on aquatic toxicology and not cancer, the experiences I gained in his lab opened my eyes to the methodology and the possibilities of basic research. From then on I became interested in pursuing a PhD."

Battle, who did her graduate and doctoral work at Cornell University, is an instructor in the medical oncology department at the Dana Farber Cancer Institute in Boston.

At Cornell, a program in environmental toxicology sparked her interest in the molecular biology of cancer.

"That's what brought me to Dana Farber," she says. "I wanted to continue pursuing my interests in both cellular and molecular biology and how they relate to cancer biology."

Battle studies the intercellular signaling pathways that control cell function. An understanding of how signaling works in both normal and abnormal cell function could lead to the design of molecular inhibitors for cancer treatment.

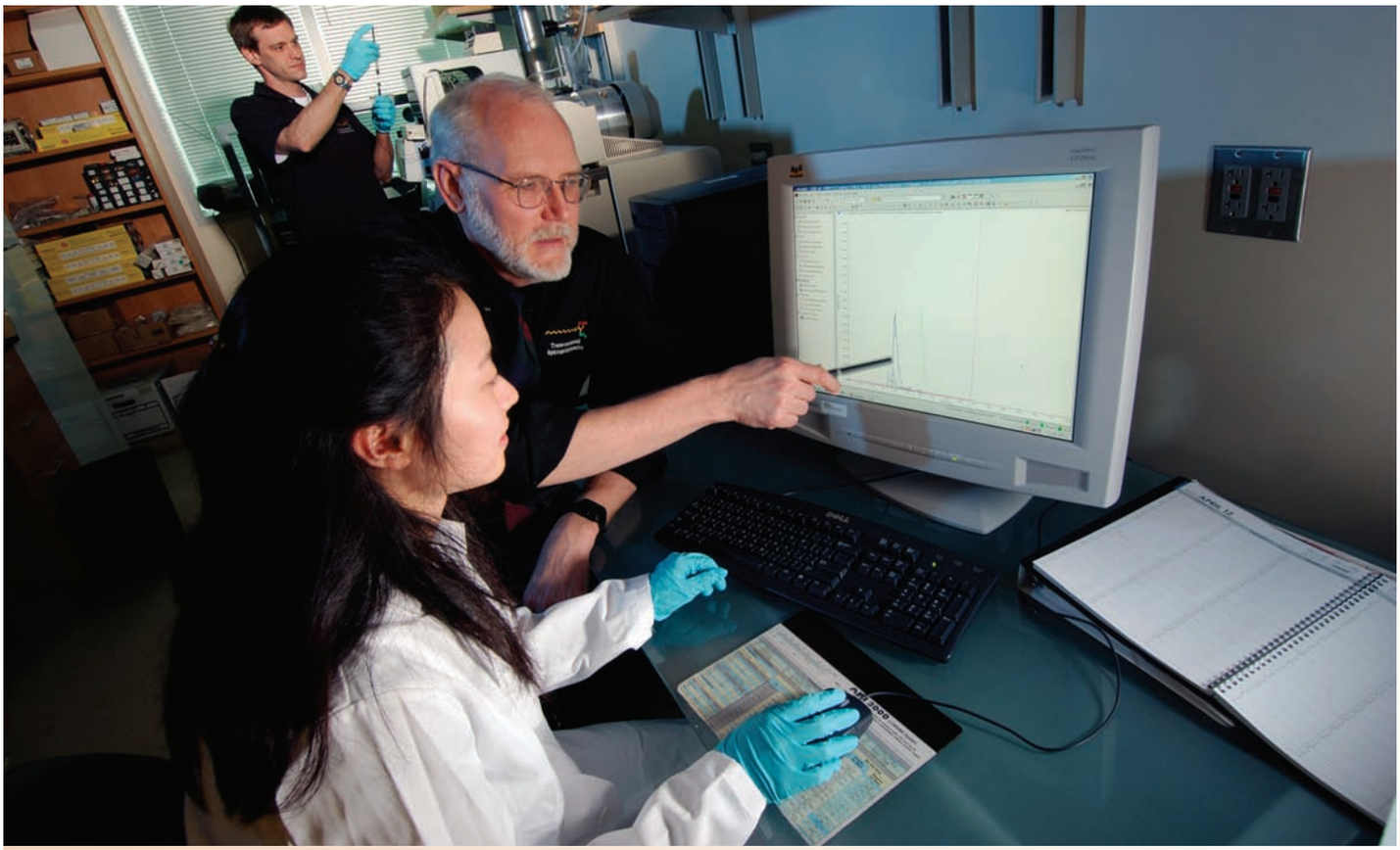
"Much of my work is centered on the family of cellular proteins or regulators called STATs," she explains. "Once they're activated, they can induce the expression of what we call target genes, which are critical for controlling certain cellular processes like cell growth and cell death.

"In many kinds of cancers STATs are activated inappropriately. They drive the growth or the survival of a cell that normally would die. In some cases, different kinds of STATs actually suppress cancer growth. So we're very interested in understanding how this family of proteins functions in cancer since they can both drive cancer and suppress cancer."

The work can be as frustrating as it is rewarding, Battle notes.

"You take two steps forward and one step back," she laughs. "Occasionally you might take three steps forward and actually make some progress. But in the end, when you do come up with some potentially new treatment that gets into the clinic, that's certainly very rewarding."

— Gary Goettling



Gary Meek

Al Merrill, who heads Tech's Cancer Research Council and holds the Smithgall chair in molecular cell biology, studies sphingolipids, which demonstrated cancer-suppressive effects in many types of cancer. He is assisted by Jia Wei, foreground, and Chris Haynes.

While more research is needed to know precisely how these molecules work, the evidence thus far indicates that they normalize cell signaling that controls call growth and death.

In fact, according to Merrill, it appears that sphingolipids are able to affect multiple signaling pathways and thereby correct, or reverse, abnormalities caused by gene defects in cancer. If so, "this could be a very promising strategy for cancer contol."

An inside-out approach

Rather than attack cancerous growths in the body with radiation from the outside in, Chris Wang is improving a method for fighting tumors from the inside out.

In neutron brachytherapy, an encapsulated neutron-emitting isotope is inserted into the tumor. Neutrons are effective tumor destroyers, but the technique has received only limited use because suitable neutron sources are too large and too weak to distribute the energy evenly throughout a tumor.

The smaller the source, the more uniformly it spreads neutrons, and with cancer, not a single cell can be missed.

Wang, an associate professor of mechanical engineering, has developed a neutron source 20 times smaller and five times more powerful than previous neutron sources. He is working on delivery systems for the tiny, pencil lead-size capsule.

Wang is also working to treat prostate cancer more effectively with a combination of his improved NBT and another neutron-based technique known as neutron capture therapy, which involves injecting a patient with a neutron-sensitive compound that settles among the cancer cells. Low-energy neutrons are drawn to the compound like a magnet, killing the surrounding cancer.

Wang calls his idea "boron-enhanced neutron brachytherapy." It involves injecting boron, a neutron-capture compound, into the tumor cells before the neutron-emitting isotope is inserted. The technique is designed to do a more thorough job of eliminating cancer cells.

Software improving surgery

Advances in radiation therapy treatment involving radioactive nucleotide implants figure prominently in the research activities of Eva Lee, an associate professor with a joint appointment to the School of Industrial and Systems Engineering and Emory's Winship Cancer Institute.

One of the challenges of radioactive seed implantation is to determine an optimal seed-placement plan that targets cancer cells efficiently without damaging healthy tissue. Since radiation emanates from within the diseased organ, seed implantation has an advantage over external beam-radiation therapy because it can more easily deliver a full necrotic dose of radiation to the tumor.

Lee has created a software program that helps doctors place radioactive implants where they will kill the most cancer cells while limiting the amount of radiation received by nearby normal tissue. Designed for integration into existing operating room computers, tumor-control probability increases from 65 percent with traditional techniques to 95 percent with the planning software, according to Lee.

The program has been licensed to a medical software company and will be

Gary Meek

Chris Haynes, who tests suppression effects of sphingolipid analogues on human-prostate cancer cells in mice, inspects samples ready for mass spectrometry testing.

marketed under the name Panther Inverse Brachy.

For treatment of prostate cancer, the planning system is connected to an ultrasound probe that captures the images, allowing doctors to adjust implant placement while the surgical procedure is under way.

Another distinct feature of the tool is that it allows incorporation of diagnostic information of cancer cell distribution within the treatment-planning procedure. This allows doctors to strategically treat cancer within the prostate by escalating dosages within regions densely populated with cancer cells, rather than target the gland as a homogeneous mass as is done at present, Lee adds.

The planning tool is designed for use in brachytherapy treatment in cancer of various types including prostate, cervix, breast, head and neck, esophagus, biliary tract, pancreas and intravascular lesion.

Delivering radiation better

Radiation has long been used to shrink cancerous tumors, but its application has not kept up with advances in delivery methods, according to Farzad Rahnema, chairman of the Nuclear and Radiological Engineering and Medical Physics Program in the School of Mechanical Engineering.

In collaboration with Tim Fox of Emory University, the scientists are using a sophisticated set of algorithms and computational methods to create a new computational tool that will more precisely calculate radiation dosage and target tumors more accurately.

Under existing methods, tumors can be difficult to locate in the body precisely, which means healthy tissue may inadvertently receive radiation while parts of the tumor escape treatment. In addition, the internal landscape of the human body such as bone, cavities and different kinds of tissue — even posture and contents of the digestive tract — affects the radiation stream.

By accounting for these variables, the new software tool's improved accuracy will allow for higher doses of cancer-killing energy.

The method could reduce dose errors by more than 50 percent overall and in some cases, depending on the tumor's location, by 80 percent.

Viruses' role in treatment

Mathematical modeling may expedite testing of a potentially new approach to cancer treatment.

Joseph Wu, an assistant professor in the School of Industrial and Systems Engineering, believes oncolytic viruses — the kind that kill cancer cells but not normal ones — could play an important role in the cancer fight by destroying tumors or at least mitigating the side effects of traditional treatment.

But virotherapy contains many unanswered questions, such as how to get the viruses to the tumor and in sufficient quantity without being destroyed by the body's immune system.

Wu says that mathematical modeling could provide the answers more rapidly than trial-and-error clinical testing alone. Modeling doesn't point to a single solution, he adds, but it's a powerful tool for narrowing the myriad possibilities to a number of workable hypotheses for which clinical experiments can be designed.

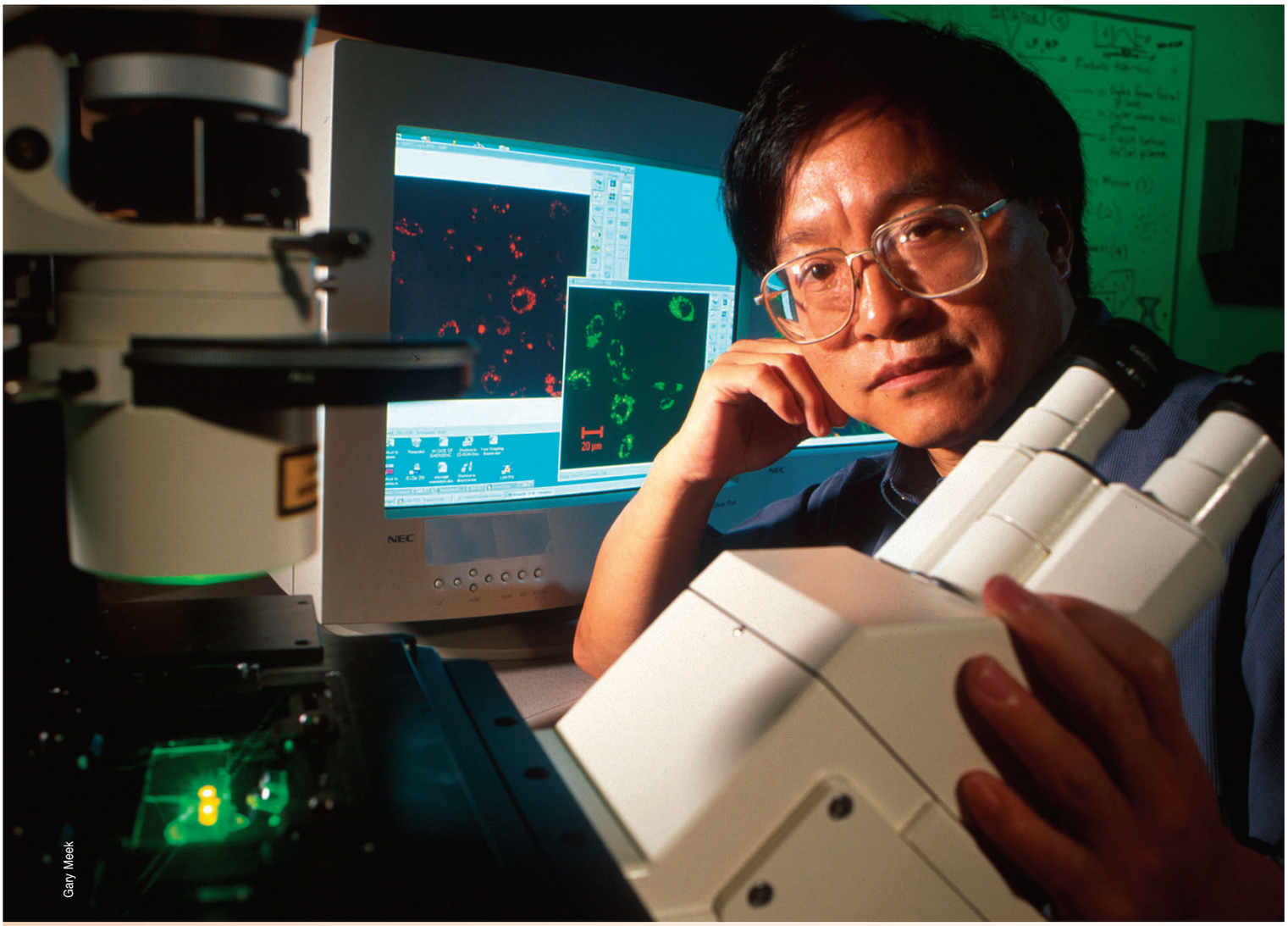
The approach can also be applied to studying virotherapy's potential effectiveness in combination with radiation or chemotherapy, or with the use of angiogenic inhibitors — compounds that starve cancerous tumors by blocking the growth of new blood vessels to feed them.

A shining new light

Gang Bao is shining a new light on cancer cells. Working with colleagues at Emory, Bao and his team of graduate students have designed a biosensor that consists of a fluorescent dye molecule and a quencher molecule on opposite ends of a hairpin-shaped oligonucleotide — a substance built of a short RNA or DNA molecule.

The oligonucleotides are chosen to

"It's basically a switch. It lights up the cell when the specific genes that cause cancer are expressed. To guard against false positives, you can target several cancer genes to mitigate that possibility."



Gary Meek

Courtesy of Gang Bao

Gang Bao, above, studies cancer using nanotechnology. When introduced into the body, biosensors called molecular beacons, left, attach to the unique sequences that are markers for cancer.

match specific genetic sequences associated with cancer.

When introduced into the body, the biosensors, called molecular beacons, attach to the unique genetic sequences that are markers for cancer, if markers are present.

The binding process causes the dye and quencher molecules to move apart, allowing emission of a fluorescent signal when excited by light.

"It's basically a switch," Bao explains. "It lights up the cell when the specific genes that cause cancer are expressed."

To guard against false positives, "you can target several cancer genes to mitigate that possibility," he adds.

Molecular beacons were invented about 10 years ago but improved by Bao and his collaborators so the tool could perform accurately in living tissue.

Sensitive to a single cell, molecular beacons could be particularly useful for early detection of pancreatic cancer, one of the disease types that is difficult to catch in its first stages of growth.

A companion biosensor called a magnetic beacon is under development. The magnetic beacon would work much like its optical counterpart, except that it would generate a magnetic signal. The magnetic beacon is intended for use in body tissues too deep for optical imaging, according to Bao.

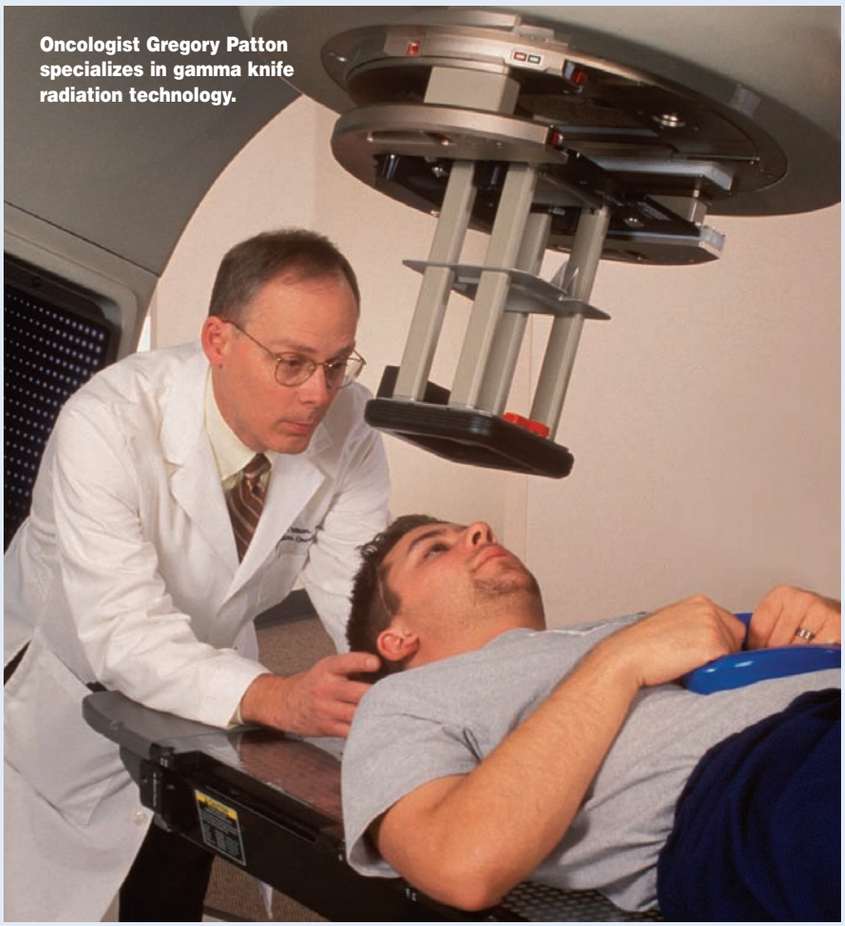
Other improvements on the drawing board include the ability to target specific organ systems and ways to rapidly disperse the beacons into cells.

Bao envisions a comprehensive system in which molecular beacons detect cancerous cells in lab-tested bodily fluids. When appropriate fluids cannot be obtained, other beacons could be introduced into the body to detect the cancerous cells. Beacons could then be used to monitor the success of cancer therapy.

Significant Advances

During the last 10 years in the battle against cancer, there has been an explosion of new drugs, classes of treatment and diagnostic equipment — and a scramble to keep up with all the new information.

By Maria M. Lameiras



Oncologist Gregory Patton specializes in gamma knife radiation technology.

No doctor wants a patient to die. In some specialties, like oncology, this outcome is sometimes painfully inevitable.

"Oncology is a double-edged sword. You lose a lot of patients and it doesn't get any better. It hurts every bit as much now as it did 30 years ago, but the field has gotten much better, especially over the last 10 years," says Martin York, ME 64, a medical oncologist with the Piedmont Hospital Cancer Program in Atlanta.

"When I was in medical school oncology didn't exist. They had a specialty called hematology, but no one was going into it because there wasn't much treatment for cancer then.

"After I finished my fellowship at Harvard in 1976, there were no improvements in the cancer field for the next 15 years. In the last 10 years there has been an explosion of new drugs, new supportive drugs, new classes of treatment, new diagnostic equipment," he says.

York, who attends educational meetings quarterly to remain informed about the latest treatments, says there is much to keep up with.

"Ten years ago you didn't have to worry about keeping up because there was nothing new in cancer treatment. Now it is a scramble to keep up with all the new information," he says.

Gregory Patton, ChE 74, is a radiation oncologist at Northwest Cancer Specialists in Portland, Ore., and a specialist in gamma knife radiation technology used to treat inoperable brain tumors and lesions.

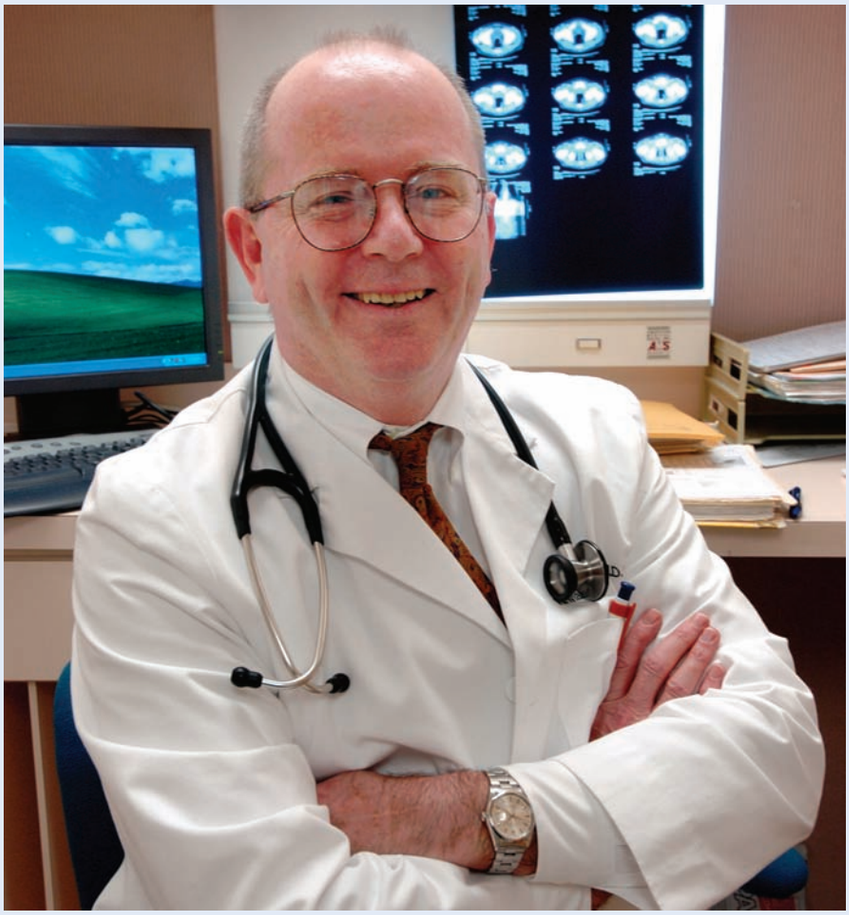
"Things don't stay the same. That is true in every discipline. Tech gets you in a position to learn how to learn and that is what we are always doing," says Patton, who holds master's degrees in administrative medicine from the University of Wisconsin-Madison and in business administration and medical informatics from the University of Utah.

York remembers that there were only a few treatable cancers when he began practice. Now he says there are only a few cancers that are not effectively treatable with combinations of chemotherapy, radiation and surgery.

"There used to be no treatments for colon cancer and now the treatment response rate is 40 to 50 percent. The two cancers we don't have treatments for are melanoma and cancer of the kidney, but there are a lot of other cancers we have curative treatments for that will improve quality of life," says York, who graduated from the Medical College of Georgia, completed a fellowship at Harvard's Dana Farber Cancer Center, then returned to Georgia, where he practiced at Emory University Hospital and was a member of the medical school faculty until 1994.

"We can cure cancers now that we couldn't cure several years ago. There are lung cancers we couldn't touch before and now, with a combination of radiation and chemotherapy, we can

Gary Meek



Martin York says there are only a few cancers that are not effectively treatable.

cure a third of the patients," he says. "With breast cancer, if a woman has to have a mastectomy or a lumpectomy, we can give her better medications to keep it from recurring. It is a nice step forward."

York says the leap from limited treatments to an explosion of innovations is "the nature of research."

"Researchers make isolated discoveries here or there and they build on each other and eventually come up with a drug or a treatment they will take to the clinic. It is a long process, but what they were working toward 15 years ago is coming into play now."

Patton says cancer treatment is a multidisciplinary practice and any advances can benefit the team of doctors treating a patient.

"Most cancer care is a team effort. Once a patient is diagnosed and it is determined how extensive the illness is, we can come up with a treatment plan that can involve a surgeon, a medical oncologist and a radiation oncologist. There is no single specialty that covers it all," Patton says.

With the advent of the Internet, patients are also exposed to greater amounts of information on cancer.

"The most chilling words a physician can hear are 'I've been on the Internet,'" York says. "Sometimes patients come up with good information, but they come up with really quite off-the-wall things as well. We just have to take a deep breath and help them sort it out. They don't know what's wheat and what's chaff. There is a lot of bad information out there."

Patton often sees patients laden with notebooks full of information when they come for appointments.

"Patients look at literature and go through publications and reports and clinical trials for anything they can find. The problem with the Internet is that it is a good resource, but it is completely unfiltered. Any boob with a computer can put information out there," he says.

"The information may or may not have validity or have undergone the test of scientific accuracy. Part of our job is to help the patient sort through the information and make heads or tails out of it."

One patient at Patton's practice went so far as to consult 13 different physicians at treatment centers across the country and received just as many opinions about how best to treat his prostate cancer.

"You will never get exactly the same opinion twice. We just have to sort out what to believe and what to do. There is often not a definitive answer or a single pathway," Patton says. "The informed patient is good for us as physicians. They push the envelope so we stay informed and on top of new information and technology instead of falling into a rut."

The spread of information has helped dispel some myths, York says, but there is still a great deal of fear among cancer patients.

"People are still terrified, but what is different now is that you can oftentimes tell them you can help them. Sometimes there is still no chance for a cure, but you can help them and relieve their symptoms," York says.

"You can treat cancer three ways — cut it out, radiate it and chemotherapy. There are some occasions when I meet people who absolutely refuse to take chemotherapy, but it is much better now than it used to be. We have much better anti-nausea drugs and drugs to keep red blood cell counts and white blood cell counts from going down. A lot of chemotherapy is easier on people than it used to be."

Since earning his medical degree from Baylor College of Medicine in Houston in 1977 and completing his residency in therapeutic radiology at the college's affiliated hospitals in 1981, Patton says the technology of radiation oncology has changed dramatically.

"When I started training, one of the mainstays of radiation therapy was the cobalt machine. We still see patients who come in and are concerned about cobalt therapy. Thirty years ago that was a very reasonable form of treatment, but it has subsequently been replaced by the linear accelerator, sophisticated X-ray machines that are

able to deliver very targeted radiation to very specific areas," he says.

One of the therapies Patton specializes in is gamma knife technology, cobalt therapy refined to its most effective form.

"Gamma knife is the trade name for stereotactic radiosurgery, also called stereotactic radiation therapy. The common method of these techniques is to position a patient's head in a fixed three-dimensional space and do a brain scan. When you determine where the tumor is, based on that scan, you position the patient so the tumor sits at the focus of that sphere," Patton says.

"All of those beams are aiming at one precise point in space. It is an outstanding method to give a high dose of radiation to a tumor instead of treatment of the whole brain," he says. "That is another example of technology's incredible ability to do a better job of treatment than existed before."

Even with advances in treatment and widely available information, he says patients still come in with serious misconceptions about cancer.

"Lots of folks think it's contagious. There's a common misconception that if you operate on a tumor, once air gets to it, it spreads," Patton says. "The common misconception about radiation therapy is that everyone getting radiation is going to lose all of their hair or have terrible burns and scars or intense nausea and vomiting. In select patients you see bits and pieces of these symptoms, but the reality is that the majority of patients don't see these side effects."

Although radiation treatment can cause some ill effects, the incidence has decreased as technology has increased.

"Cancer is inevitably surrounded by normal tissue and every organ has a limit of how much radiation it can take. You have to pay attention to where a tumor sits and how much radiation the normal tissue can take without causing problems with patients," Patton says.

"If you do too little, you cause zero side effects but you also have no impact on the tumor. If you do too much, the success rate of getting rid of the tumor goes up, but you can cause long-term harm to organs with scar tissue and too much radiation can kill an organ."

Imaging has made great strides in improving delivery of treatment and success, he says.

"A tremendous amount of what we do in radiation oncology is based upon imaging, seeing where a tumor is and how big it is and where it stands, what it is next to," Patton says.

"In the past we would use diagnostic X-rays to help, but you had to have enough knowledge of anatomy to draw a circle on the patient's skin and target the radiation that way. Now we use computed tomography imaging, magnetic resonance imaging and positron emission tomography. Each of these scans give different views of what's inside the body, and by seeing where it sits and what organs are nearby, we can come up with the best way to put radiation on a tumor without damage to surrounding tissue."

Prostate cancer treatment is an example of how imaging can help in delivery of therapy.

"It is a major modality right now to treat prostate cancer by implanting radioactive seeds in the prostate to eliminate the cancer cells. Back in the late 1970s and early 1980s, that was in the developmental stage. It was very primitive, but 10 years ago the technique leapt forward," Patton says.

"When the technology for computer applications and ultrasound imaging pulled together to visualize the prostate at the time of implantation, physicians began using needles to very accurately place those seeds. The success rate of the therapy became on par with surgical prostatectomy."

Computer software plays a large role in treatment as well.

"When we do a scan of a patient, that information is transmitted to a workstation to map out the area of the tumor and where we want to treat it," Patton says. "The technology we have for putting radiation on a tumor — the tools and the supporting network — is far superior."

Two new research initiatives York says are creating a stir are monoclonal antibodies that are made against an antigen on a tumor and injected into the body to attach to the tumor to shrink it and tumor vaccines.

He is also keeping an eye on nanotechnology research, such as that being conducted at Georgia Tech.

"Tumor vaccines, which are injected and are supposed to prevent certain cancers or shrink tumors, are being talked about a lot, but haven't worked yet," York says. "Nanotechnology is wonderful and if they can figure out a way to attach a drug to a nanoparticle so it will selectively go into a tumor, that will be great, but it will be quite a while though."

Patton chose therapeutic radiology over diagnostic radiology because he has the opportunity to make a tremendous difference in patient quality of life regardless of the outcome.

"I do see patients who are in the last phases of life. Even if you can't cure a patient you have an impact on their quality of life. Also, cancer is more curable than people think. Of the chronic illnesses, cancer is the most curable. You can't cure arthritis. You can't cure emphysema. Cancer is not curable across the spectrum, but there are many types that are curable with a great degree of success. We do lose patients, but that is true if you are a surgeon, if you are in gynecology, even in pediatrics," he says.

"Not everyone survives, that is the reality of health care. In some specialties more patients die than in others, but there are still aspects that are gratifying. When a patient comes back 10 years later and they are still cured, there is a lot of gratification in that."

"The most chilling words a physician can hear are 'I've been on the Internet.' Sometimes patients come up with good information, but they come up with really quite off-the-wall things too. They don't know what's wheat and what's chaff."

Golden Age

Georgia Cancer Coalition chief foresees remarkable breakthroughs

By Kimberly Link-Wills

These are the glory days of cancer research and breakthroughs. Bill Todd, president and CEO of the Georgia Cancer Coalition, is confident in that statement. Todd believes that by the end of the 10-year state initiative in 2012 Georgia will have lifted itself out of its dismal ranking in mortality/morbidity rates and research conducted on its university campuses will have dramatically improved detection and treatment.

"If you were an aerospace engineer, you would have wanted to be at the peak of your career in the '60s because that was the glory period for aerospace engineering," says Todd, IM 71. "The whole country was poised behind your work. What a wonderful time, when public policy and science converged.

"If you were a small particle physicist, you would have wanted to be around the Manhattan Project. The free world was depending on your success, counting on you to save the world. What a glorious time.

"I think that's what we've got in a microcosm here in Georgia right now. I think we're in the golden age of discovery in cancer. We've got this civic will to make a major move. The public is behind the clinicians and scientists," Todd asserts.

"It is a glory time in scientific productivity. We have an advantage structurally in that we have this relationship between Georgia Tech and Emory at a time when engineering is needed to get into the fight in a big way. It won't happen without engineering."

Todd says studies have shown that Americans fear cancer more than bioterrorism or economic collapse. They fear cancer more than anything.

"There are 50 kinds of cancer. People do hate it and that's a powerful motivator."

The former head of the Georgia Research Alliance was handpicked by Gov. Sonny Perdue to serve in his administration as executive director of the Commission for a New Georgia. In December 2003, Perdue asked Todd to take a new direction and lead the Georgia Cancer Coalition forces.

"Our vision is that we will move Georgia from the fourth quartile among the 50 states in cancer mortality/morbidity up to the first over this 10-year period as a matter of civic will," Todd says.

Tech armed for battle

Much of the current cancer research is devoted to diagnostics.

"I think that's a specific way for Georgia Tech to contribute. So much of it involves core strengths at Georgia Tech — imaging technologies, computing technologies, nanotechnology," Todd says.

"It puts us in a wonderful position to compete very effectively, primarily with the Georgia Tech and Emory relationship, for this big $144.3 million National Cancer Institute nanotechnology initiative. We have an Emory-Georgia Tech group that has been tasked with winning 10 percent of that. We want to be a big player in nanotechnology applications in cancer therapies and diagnostics."

In October the National Institutes of Health announced that it was awarding nearly $10 million in research grants to associate professor Shuming Nie and assistant professor May Wang, both from the Coulter Department of Biomedical Engineering at Georgia Tech and Emory University, to establish a multidisciplinary program in cancer nanotechnology and develop a new class of nanoparticles for molecular and cellular imaging.

"The Emory-Georgia Tech relationship really became the model of inter-institutional collaboration that led first to the creation of the Georgia Research Alliance and later to the Georgia Cancer Coalition. I know because I was there," says Todd, who worked with Don Giddens, now dean of the College of Engineering, to bring Tech and Emory representatives to the table in 1987.

"It was so obvious. Here was Emory with medicine and no engineering. Here was Georgia Tech with engineering and no medicine. Here was this emerging field called biomedical engineering that neither could play in without the other, so it was the basis of a robust collaboration," Todd says.

"Each side committed $200,000 and put together a joint

> **"I think we're in the golden age of discovery in cancer. We've got this civic will to make a major move. The public is behind the clinicians and scientists."**

Gary Meek

Bill Todd, president and CEO of the Georgia Cancer Coalition, wears a LIVESTRONG bracelet and appreciates the help of cancer survivor Lance Armstrong, who donated one of his cycling jerseys to the Atlanta-based organization.

Christopher Gooley

Champion cyclist Lance Armstrong rides in the Tour de Georgia.

seed grant program where, in order to apply, you had to have a collaborator from the other side.

"Because of this relationship, we are ahead of the curve and perfectly positioned to respond to the National Cancer Institute priorities."

Todd says NCI director Andrew von Eschenbach, a cancer survivor, is passionate about translational research and consistently refers to the "three D's" — discovery, development and delivery.

"That delivery piece has never been emphasized before. I think he's right in saying we come up short by not being committed about delivery from the bench to the bedside, from the laboratory to the clinic.

"The very discipline that is needed to do that is engineering. He is the first director to ever be passionate and committed to bringing engineering into the cancer fight," Todd says.

"You can have some better understanding of the biological processes that are working in which genes are overexpressing and cells are dividing when they shouldn't be, but unless you then take that and do something with it to apply it to a diagnostic or therapeutic solution, it doesn't change the quality of care.

"There are tremendous inroads being made in prostate cancer and breast cancer, but screenings and early detection mechanisms are still not very reliable. Mammograms are only 70 percent accurate," Todd says. "We must do better than that. Much of our research agenda asks: What do you do to move that up scale?"

Thanks to the relocation of the Ovarian Cancer Institute Laboratory in the fall, Georgia Tech also is playing a key role in that arena.

"Ovarian cancer is one of the most pernicious and one of the most difficult to diagnose. That's why the Ovarian Cancer Institute Laboratory at Tech is so important. If you can use sophisticated imaging technologies to diagnose earlier, you have a better chance," Todd says.

"Ovarian cancer can be controlled if it's found early, but it almost never is. Therefore it has a very poor prognosis because by the time the symptoms manifest themselves or are correctly identified, it's Stage III and it's too late. There are things happening at the cellular level that if we can detect them earlier, then we'll have a better chance.

"For Georgia Tech to be involved that directly in the human condition is horizon expanding, eye opening. Imagine if that approach works and the number of women that are going to be impacted by it. There also is the symbolic value of the assets of a technological university being relevant to something so personal as cancer care, not just understanding how cancer works," he says.

The best of the best

The GCC has five focus areas: research, prevention and early detection, education, treatment and economic development.

"Clearly the most successful part of our comprehensive program has been the distinguished cancer clinicians and scientists," Todd says. "We have recruited 66 scientists and clinicians to come in from the best cancer centers in the nation to our four medical schools and four universities, including Georgia Tech, and work in collaboration with them.

"Our business plan calls for us to recruit 150 of these people over the 10-year period. All 66 of them came together as a team for the first time in 2004," says Todd, who expects to bolster the ranks with 18 more leading-edge scientists and clinicians this year.

Todd gathered them together — including Tech's distinguished cancer scientists Nie, Wang, Marion Sewer, Joseph Wu and Nathan Bowen — in April for a daylong scientific symposium.

"It was an electric environment," he says. "We have coalesced this group and built a bit of a fraternity like never before. That is the essence of building robust collaborations — getting to know each other, understanding the needs and opportunities in other research labs.

"In September Governor Perdue assisted us by having all 66 of them and all 50 of the GRA eminent scholars to the mansion for a half-day think tank where he was engaged with these folks, asking them to help him think about the future, what's around the corner, what the state should be doing to prepare for that. This is the brain power of the state, by and large, this cadre of 50 plus 66," says Todd, who remembers the governor's mansion that day as "the epicenter of intellectual capacity."

Besides gathering the best minds, Todd must try to bring in the most money to help the GCC do its work. "Our business plan calls for us to raise and invest $1 billion over 10 years," says Todd, breaking it down to $400 million from the state from the tobacco settlement, $500 million from the federal government, primarily won through research grants, and $100 million raised privately.

"The whole division of resources is key. You could put the whole billion dollars into treatment and those people who had gotten services would be happy, but at the end of the time you wouldn't have moved the needle much.

"You could put the whole billion dollars into screening

"For Georgia Tech to be involved that directly in the human condition is horizon expanding, eye opening. There also is the symbolic value of the assets of a technological university being relevant to something so personal as cancer care, not just understanding how cancer works."

and early detection and just make people upset because you couldn't fix what you found out. It is a very complex balancing act. That's the world I work in, trying to make big change. You have to look at it from a business and systems standpoint. We have to be very sharply focused and make sure that we're making a big impact."

The power of faith

There are pieces of the GCC's budget pie that one might not expect.

"One of the tiny pieces in this year's $28 million budget proposal is to begin a faith-based initiative. It's pretty clear to me that the faith community has a great deal to contribute to this whole effort, that houses of worship are traditionally places of wholeness and healing and focused prayer for this purpose," Todd says.

"We can do some things to support that. There are some fascinating things that are happening at the grassroots level. We can take some of those models and spread the word. There's a church in Snellville, Georgia, that has a cancer ministry that 200 people are involved in."

Todd says through CaringBridge, a nonprofit, free online service, patients and families can receive Web messages of hope and encouragement at any time of the day or night from anywhere in the world.

Georgians also are giving from their wallets.

"We are benefiting from a million dollars that people are voluntarily giving us from taxes," says Todd, explaining that check-off boxes on state income tax returns contribute to breast, prostate and ovarian cancer research. "And they're buying breast cancer license plates — $24 of the $25 goes to the Georgia Cancer Coalition for cancer research."

The GCC also reaches out to those too young to pay taxes. Public health nurses are sent to schools to urge youngsters never to take up smoking.

"We all know that prevention is a critical part of the overall success formula. We need to make the prevention part of our program just as rigorous and just as based on sound science as the research agenda," Todd says.

"There are things that we know can be involved in the prevention, yet there's not enough compliance with those known behaviors. Don't smoke and eat right. Obesity is linked to cancer. Smoking is definitely linked to cancer. We need to work much more diligently on the prevention side. We need to have the same rigor in those programs that we do in our bench laboratory science and that's a challenge."

Advocates for hope

Three of the nine Georgia Cancer Coalition staffers are survivors. They keep Todd focused on the big picture.

"Survivors inspire us with their tenacity and hope. This is a hopeful enterprise. This is all about victory and hope and triumph," he says.

"I've learned the incredible power of the survivors' movement. This is a group that is growing. As the population ages, cancer is primarily a disease of aging, and as we are more successful in saving people, that pool of survivors is growing. There are many advocacy groups. They're usually organized around organs — the breast, prostate, ovary and lung — and they're very dedicated. Those survivors are passionate."

Todd calls champion cyclist Lance Armstrong and former White House chief of staff Hamilton Jordan the most famous cancer survivors in America.

"Hamilton was really the architect of this initiative," Todd says, explaining that Jordan urged then-Gov. Roy Barnes to use the 1998 tobacco settlement of $4.8 billion to the state as a "windfall for strategic purposes, which was brilliant."

"Most states have just frittered it away, put it in their general funds and will never see anything from it. We can be proud of the statesmanship of avoiding that temptation and using it for strategic purpose. We'll look back 10 years from now and see a profound change and other states won't be able to see anything. Georgia is unique in having a comprehensive 10-year strategic vision," he says.

The GCC is a beneficiary of the Lance Armstrong Foundation and the testicular cancer survivor raced in the Tour de Georgia last spring.

"By his own words, he said, 'This is the first time I've ever combined my two passions — cancer and bicycle racing.' He was moved by it and I was moved by watching his impact on the crowd. People were holding up Lance's book and their bracelets," Todd says.

The LIVESTRONG bracelets are simple yellow bands that sell for $1 apiece. Schoolchildren wear them. Cancer survivors wear them. Advocates for change — including Todd — wear them.

"They've sold 20 million of them. They're everywhere. Every Olympic athlete had one on. (Georgia Sen.) Saxby Chambliss is a survivor. I saw he had one on. He's the most distinguished, senatorial-looking guy and he had this bracelet on that is a kid cult thing," Todd says.

He arranged for a 15-year-old young man, also a testicular cancer survivor, to be an honorary starter at the Tour de Georgia. The boy had already beaten leukemia, diagnosed at age 3, and was orphaned at 5 before he developed testicular cancer in his early teens.

"Lance rode right up to the boy at the start of the race, stopped and they had a five-minute, one-on-one conversa-

"Survivors inspire us with their tenacity and hope. This is a hopeful enterprise. This is all about victory and hope and triumph. I've learned the incredible power of the survivors' movement. This is a group that is growing."

Todd says even after his death Kim King continues to make an impact in the war against cancer.

tion," he says. "Every once in awhile it hits me like a ton of bricks that it's all about one person."

Trials in local jurisdictions

Georgia has been an exporter of cancer patients.

"The people with means will leave the state and go to Johns Hopkins or Sloan-Kettering because they know they can get high-quality care and access to clinical trials of the latest breakthroughs there and they can't get them here," Todd says.

"The greatest defect we have as a state is that we're the largest state in the nation and have the largest city in the nation without an NCI comprehensive cancer center. There are 39 in the nation and they are won competitively."

Todd, who says NCI centers receive more federal funding and get access to select clinical trials, expects Georgia to win the designation within the next two and a half years.

"The Winship Cancer Institute at Emory is close and Georgia Tech is a big part of the success that is causing them to emerge as a competitor."

Right now the GCC does have a Web-based product called TrialCheck in which cancer patients can find the innovative treatment programs that are being conducted in the state.

"We're spending a lot of money and time and effort to create a statewide clinical trial network where the National Cancer Institute or a big pharmaceutical company can say, 'Get me 1,000 patients that are demographically appropriate to test this new drug,' and we'll say, 'We've got it.' In the process of doing that, more of our people will participate and the quality will go up," Todd says.

"When we were growing up, if you had a diagnosis of leukemia as a child it was bad. Now there's a 70 percent survival rate and there's some structural reasons for that. Almost every child who has cancer is in a clinical trial.

"We only have a 3 percent participation rate in adults in clinical trials. What we're striving for in Georgia is to dramatically improve that, perhaps up to 10 percent, which will by definition increase quality. Somebody has to really be concerned about that, get that participation rate up. That's us and we do."

Kim King traveled outside Georgia to get cutting-edge care. Todd says although King lost his battle against cancer in October, he continues to make an impact in the war.

King, IM 68, was the longtime play-by-play radio announcer for Yellow Jackets football, a standout quarterback during his Tech playing career and a successful Atlanta businessman.

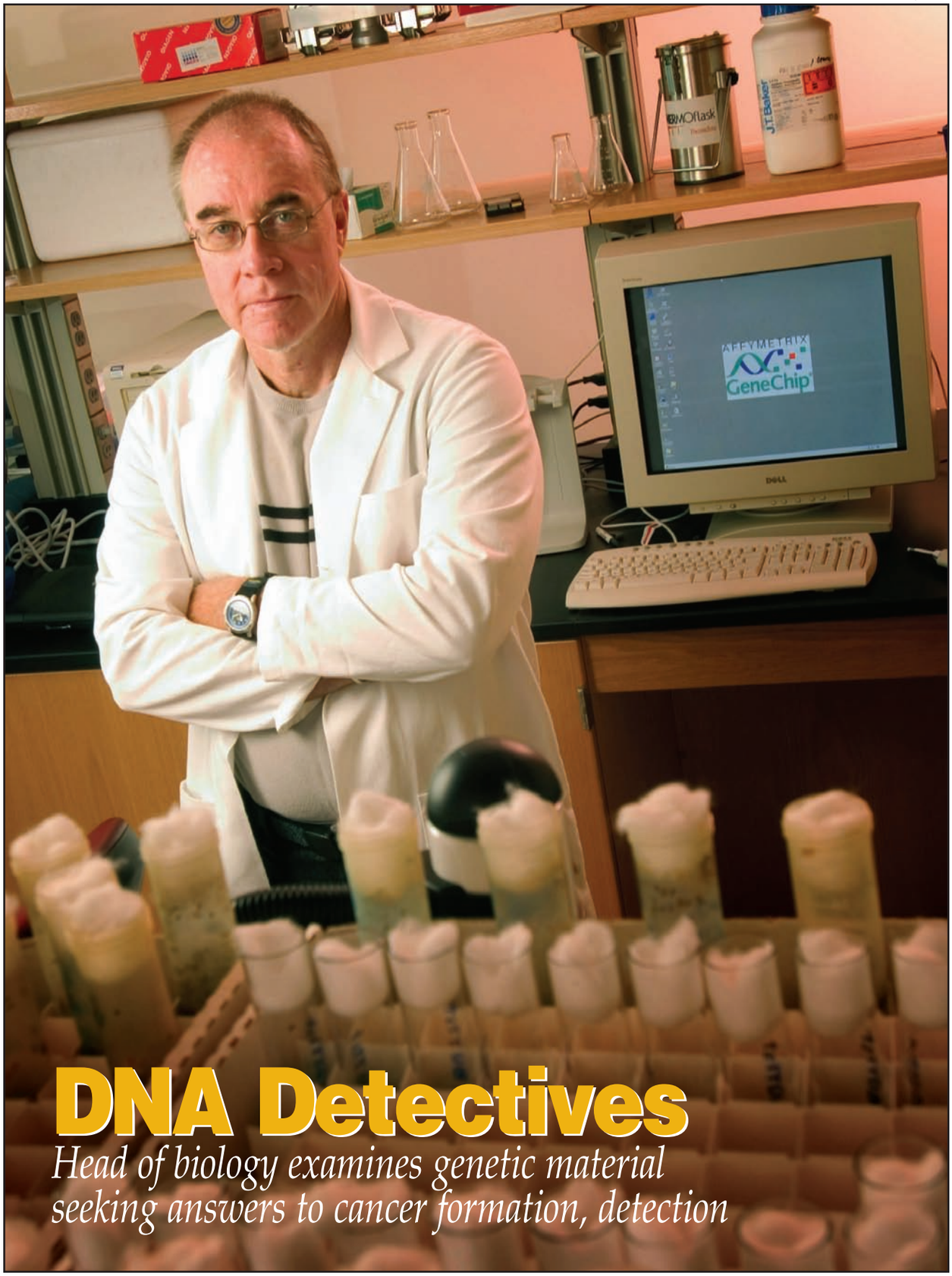
"I went to his very moving, very touching memorial service at Alexander Memorial Coliseum. I came out more dedicated and more committed to this role than ever before because he was such a powerful advocate for the fight. He had the best attitude that anybody could have. He had a survivor's mentality. He had the aggressiveness that you might expect of a competitive athlete," Todd says.

"He had ironically been involved as a Georgia Research Alliance trustee in the founding of the Georgia Cancer Coalition. The greater irony is that we had planned to elect him to our board of trustees the week after he died. He contributed a lot during his life and I would say continues to do so through what he has inspired in others. I came away from Kim's memorial service energized, excited and passionate about my work."

Todd also lost his father last year. He died of cancer in May.

"That is all the inspiration I need." **GT**

Gary Meek



DNA Detectives

Head of biology examines genetic material seeking answers to cancer formation, detection

By Maria M. Lameiras

John McDonald believes that one of the keys to identifying the genetic changes between normal cells and cancer cells may lie in what was once thought of as "junk DNA."

McDonald, chair of Georgia Tech's School of Biology and head of the Ovarian Cancer Institute Laboratory, has been studying the elements of disease for many years and is now tapping into Tech's interdisciplinary approach to try to find new ways to identify and treat cancer.

"One of the most surprising results coming out of the Human Genome Project is that the component of our genome that actually encodes for the proteins that make us what we are only comprises about 1 to 2 percent of our total complement of DNA. A majority of the human genome is comprised of viral-like sequences called retrotransposons," he says.

"Initially this component of the genome was called 'junk DNA,' but I always felt it was playing a significant role and spent many years studying where these retrotransposons came from and how they were affecting our genes. We study these elements computationally by identifying all of the retrotransposons in the sequenced human genome using specially designed search algorithms. Once identified, we use molecular techniques to study how these elements influence gene expression."

This may lead to discovery of what genetic changes cause a normal ovarian cell to change into a cancer cell and thus to tests for early detection.

"We use a variety of techniques to characterize the genetic differences between normal cells and cancer cells. Finding out the genetic changes that are different between normal and cancerous ovarian cells will help us attain the research goals of OCI, which are to identify a molecular marker of early stage ovarian cancers, to use molecular profiles to identify subtypes of ovarian cancers and, hopefully, to understand more about the causal basis of the cancer and possibly identify novel targets for the development of new therapies," McDonald says.

John McDonald, chair of Tech's School of Biology, says what was once called "junk DNA" may be key to a cancer cure.

Presently, most ovarian cancers are not detected until very late in their progression and by that time prognosis is quite poor even after surgery, about 25 percent survivorship over five years, McDonald says.

"If a blood test could be developed to detect ovarian cancer in its early stages, the tumor could be removed surgically before it spreads and the prognosis would be dramatically better, approximately 95 percent or more survivorship," he says. "Identifying subtypes of ovarian cancer would aid in selecting the correct treatment."

McDonald says the lab's work may also lead to more effective noninvasive therapies like the development of drugs that would specifically target the cancer cells while leaving noncancerous cells alone. This also could extend to other types of cancers.

"The future of biology will be characterized by the integration of the traditional biological sciences with engineering and computer sciences."

"There are many similarities among all cancers and so some of the discoveries in understanding in one type of cancer can be extended to all. However, different types of cancer have many unique properties that need to be factored into how they may be best treated," he says.

McDonald became involved with the Ovarian Cancer Institute when contacted in 2002 by Dr. Benedict Benigno, a highly respected Atlanta surgeon who launched the nonprofit institute in 1999 and asked him to establish a research arm.

"At the time, I was working predominantly on retroviruses and retroviral-like elements and one of my interests was the role these elements played in cancer. I was interested and met with Dr. Benigno and soon afterward agreed to organize the research program for OCI," says McDonald, who was head of the genetics department at the University of Georgia at the time.

"My plan was to organize a virtual research institute by establishing collaborations with some of the top scientists in the state. Some of these individuals had previous experience working on cancer, some did not. However, all of the collaborators were experts in some aspect of cell or molecular biology and I felt could contribute to the research goals of OCI."

McDonald says many of the modern technologies in molecular biology result in the acquisition of large amounts of data over short periods of time, making collaboration with computer scientists and statisticians a must. It's an interdisciplinary approach ideally suited to Tech.

"We conduct microarray analyses of gene expression. In a few hours we can generate data on the expression patterns of around 30,000 genes in each of six patient samples. When we are completely operational, we will be analyzing over 300 patient samples per year. Many of our collaborators will have the capacity of generating equally large data sets, thus data storage and analysis need to be handled in a sophisticated manner," he says.

McDonald says moving to Atlanta made sense because he would be closer to Benigno and other OCI collaborators and because of the unique potential of Tech's biology program.

"I was offered the position of chair of Tech's School of Biology last year and I accepted because it provided me with the opportunity to help build the biology program at Tech into one of the top programs in the country," McDonald says. "I believe that the future of biology will be characterized by the integration of the traditional biological sciences with engineering and computer sciences and Tech seemed to me an ideal environment in which to build an integrated biology program." **GT**

Jamie Howell

Breathtaking Suspense

Georgia Tech diver Stephanie England, who appears to be suspended above the Earth's atmosphere, is actually twisting out of a reverse pike off the 3-meter board in a competitive meet against the University of Virginia in November. The freshman from Merritt Island, Fla., finished second in the 1- and 3-meter events.