ANNUAL REPORT 2011

LEVERAGING MOMENTUM FOR STRATEGIC GROWTH

Georgia Institute of Technology®

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LEVERAGING MOMENTUM FOR STRATEGIC GROWTH

Constantly anticipating and adapting to the ever-changing needs of an increasingly technological world have been at the heart of Georgia Tech's mission for 125 years. Finalized and published in 2010, the Institute's twenty-five-year strategic plan—"Designing the Future"—embraces this revered tradition while pointing us toward a path of global leadership, academic preeminence, and societal and economic relevance.

The vision articulated in the strategic plan makes a decidedly bold assertion: "What does Georgia Tech think?" will be a common question in research, business, the media, and government.

An increasing number of faculty, staff, and alumni are gaining national prominence as experts, leaders, and researchers, and thereby providing tremendous momentum for this aspect of the strategic plan. These include:

- expertise and assistance sought in the wake of the earthquake and tsunami in Japan;
- research-related expertise that is routinely sought in areas such as earthquake engineering, geographic information systems, nuclear and radiological engineering, humanitarian logistics, supply chain management, and search and rescue robotics; and
- faculty appointments to key scientific and policy positions including NASA chief technologist, U.S. Patent and Trademark Office chief economist, and Tennessee Valley Authority board member.

In addition to these impressive achievements, I was both excited and honored to be appointed by President Barack Obama to represent Georgia Tech on the recently established Advanced Manufacturing Partnership steering committee this past June. The partnership is bringing together industry, universities, and the federal government to identify and invest in key emerging technologies such as information technology, biotechnology, and nanotechnology. The national initiative is designed to help U.S. manufacturers improve cost, quality, and speed of production in order to remain globally competitive.

The pages of this Fiscal Year 2011 Annual Report are filled with many more examples of how our students, faculty, staff, and friends are building Georgia Tech's momentum in support of the goals outlined in the strategic plan. The Georgia Tech community envisions a future in which the Institute defines the technological research university of the twenty-first century. The advancements we are making today will make that vision a reality.

Sincerely,

G. P. "Bud" Peterson, President

STUDENT SUPPORT AND ACHIEVEMENT

Georgia Tech students are like no others. Adaptable and intellectually curious problem solvers, they are unwaveringly tenacious and eternally optimistic about the future of our nation and our world. The Institute provides numerous programs and services to support student success, and the accolades our students garner year after year for their academic and innovative achievements are truly remarkable.

Joy Buolamwini, a junior computer science major, received a $10,000 scholarship from the Astronaut Scholarship Foundation.

Students win prestigious honors

From robotics to biomedical engineering to alternative energy, Georgia Tech students were recognized for a wide array of accomplishments in 2010-11.

The very first Space Shuttle pilot, Robert Crippen, presented Georgia Tech Junior Joy Buolamwini with a $10,000 scholarship from the Astronaut Scholarship Foundation (ASF) last year.

"Joy is a bright, up-and-coming forerunner in the field of computer science," said Crippen, "and she will be one of the many leaders who will keep the United States at the leading edge of breakthrough technology."

A computer science major, Buolamwini has worked on a data tracking system for Google-sponsored research and is interested in developing affordable mobile technology to propel economic development in West African nations. Buolamwini is also interested in healthcare applications of computer technology. She plans to pursue a PhD in computer science and engage in "research with an entrepreneurial spirit."

The Astronaut Scholarship is the largest monetary award given in the United States to science and engineering undergraduates based solely on merit.

Two undergraduates from the College of Engineering were named 2011 Goldwater Scholars.

Allison Del Giorno

Chun Yong

Allison Del Giorno, a sophomore majoring in electrical engineering and minoring in biomedical engineering, and Chun Yong, a junior biomedical engineering student, were awarded Goldwater Scholarships for the 2011-2012 academic year. Del Giorno will also receive the scholarship for her senior year. Each scholarship covers eligible expenses for undergraduate tuition, fees, books, and room and board, up to a maximum of $7,500 annually.

Del Giorno, a Georgia Tech President's Scholar, has held a National Institutes of Health Intramural Research Training

Award at the National Institute of Neurological Disorders and Stroke and another at the National Institute of Bioengineering and Biomedical Imaging. She received a Northrop Grumman Engineering Scholarship upon entering Georgia Tech. Del Giorno is studying electrical engineering approaches to the nervous system, specifically investigating the spatiotemporal electrical properties of neurons that control respiration.

Upon completion of her undergraduate studies, Del Giorno plans to pursue a doctorate in computational neuroscience to conduct neuroscience research focused on fundamental discoveries for clinical applications.

Yong has received many accolades during his time at Georgia Tech. He was honored as a 2010 Petit Research Scholar and also won several President's Undergraduate Research Awards. Yong participated in the National Science Foundation's Research Experiences for Undergraduates and held a Russ Bell Undergraduate Research Scholarship. He also participated in the Summer Undergraduate Research Fellowships program at the Mayo Clinic.

Yong is co-founder of a new Biomedical Research and Opportunities Society, executive vice president of the American Medical Student Association, and a member of the Biomedical Engineering Society and the National Society of Collegiate Scholars.

Not to be outdone by his undergraduate engineering counterparts, Ryan Maladen, a bioengineering doctoral candidate, won the best paper award at the 2010 Robotics Science and Systems (RSS) conference held in Zaragoza, Spain.

RSS is a highly prestigious and selective conference that brings together researchers working on algorithmic or mathematical foundations of robotics, robotics applications, and analysis of robotic systems.

The paper, "Biologically Inspired Development of a Sand-swimming Robot," focuses on the design and construction of a robot that can move through granular media with performance comparable to a biological organism, the sand-swimming sandfish lizard. His co-authors were Paul Umbanhowar in the Department of Mechanical Engineering at Northwestern University and Yang Ding, Adam Kamor, and Daniel Goldman (Maladen's advisor and assistant professor) in the Georgia Tech School of Physics. Maladen, a fourth-year doctoral candidate in Goldman's Complex Rheology and Biomechanics (CRAB) Lab, received $1,500 and a certificate for the award.

Doctoral student Ryan Maladen (left) won the best paper award at the 2010 Robotics Science and Systems conference.

"Maladen's integration of biological studies of the sandfish lizard with his systematic studies of a robot model, all while working in a lab in the School of Physics, show his outstanding ability to work among disciplines," said Goldman. "In addition, his collaboration with physicists in my group to develop predictive simulations of sand-swimming could lead to improved understanding of movement in complex terrain as well as provide engineers with experimentally validated design tools."

Three of Maladen's doctoral classmates were awarded 2010 Intel PhD Fellowships. The program, which recognizes students working in fields related to Intel's business and research interests, recognized twenty-seven outstanding PhD students from thirteen universities.

The recipients of the fellowship, which includes a cash award (tuition, fees, and stipend) and an introduction to an Intel mentor, are:

- **Marshini Chetty, Human Centered Computing**
- **Calvin King Jr., Electrical and Computer Engineering**
- **Shreyas Sen, Electrical and Computer Engineering**

Additional honors for Tech PhD students included the selection of Sarah Miracle and Chris Shearer to receive fellowships as part of a new U.S. Department of Energy (DOE) Graduate Fellowship program. Miracle is studying randomized algorithms and Markov chains in the School of Computer Science, while Shearer is investigating sustainable concrete materials technology in the School of Civil and Environmental Engineering.

Miracle and Shearer are two of 150 students selected by DOE to receive the fellowship. Each graduate fellow will be provided with tuition, living expenses, and research support for three years for study at academic institutions across the country. The new fellowship program is

Sarah Miracle

Chris Shearer

designed to strengthen the nation's scientific workforce by providing support to young students during the formative years of their research.

"The exceptionally talented students selected as graduate fellows are part of our nation's next generation of scientific and technical leaders," said U.S. Energy Secretary Steven Chu. "This investment in the training of scientists and engineers is part of the administration's continued effort to ensure that America has the scientific and engineering workforce we need to secure our energy future and our continued economic competitiveness."

Each fellow will be provided $50,500 per year for up to three years to support

Committee formed to develop "X-College"

Provost Rafael L. Bras announced the creation of a committee that will review options and formulate strategies for the creation of an X-College, one of the ideas that resulted from the Institute's yearlong strategic planning process.

"The X-College Initiative grew from the very strong recommendations from students and faculty in the strategic planning process that Georgia Tech needs to increase student-faculty interaction and allow more flexibility in curricula," said Richard Barke, associate professor in the School of Public Policy and chair of the X-College planning committee. "For example, the X-College is considering whether to allow students — with strong faculty guidance — to compose programs of study that focus on particular 'grand challenges' facing society, using knowledge from a wide range of relevant fields. The committee is investigating how to achieve these goals while balancing disciplinary and interdisciplinary learning, maintaining the traditional rigor of a Tech education, innovating in learning techniques and educational technologies, and respecting the expectations of graduate schools and employers."

The vision is broader than student-designed degrees, however. An X-College experience should also serve to challenge faculty to experiment with learning techniques, balancing core instruction with problem-based approaches. Other opportunities could lie in developing alternatives to regular courses taught in semester-length blocks.

"For some time, our students have asked the administration to offer some kind of self-directed learning options," Bras said. "The X-College concept should be developed to reflect the fundamental importance of a rigorous Georgia Tech education, to complement existing degree programs and academic units, and to prepare students for creative careers."

Student medical organization earns top chapter honor

The American Medical Student Association (AMSA) honored the Georgia Tech chapter with its Paul R. Wright Award for chapter excellence. The Tech chapter won out over five other finalists, and is the first pre-medical chapter to ever receive the honor. Students Robin Jacob, co-president, and Chun Yong, vice president, received the award at the AMSA Annual Convention in Washington, DC.

"Georgia Tech has done a lot to receive this award," said Yong, who helped plan the organization's pre-health conference. "We have had many meetings, volunteer events, banquets, global health education weeks, and our annual pre-health conference."

Yong said the primary criteria for the award were recruitment and activities, both heavily emphasized by Tech's chapter, which at 350 members is the largest in the state.

Nick Wellkamp was named a Marshall Scholar.

tuition, living expenses, research materials, and travel to research conferences or to DOE scientific user facilities.

Augmenting the honors earned by current students are those received by young alumni.

Recent graduate Nick Wellkamp was named a Marshall Scholar and is pursuing a master's degree in economics at the University of Oxford. He ultimately plans on pursuing a doctorate. Wellkamp says he appreciates how a world-class education in economics can help him with his long-term goals.

"Given the economic challenges our country and our world are facing right now, and looking forward to our long-term challenges such as energy, climate change, and sustainable economic development, I think we need more leaders who are well-versed in economics," said Wellkamp.

Four Georgia Tech graduates were among the 2010 American Society of Mechanical Engineers (ASME) Federal Government Fellows. The program provides a valuable public service to the nation while simultaneously giving engineers a unique opportunity to participate directly in the policy making process.

Adam Christensen worked in the office of a Washington state congressman, Tony Dickherber worked with the National Cancer Institute, and Richard Simmons and Jaqueline Tront were both assigned to the U.S. State Department.

Over the past few decades, ASME Federal Fellows have distinguished themselves as key advisors on standards, nanotechnology, risk analysis, critical infrastructure, energy, education, aerospace, manufacturing, technology development, and other national issues.

Programs support student success

Georgia Tech has a long history of providing the support that students need to excel in the classroom, the research lab, the career marketplace, and an array of other venues.

A relatively recent initiative that has become increasingly critical for many students is the G. Wayne Clough Georgia Tech Promise Scholarship Program, which has assisted more than 360 students. In the fall of 2010, seventy-one incoming freshmen representing thirty-six Georgia counties participated in the program, comprising the largest incoming class in the program's history.

Launched in 2007, Tech Promise is designed to help academically qualified Georgia students whose families have an annual income of 150 percent of the federal poverty level—$33,300 per year—earn their college degree debt-free. To date, 179 students have graduated from Georgia Tech with the support of the program.

Picking up where Georgia's HOPE scholarship and other financial aid options leave off, the program is individually tailored for each applicant. Assistance includes scholarships, grants, and job opportunities that allow eligible in-state students to attend Georgia Tech without the burden of student loan debt.

Once students enroll at Georgia Tech, the Office of Success Programs plays a vital role in supporting their academic achievement. Over the summer, Success Programs instituted changes designed to make life easier for students. The academic programs offered by the office—GT 1000 (freshman seminar), tutoring, and academic support services—transitioned to the Office of Academic Affairs, which is based in the recently opened Clough Undergraduate Learning Commons.

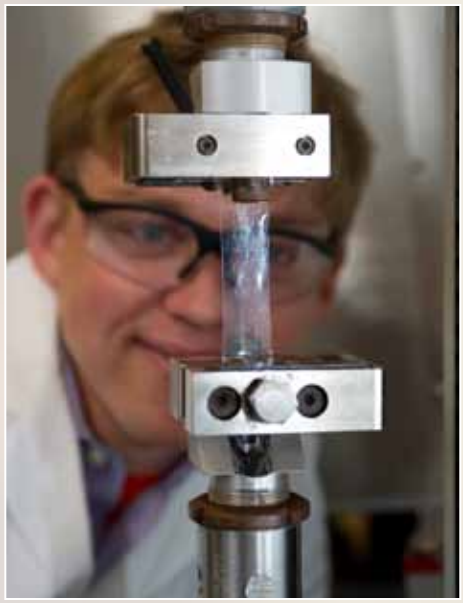
Steven Girardot, former director of Success Programs, is now director of the Center for Academic Success, which oversees the academic programs.

"The reorganization of the Office of Success Programs into two units allows both areas to move forward on new initiatives that will benefit the educational experience of undergraduates and help the Institute work toward the goals outlined in the strategic plan," Girardot said. "For academic affairs, this reorganization is also an important component of the vision of Clough Commons, which includes enhancing and expanding academic support services."

The other programs formerly offered by Success Programs—FASET Orientation, New Student Convocation, Welcome Week, Welcome Home Month, RATS Week, and sophomore year nonacademic programs—remain under the management of Student Affairs and are based in the Student Services Building.

A critical factor in fostering academic success is the quality of student-faculty relationships. After the results of a May 2009 Student Experience Survey were released, one thing became obvious to the campus community—students at Georgia Tech felt like student-faculty interaction wasn't a priority.

Students took a significant step toward improving that situation with the creation of the Student-Faculty Expectations Agreement (SFEA), which was developed by the Student Government Association (SGA).



TI:GER is a collaboration between various Georgia Tech colleges and the Emory University School of Law that brings together law, economics, management, and science and engineering graduate students in a classroom and research environment. Through the TI:GER program, Walter Voit helped to develop a shape-memory plastic that can mold to the inside of an ear, for use in earphones and hearing aids.

The document replaces the Student Bill of Academic Rights and went into effect over the summer.

"As students, we must acknowledge our responsibility in building a positive classroom environment and promoting good stewardship of this duty," said John Miller, chair of the student-faculty development committee. "Improving student-faculty relations has been an ongoing goal of SGA for more than two years, and we are finally seeing a lot of improvement."

Miller and Austen Edwards, SGA's vice president of academic affairs, worked to build on efforts made the previous year to bring students and faculty members together by completing the agreement.

"The Student Bill of Rights was one-way and the new document is two-way—it contains expectations for both students and faculty," said Anderson D. Smith, senior vice provost for academic affairs. "There was no record that the original bill of rights had been vetted through the Academic Senate, but this new document has been endorsed by the Senate and the undergraduate and graduate student government."

Augmenting on-campus student success programs are a number of off-campus initiatives, and an important strategic partner in many of these efforts is Emory University.

Georgia Tech and Emory have a history of collaborating in numerous ways to leverage each other's varied resources. One new area of emphasis is to provide both

Duane Carver (right), the first Georgia Tech Promise scholar to graduate from the Institute, shakes hands with President Peterson at Commencement.

student populations with more curriculum choices, an approach that's being furthered by a concerted effort to offer more cross-registration options.

Tech students have long had the ability to register for classes at other area colleges through the Atlanta Regional Council for Higher Education (ARCHE). This group is comprised of a host of area colleges and universities and allows students to take classes not offered at Tech that will help them reach their academic or career goals. Senior Vice Provost Anderson D. Smith hopes that both institutions' increased promotion of cross-registration will make it easier for students to identify courses of interest that would not otherwise be available to them.

"This is about strengthening the relationship between Emory and Georgia Tech, and it makes sense because we both attract outstanding, high-quality students," Smith said. He also noted that because Tech already provides transportation to Emory with a shuttle every two hours, it makes sense for students enrolling in courses outside of Georgia Tech to do so at Emory.

While Tech's relationship with Emory is longstanding, a new partnership with the Woodruff Arts Center is providing Tech students unlimited access to the arts in Atlanta at deeply discounted rates. By purchasing a season pass for just $20, Tech students have access to all exhibitions at the High Museum of Art and all performances of the Alliance Theatre and Atlanta Symphony for an entire academic year.

"There is a clear and proven connection between involvement in the arts and academic achievement," said Woodruff Arts Center CEO Joe Bankoff. "At the Woodruff, we are committed to making the arts accessible to students and are thrilled to be partnering with Georgia Tech to provide extensive and inexpensive access to our artistic offerings."

Student creativity and innovation unparalleled

When Georgia Tech students let their imaginations run free and apply their legendary work ethic, the results are incomparable.

A great example of this creativity is a team of biomedical engineering and mechanical engineering students who developed a surgical instrument that performs the most difficult step of cataract surgery. The instrument won first prize at the 2010 Mechanical Engineering Capstone Design Expo.

Jorge Baro, Kanitha Kim, Rebeca Bowden, Chris Giardina, Khaled Kashlan, and Shane Saunders developed the AutoRexis, a surgical instrument that aims to make cataract surgery safer and more cost effective.

Age-related cataracts are protein accumulations in the lens of the eye, clouding vision. During cataract removal surgery, an ophthalmologist gains access to the cataract through capsulorhexis, a time-consuming and difficult process using surgical tweezers to make a circular incision in an internal membrane of the eye.

The AutoRexis has rotating dual-arc blades that can improve consistency in capsulorhexis size, circularity, centering, and time to completion when compared to existing products.

Another student project, Urban RePeel, won first place in Georgia Tech's 2011 Ideas to SERVE Competition for its environmentally friendly business concept that would help minimize the amount of local food waste going into landfills.

Urban RePeel, which won $2,000 for first place, includes environmental engineering graduate students Nicole Sullivan and Jared McGrath and chemical engineering graduate student Ryan Ravenelle. During their presentation at the competition finals, they highlighted the fact that 12 percent of the annual landfill waste in Georgia is from food and that America spends $1 billion a year to deposit food waste in landfills.

Urban RePeel seeks to minimize the amount of food waste going into local landfills.

Urban RePeel would help solve this problem by collecting food waste from Atlanta restaurants, cafeterias, and apartment complexes and converting it into vermicompost using red wigglers at an industrial warehouse center. The excrement of the red wigglers, who can eat their weight in food waste daily, could be sold to local farmers, landscapers, and gardeners as an environmentally friendly alternative to chemical fertilizers.

Accolades also went to Georgia Tech's Wreck Racing team, which took the top spot in the Grassroots Motorsports $2010 Challenge, including first-place finishes in the autocross and concours events. Wreck Racing's No. 81 Lexus-V8-powered Mazda Miata claimed the overall title, beating fifty-three teams that included cars from professional tuning shops and veteran racecar builders.

Held annually in Gainesville, Florida, the event was hosted by *Grassroots Motorsports* magazine. The competition required competitors to buy and build a racecar for less than the dollar amount of the calendar year. The cars competed in three different events including autocross, drag, and concours.

The 2010 race marks the first time Wreck Racing placed in the event categories; the team's best overall finish in previous years was twelfth place.

Wreck Racing is a volunteer student organization, comprised of more than thirty-five students representing schools across campus.

A team of engineering students developed AutoRexis, an instrument that makes cataract surgery safer and more cost effective.

Another group of twelve Georgia Tech students were awarded $14,000 in recognition of their innovative ideas for GE Energy Service's Smart Grid Challenge Program. The competition provided the opportunity for students to address problems related to smart grid technologies.

Six teams of Georgia Tech students participated in the challenge, tackling smart grid problems related to distribution losses, liability, and demand.

Executive Vice President for Research Stephen E. Cross commended the students who participated in the challenge. "This competition hit a sweet spot for one of our strategic plan initiatives—to provide team-based, real-world research opportunities for our students," Cross said. "The experience that our students gain through opportunities like this will pay great dividends in the future."

The Wreck Racing team won the Grassroots Motorsports $2010 Challenge.

Student-athletes continue to excel

The Yellow Jackets provided another great year of athletic competition, to the delight of their many fans both on and off campus.

The football team, which advanced to a bowl game for the fourteenth consecutive season, led the nation in rushing offense—the first team in Atlantic Coast Conference (ACC) history to do so.

The golf team, ranked No. 2 nationally, captured its third straight ACC title with a tournament-record score of 33-under-par 831. The conference title brought with it an automatic berth in the NCAA Championship, the twenty-third in Georgia Tech history.

The women's tennis team earned its twelfth consecutive NCAA Tournament appearance, and junior Jillian O'Neill earned a spot in the NCAA singles tournament. On the men's team, Guillermo Gomez broke the Tech record for career singles victories (he now has 116) and he was selected to compete in the NCAA Singles Championship. Gomez was also named ACC Player of the Year.

On the Yellow Jacket diamond, pitcher Mark Pope was named National Player of the Week twice during the season by *Collegiate Baseball* newspaper. Pope has four career complete game shutouts, a Georgia Tech modern day record. He also tossed the first nine-inning complete-game one-hitter for a Georgia Tech pitcher since 1997.

Women's basketball standout Alex Montgomery was named Second Team All-ACC, ACC All-Defensive Team, Atlanta Tipoff Club's State of Georgia Player of the Year, State Farm/WBCA Coaches All-America Honorable Mention, and was the tenth pick overall in the 2011 WNBA Draft, the highest a Tech player has been drafted and the first ACC player to be selected for the year.

The softball team won its third consecutive ACC regular season title.

Junior Jillian O'Neill earned a spot in the NCAA singles tournament.

A HUMAN-CENTERED RESEARCH AGENDA

Research at Georgia Tech has always been driven by a common goal: to improve the human condition. Those improvements are expressed in a wide variety of ways: new diagnostic tools and treatments for diseases, development and refinement of alternative energy sources, novel applications of computing and robotics that help humans use their time and energy more efficiently, and advances that help promote environmental sustainability while at the same time fostering economic growth.

Professor David Ku (right) challenged a group of engineering students to develop an accurate device for diagnosing pneumonia. The result was PneumoniaCheck.

Innovating for better health

Applying the principles of technological research to the challenges of medicine and healthcare has been a primary element of Georgia Tech's research agenda since the 1990s. Institute researchers took a giant step in this arena last year with the development of a sampling device that could prevent thousands of people worldwide from dying of pneumonia each year.

Called PneumoniaCheck, the device is a solution to the problem of diagnosing pneumonia, an inflammation of the lungs that kills about 2.4 million people each year. The problem is particularly devastating in Africa, Southeast Asia, and the Eastern Mediterranean, where a child dies of pneumonia every fifteen seconds.

Developed by mechanical engineering students, graduate business students, and faculty at Georgia Tech, PneumoniaCheck has been commercially launched to healthcare professionals through a startup company, MD Innovate Inc.

"Georgia Tech created a simple and new device to detect the lung pathogens causing pneumonia," said Mechanical Engineering and Management Professor David Ku, who is also a professor of surgery at Emory University. "It has the potential to save more lives than any other medical device."

Last year, Ku was asked by the head of virology at the U.S. Centers for Disease Control and Prevention to develop a quick and economical way to diagnose pneumonia, particularly in developing nations where it is a leading cause of death among children. Ku challenged a group of mechanical engineering and bioengineering graduate students to develop an accurate device for diagnosing pneumonia.

In developing nations, many children with respiratory infections fail to receive adequate care, and the overuse of antibiotics has led to an increase in drug-resistant bacteria. An accurate, easy-to-use, and widely available new diagnostic test—such as PnuemoniaCheck—could improve identification of bacterial respiratory infection in children, reducing the inappropriate use of antibiotics and the long-term negative impacts of drug resistance.

Children's health is also the focus for physicians and engineers within a new center devoted to pediatric nanomedicine that will develop targeted, molecular-sized nanoparticles as part of a unique approach to treating pediatric diseases. Specific focus areas will include pediatric heart disease and thrombosis, infectious

diseases, cancer, sickle cell disease, and cystic fibrosis.

The Center for Pediatric Nanomedicine is the first of its kind in the world. Directed by Biomedical Engineering Professor Gang Bao, the center will involve researchers from Emory University, Georgia Tech, and Children's Healthcare of Atlanta.

"Because nano-scale structures are compatible in size to biomolecules, nanomedicine provides unprecedented opportunities for achieving better control of biological processes and drastic improvements in disease detection, therapy, and prevention," said Bao.

In addition to College of Engineering faculty, scientists at the Georgia Tech Research Institute (GTRI) are also pursuing critical health-related research. A prime example is a project aimed at rapid diagnosis of concussions.

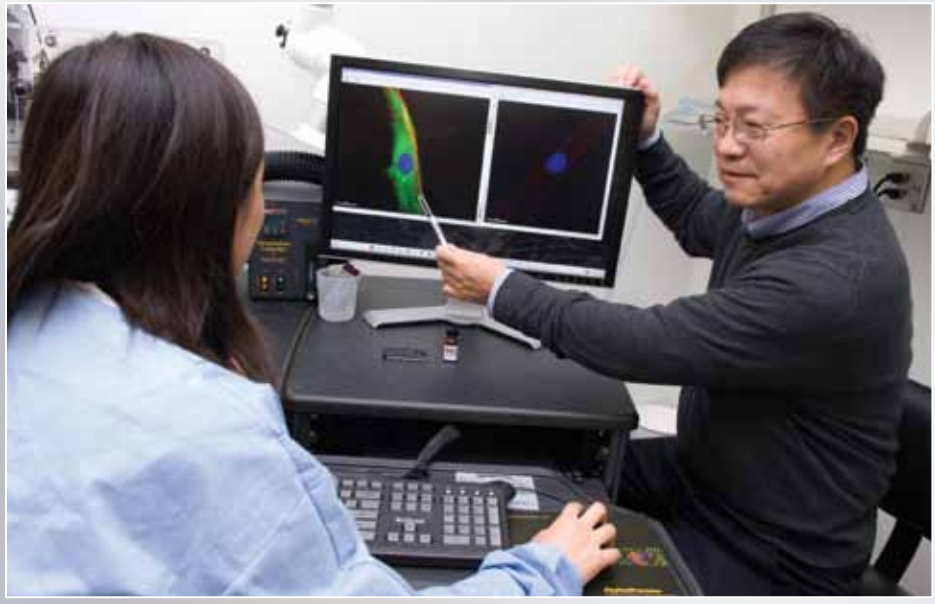
Walking and thinking at the same time can be especially difficult for persons who've suffered concussions, and GTRI scientists hope to use that multitasking challenge—measured by a simple radar system—to quickly screen individuals who may have suffered brain injuries.

By asking an individual to walk a short distance while saying the months of the year in reverse order, researchers are trying to determine whether that person is impaired. This simple test, which could be performed on the sideline of a sporting event or on a battlefield, has the potential to help coaches and commanders decide whether athletes and soldiers are ready to engage in activity again.

"Research performed at the University of Oregon found that when a person with a concussion performs cognitive and motor skill tasks simultaneously, they have a different gait pattern from a healthy individual, and we are working to identify those anomalies in a person's walk with radar," said GTRI Research Engineer Jennifer Palmer.

Faculty in the College of Sciences are looking to the ocean to help prevent malaria. A group of chemical compounds used by a species of tropical seaweed to ward off fungus attacks may have promising anti-malarial properties for humans. The compounds are part of a unique chemical signaling system that seaweeds use to battle enemies—and that may provide a wealth of potential new pharmaceutical compounds.

Using a novel analytical process, researchers found that the complex antifungal molecules are not distributed evenly across the seaweed surfaces, but instead appear to be concentrated at specific locations—possibly where an injury increases the risk of fungal infection.



Professor Gang Bao (right) leads the new Center for Pediatric Nanomedicine.

Associate Professor Julia Kubanek (right) is exploring the potential of tropical seaweed to treat malaria.

"The language of chemistry in the natural world has been around for billions of years, and it is crucial for the survival of these species," said Julia Kubanek, an associate professor in the School of Biology and the School of Chemistry and Biochemistry. "We can co-opt these chemical processes for human benefit in the form of new treatments for diseases that affect us."

A Biology colleague of Kubanek's is leading the development of new electronic biosensing technology that could render the multi-welled microplate, long a standard tool in biomedical research and diagnostic laboratories, a thing of the past.

"This technology could help facilitate a new era of personalized medicine," said Biology Professor John McDonald, chief research scientist at the Ovarian Cancer Institute. "A device like this could quickly detect in individuals the gene mutations that are indicative of cancer and then determine what would be the optimal treatment. There are a lot of potential applications for this that cannot be done with current analytical and diagnostic technology."

Essentially arrays of tiny test tubes, microplates have been used for decades

New interdisciplinary centers aimed at dramatically advancing Georgia Tech's research agenda

When President G. P. "Bud" Peterson named Stephen E. Cross as Georgia Tech's first Executive Vice President for Research in early 2010, he was clear on his expectations for the new position.

"At every point in his career, Steve has increased the breadth of the technology portfolio and the size of research budgets under his direction," Peterson said. "He will be a strong advocate for Georgia Tech, both supporting a robust research enterprise internally and extending our influence with external research partners."

Since Cross's appointment, the robustness of Georgia Tech's research enterprise has grown rapidly with the establishment of four interdisciplinary research centers that will address key strategic issues of the twenty-first century:

- **Center for 21st Century Universities**, led by former College of Computing Dean Rich DeMillo, distinguished professor in Computing and Management. The center, based in the College of Computing with faculty from Management, Public Policy, and Industrial and Systems Engineering, focuses on the role of disruptive technologies such as social networking and innovations such as open courseware, serving as a living laboratory for testing new educational ideas.

- **Institute for Electronics and Nanotechnology (IEN)**, led by Electrical and Computer Engineering Professor Mark Allen, who also serves as senior vice provost for Research and Innovation. IEN consolidates multiple electronics and nanotechnology research centers and related programs into an organization designed to enhance support for rapidly growing programs spanning biomedicine, materials, electronics, and nanotechnology.

- **Institute for People and Technology (IPaT)**, led by Computing Professor Beth Mynatt, former director of the GVU Center. IPaT supports the strategic plan's focus on faculty-led, interdisciplinary, and transformative research. It supports various college-based research centers that collectively pursue transformations in healthcare, education, consumer media, and other complex human enterprises by integrating advances in human-centered computing, architectural and digital design, policy, and system science and engineering.

- **Georgia Tech Fund for Innovation in Research and Education (GT FIRE)**, led by Cross and Provost Rafael L. Bras. GT FIRE aims to facilitate planning for large extramural proposals—those that are of strategic value to the Institute and have more than $500,000 in direct costs per year—and to provide support for feasibility studies of transformative ideas in research and/or education. Funding of up to $4,000 per group is available on an ongoing basis for large extramural proposals and can be requested for costs associated with workshops, meetings, retreats, and limited travel. Funding of up to $40,000 for up to two years is available for transformative research and education proposals for costs associated with feasibility studies.

to simultaneously test multiple samples for their responses to chemicals, living organisms, or antibodies. Fluorescence or color changes in labels associated with compounds on the plates can signal the presence of particular proteins or gene sequences.

The researchers hope to replace these microplates with modern microelectronics technology, including disposable arrays containing thousands of electronic sensors connected to powerful signal processing circuitry. If they're successful, this new electronic biosensing platform could help realize the dream of personalized medicine by making possible real-time disease diagnosis—potentially in a physician's office—and by helping select individualized therapeutic approaches.

The National Institutes of Health continues to provide significant support for Georgia Tech's health-related agenda, as evidenced by a number of key projects the agency funded last year:

- A EUREKA grant to design a new way to treat invasive brain tumors by capturing the migrating cells that spread the disease. The EUREKA—Exceptional, Unconventional Research Enabling Knowledge Acceleration—program helps scientists test new, unconventional ideas or tackle major methodological or technical challenges.

- A five-year, $14.6 million contract to continue the development of nanotechnology and biomolecular engineering tools and methodologies for detecting and treating atherosclerosis, which typically occurs in branched or curved regions of arteries where plaques form because of cholesterol buildup. Inflammation can alter the structure of plaques so they become more likely to rupture, potentially causing a blood vessel blockage and leading to heart attack or stroke.

- A five-year, $16.1 million award to the Georgia Tech-led Nanomedicine Center for Nucleoprotein Machines to pursue development of a clinically viable gene correction technology for single-gene disorders and demonstrate the technology's efficacy with sickle cell disease.

- A five-year, $10 million award to Georgia Tech, Emory University, and PATH, a Seattle-based nonprofit organization, to advance technology for the painless self-administration of flu vaccine using patches containing tiny microneedles that dissolve into the skin.

Professor Facundo Fernandez (second from right) led efforts to develop a test that uses a single drop of blood to detect the presence of ovarian cancer.

Cancer detection and treatment

While the scourge of cancer continues to touch far too many individuals and their loved ones, Georgia Tech researchers are making solid progress in devising better ways to diagnose and treat the disease.

For instance, Georgia Tech scientists have attained very promising results on their initial investigations of a new test for ovarian cancer. Using a new technique involving mass spectrometry of a single drop of blood serum, the test correctly identified women with ovarian cancer in 100 percent of the patients tested.

"Because ovarian cancer is a disease of relatively low prevalence, it's essential that tests for it be extremely accurate. We believe we may have developed such a test," said Biology Professor John McDonald, chief research scientist at the Ovarian Cancer Institute.

The measurement step in the test, developed by the research group of Chemistry and Biochemistry Professor Facundo Fernandez, uses a single drop of blood serum, which is vaporized by hot helium plasma. As the molecules from the serum become electrically charged, a mass spectrometer is used to measure their relative abundance. The test looks at the small molecules involved in metabolism that are in the serum, known as metabolites. Machine learning techniques developed by Computing Professor Alex Gray were then used to sort the sets of metabolites that were found in cancerous plasma from the ones found in healthy samples. Then, McDonald's lab mapped the results between the metabolites found in both sets of tissue to discover the biological meaning of these metabolic changes.

The assay did extremely well in initial tests involving ninety-four subjects. In addition to being able to generate results using only a drop of blood serum, the test proved to be 100 percent accurate in distinguishing sera from women with ovarian cancer from normal controls.

Augmenting the work of McDonald and the Ovarian Cancer Institute to detect ovarian cancer at the earliest stages are their efforts to fight the disease more effectively after it develops.

McDonald's team has discovered that a type of regulatory RNA may be effective in this battle. Ovarian cancer isn't typically discovered until it's in the advanced stages, where it is already spreading to other organs and is very difficult to fight with chemotherapy. This new discovery may allow physicians to turn back the clock of the tumor's life cycle to a phase where traditional chemotherapy can better do its job. A regulatory RNA called miR-429 may be successful in inducing metastatic or spreading cancer cells to convert back to a less metastatic, non-invasive form.

"Primary tumors are rarely fatal," said McDonald. "Most cancer patients succumb because the cancer metastasizes, and current chemotherapies are not designed to kill metastasizing cancer cells. We found that when we introduced miR-429 into the highly metastatic ovarian cancer cells, they became less invasive, less migratory, and more like the cancer cells associated with primary tumors," said McDonald.

The cellular level of cancer is also the focus of research dubbed T cell transfer being conducted in Georgia Tech and Emory University's joint Department of Biomedical Engineering.

Those researchers have found that manipulation of cells by a new microfluidic device may help clinicians improve a promising T cell transfer, cancer therapy that harnesses the body's own immune cells to fight such diseases as metastatic melanoma, non-Hodgkin's lymphoma, chronic lymphocytic leukemia, and neuroblastoma. T cell transfer has shown encouraging results in clinical trials. The treatment involves removing disease-fighting immune cells called T cells from a cancer patient, multiplying them in the laboratory, and then infusing them back into the patient's body to attack the cancer. The effectiveness of this therapy, however, is limited by the finite lifespan of T cells—after many divisions, these cells become

Professor John McDonald is leading pioneering efforts to improve chemotherapy outcomes in the treatment of ovarian cancer.

Assistant Professor Melissa Kemp's research strengthens the body's cancer-fighting T cells.

unresponsive and inactive.

Georgia Tech and Emory researchers have addressed this limitation by developing a microfluidic device for sample handling that allows a statistical model to be generated to evaluate cell responsiveness and accurately predict cell "age" and quality. Being able to assess the age and responsiveness of T cells—and therefore transfer only young functional cells back into a cancer patient's body—offers the potential to improve the therapeutic outcome of several cancers.

"The statistical model, enabled by the data generated with the microfluidic device, revealed an optimal combination of extracellular and intracellular proteins that accurately predict T cell age," said Biomedical Engineering Assistant Professor Melissa Kemp. "Knowing this information will help facilitate the clinical development of appropriate T cell expansion and selection protocols."

Energy policy and production

Producing sufficient, affordable energy in an environmentally sustainable fashion—and crafting policy to facilitate that production—is one of the defining global challenges of the twenty-first century, and it's a challenge that Georgia Tech researchers are enthusiastically embracing.

Energy policy is an especially critical issue in the American South, according to a report produced by Georgia Tech and Duke University. The report asserts that within the next twenty years, the South could generate 20 percent to 30 percent of its electricity from renewable energy sources—up from less than 4 percent today—and pay less for its electricity than is currently projected, if strong federal policies are enacted.

The analysis, "Renewable Energy in the South," finds that conventional wisdom has underestimated the available renewable resources in the region and that a federal renewable electricity standard (RES) would enable the South to capitalize on this untapped renewable energy potential. The South lags behind all other regions in renewable electricity, obtaining 3.7 percent of its power from renewable sources, compared to 9.5 percent for the country as a whole.

Georgia Tech researchers are collaborating with business and industry to help reduce the cost of manufacturing and operating wind turbines for generating electricity.

The solar panels atop the new Clough Undergraduate Learning Commons help make the facility one of the most sustainable on any university campus.

"Countries around the world are already tapping into the potential of renewable energy, and are capturing export markets and generating jobs in the process," said Georgia Tech Public Policy Professor Marilyn Brown, co-lead researcher of the study. "The report demonstrates that although many states in the South are off to a slow start, renewable initiatives are now under way across the region, and the potential for expansion is promising."

On the cost side, wind, biomass, hydropower, and customer-owned renewables stand out as money savers.

"While the South enjoys some of the lowest electricity rates in the country, there is resistance to developing new technologies that seem much more costly than coal-based electricity," said Etan Gumerman of Duke University's Nicholas Institute for Environmental Policy Solutions and a co-lead researcher on the study. "In reality, that's not the case."

With a customized version of the economic modeling system used by the U.S. Energy Information Administration, researchers found that if supportive policies and tax incentives are implemented or extended, total regional energy costs would be 7 percent less by 2030 than they are projected to be if policies do not change.

In the spirit of fostering the types of projects called for in the Georgia Tech-Duke report, four Tech projects were among the

forty-three green technology initiatives awarded funding by the U.S. Department of Energy as part of the American Recovery and Reinvestment Act through DOE's Advanced Research Projects Agency-Energy.

The projects are based in eighteen states with 36 percent of projects led by universities, 33 percent by small businesses, 24 percent by large businesses, 5 percent by national labs, and 2 percent by nonprofits. The Georgia Tech projects comprise the following:

- Georgia Tech partnered with Stone Mountain Technologies Inc. and ARS Solutions LLC on "Vapor Absorption/Adsorption: Modular Thermal Hub for Building Cooling, Heating, and Water Heating." This $2.4 million project based in the School of Mechanical Engineering will develop a hub for cooling and heating systems in buildings using microscale passages. It uses fluids with zero Global Warming Potential and can achieve from hundreds to tens of thousands of watts in cooling capacity and a 51 percent primary energy use reduction.

- Massachusetts Institute of Technology partnered with Dartmouth College, Georgia Tech, the University of Pennsylvania, and OnChip Power on "Switches/Magnetics—Lighting: Advanced Technologies for Integrated Power Electronics." This $4.4 million project based at MIT aims to radically improve the size, integration, and performance of power electronics for high-efficiency solid-state lighting.

- Georgia Tech partnered with National Semiconductor on "Magnetics—Consumer Electronics: Highly Laminated, High Saturation Flux Density Magnetic Cores for On-Chip Inductors in Power Converter Applications." The goal of this $1 million project based at Georgia Tech is to greatly reduce the size and cost, and increase the efficiency of, laptop power supplies and other chargers used to power consumer electronics. It will do so through the development of new magnetic materials that support high currents despite their small size.

- Technology developed in the "Circuit Topology/Switches—Transmission: Dynamic Control of Grid Assets Using Direct AC Converter Cells" project will enable dramatic cost reductions in smart grid implementation and allow increased penetration of renewable energy resources by reducing transmission and distribution upgrade costs by up to 80 percent. The $981,000 project, based in the School of Electrical and Computer Engineering, will involve several key developments: a new converter layout that achieves an AC/AC function using a minimal number of switches, and the elimination of large capacitors in the system.

Computing Professors Gregory Abowd (left) and Jim Rehg are playing key roloes in research aimed at identifying children at risk for autism and other developmental delays.

To improve the performance of neural implants for those with certain disabilities, a Georgia Tech research team is seeking to enhance the brain-machine interface (left) by irrefutably identifying why current methods often fail.

Regents' Professor Ronald Arkin (left) is leading research on the development of deceptive robots.

Computing and robotics

Advances in computing and robotics are being applied to an array of concerns such as early diagnosis of developmental delays in children, improving technology-related education, and strengthening cyber security.

For example, a Georgia Tech-led team received a $10 million "Expeditions in Computing" award from the National Science Foundation (NSF) to develop novel computing techniques for measuring and analyzing the behavior of children. These technologies will be used to enable new approaches for identifying children at risk for autism and other developmental delays. In addition, these methods may potentially improve the delivery and evaluation of treatment.

The award—one of only ten given by the NSF since 2008—provides up to $2 million in funding each year for five years and is designed to push boundaries in computer science. This project will push the limits by catalyzing a new scientific discipline called computational behavioral science, which will draw equally from computer science and psychology to transform the study of human behavior.

"There is a great deal of creativity in the computer science research community today," said Deborah Crawford, acting assistant director of Computer and Information Science and Engineering at NSF. "Our intentions with the Expeditions in Computing program are to stimulate and use that creativity to expand the horizons of computing."

Autism affects one of every 110 children in the United States, and the long-term outcomes for a child who is at risk for autism can be significantly improved if the child is treated at an early age.

Another computing research project aimed at improving the lives of young people is a National Science Foundation Alliance collaborative grant that partners Georgia Tech with the University of Georgia as lead institutions, with Georgia Perimeter College and three Georgia public school systems also serving as critical partners. The project— Georgia STEM Accessibility Alliance—focuses on creating a new virtual world to improve Science, Technology, Engineering, and Mathematics (STEM) education for all students, especially those with disabilities.

Senior Research Scientist Robert Todd and his research team in the Center for Assistive Technology and Environmental Access—part of the College of Architecture—are creating a virtual island in the popular Second Life world that will be a place for students with any kind of disability to go and get help with STEM subjects.

"We're building a universally designed

virtual world to give everyone better access to support in the STEM fields of study," said Todd. "This island will focus on those students who may have a wide range of issues such as learning disabilities, blindness, motor skill problems, or cognitive issues and it will allow them to have access to mentors, tutors, and other resources to help them succeed in their courses."

Those with disabilities are also the focus of a project being led by a group of biomedical engineers at Georgia Tech and Emory University. The research focuses on the role of neural implants, which have shown great initial promise for activities such as controlling movement of a prosthetic limb or the cursor on a computer monitor. However, widespread use of the technology is hampered by a lack of reliability over time, and clear evidence of the reasons for the failures remains elusive.

To address this problem, the research team is seeking to improve brain-machine interface by irrefutably identifying why current methods fail. The Defense Advanced Research Projects Agency (DARPA) has provided $4.5 million for three years to support the multidisciplinary team as they seek reasons for the failure of neural implants.

"This research is a great match between our desire to develop new, innovative ways to interface technology to the human nervous system, and DARPA's desire to overcome the scientific hurdles that are thwarting the development of the next generation of neuro-controlled prosthetic devices," said Biomedical Engineering Professor Ravi Bellamkonda, principal investigator for the grant.

Computing and robotics technology has the ability to assist humans in ways never before conceived of, and researchers in the School of Interactive Computing are pushing those boundaries even further with what is believed to be the first detailed examination of robot deception.

A robot deceiving an enemy soldier by creating a false trail and hiding so that it will not be caught may sound like a scene from one of the *Terminator* movies, but it's actually the scenario of an experiment conducted by Interactive Computing Professor Ronald Arkin and his research team.

"We have developed algorithms that allow a robot to determine whether it should deceive a human or other intelligent machine," explained Arkin, "and we have designed techniques that help the robot select the best deceptive strategy to reduce its chance of being discovered."

In the future, robots capable of deception may be valuable for several different purposes, including military and search and rescue operations. A search and rescue robot may need to deceive in order to calm or receive cooperation from a panicking victim. Robots on the battlefield with the power of deception will be able to successfully hide and mislead the enemy to keep themselves and valuable information safe.

Bo Rotoloni (right) is director of GTRI's new Cyber Technology and Information Security Laboratory. Rotoloni is pictured with GTRI Principal Research Engineer Fred Wright.

"The consolidation of GTRI's key cyber researchers, programs, and resources under a single umbrella of shared research objectives will be a powerful driver in the development of new cyber solutions and technologies that will have an immediate impact on the United States."

—Bo Rotoloni

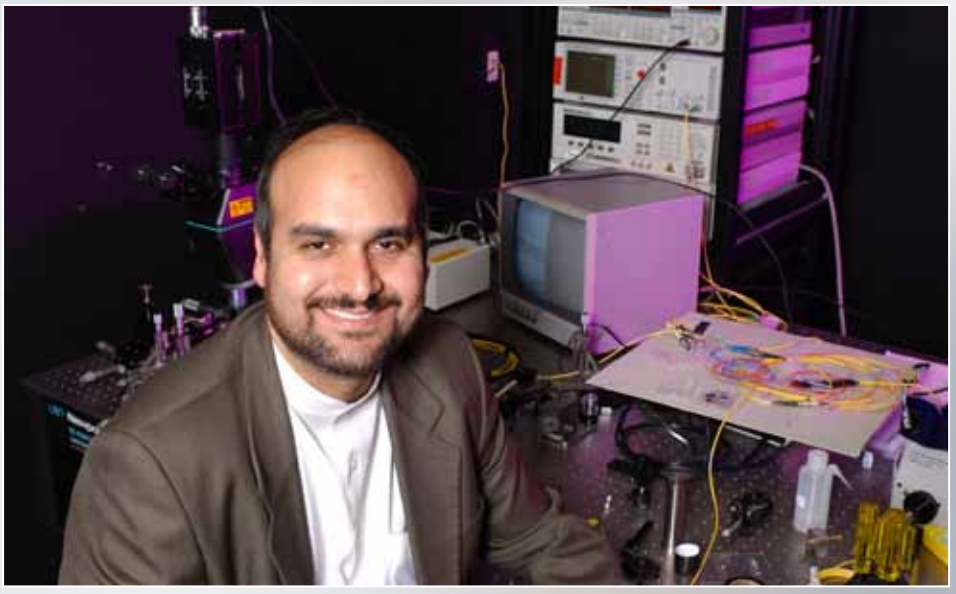
A key partner in the deceptive robot research, the Georgia Tech Research Institute (GTRI), has also formed a new Cyber Technology and Information Security Laboratory (CTISL) to apply GTRI's broad expertise and systems engineering experience in cyber-related research to a wide range of information security issues.

CTISL researchers will develop cutting-edge capabilities that will allow data to be sent across trusted networks to ensure effective missions for GTRI's customers. CTISL's work will focus on providing resilient command and control solutions to military personnel operating in contested environments, helping industry defend against cyber criminals, and safeguarding the nation's critical infrastructure.

"The consolidation of GTRI's key cyber researchers, programs, and resources under a single umbrella of shared research objectives will be a powerful driver in the development of new cyber solutions and technologies that will have an immediate impact on the United States," said CTISL Director Bo Rotoloni.

Rotoloni, who was previously the deputy director of GTRI's Signature Technology Laboratory, brings to the job an understanding of GTRI's existing customers and a vision for developing new cyber research areas where the laboratory can apply its expertise. To develop and deploy advanced technologies to defend and deter cyber attacks against the United States, researchers in the new laboratory will pursue opportunities in various agencies within the U.S. Departments of Defense and Homeland Security; local, state, and foreign ally governments; and commercial and private entities.

CTISL will also leverage basic research from across Georgia Tech as part of the Georgia Tech Information Security Center.



Professor Ali Adibi directs Georgia Tech's Center in Integrated Photonics Engineering Research.

Security and sustainability

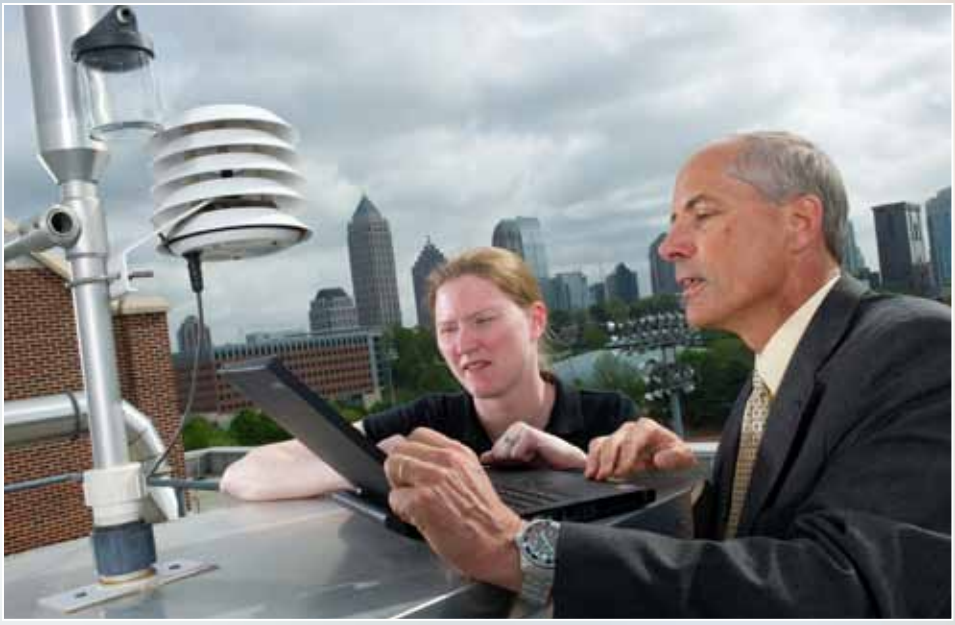
Using technology to create a safer and more environmentally sustainable world is a high priority on Georgia Tech's research agenda, and faculty from across the Institute are engaged in this type of research.

Detecting multiple biological and chemical threats simultaneously with unprecedented performance is the goal of a new class of sensors being developed through a new multi-million-dollar research center led by Georgia Tech engineers.

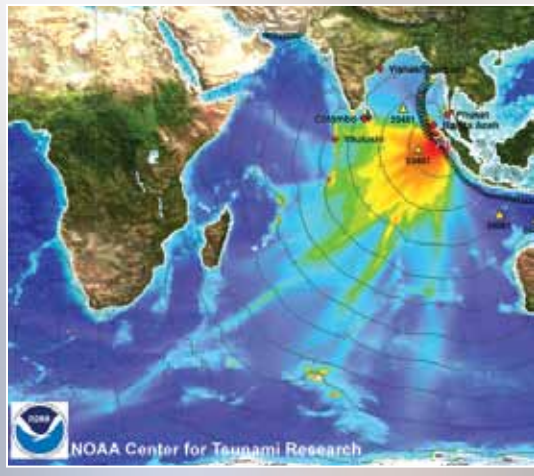
Biological and chemical sensing are active research areas because of their applications in clinical screening, drug discovery, food safety, environmental monitoring, and homeland security. Using integrated photonics, the new class of sensors will be capable of detecting chemical agents—such as toxins, pollutants, and trace gases—and biological agents—such as proteins, viruses, and antibodies—simultaneously on the same chip.

"The proposed sensors will detect multiple biological and chemical threats on a compact integrated platform faster, less expensively, and more sensitively than the current state-of-the-art sensors," said Electrical and Computer Engineering Professor Ali Adibi, the center's leader.

Earthquakes and the resulting tsunamis pose a very different kind of threat. Georgia Tech seismologists have developed a new system that could be used to warn future



Georgia Tech Professor Ted Russell (right) and Emory Professor Paige Tolbert (not pictured) are working to protect the public from the harmful effects of air pollution.



Data collected during the 2010 Sumatra earthquake will help warn future potential victims of impending quakes and tsunamis.

populations of an impending tsunami only minutes after the initial earthquake. The system, known as RTerg, could help reduce the death toll by giving local residents valuable time to move to safer ground.

"We developed a system that, in real time, successfully identified the magnitude 7.8 2010 Sumatran earthquake as a rare and destructive tsunami earthquake," said Earth and Atmospheric Sciences Professor Andrew Newman. "Using this system, we could in the future warn local populations, thus minimizing the death toll from tsunamis."

Tsunami earthquakes—unlike their non-tsunami counterparts—are a rare class of earthquakes that rupture more slowly, at 1-1.5 kilometers per second, and propagate up to the sea floor near the trench. This results in nearby wave heights up to 10-20 meters in nearby coastal environments. Such was the case with the Sumatran earthquake, with reported wave heights of up to 17 meters, causing a death toll of approximately 430 people.

"Because tsunami earthquakes rupture in a shallow environment, we can't simply use a measurement of magnitude to determine which ones will create large waves," said Newman. "When they occur, people often don't feel that they're significant, if they even feel them in the first place, because they seem like they're an order of magnitude smaller than they actually are."

RTerg uses its algorithmic tools to find quakes with tsunami attributes, then sends an alert to the National Oceanic and Atmospheric Administration's Pacific Tsunami Warning Center as well as the United States Geological Survey's National Earthquake Information Center.

The public health impacts of air pollution are the target of a five-year, $8 million Environmental Protection Agency grant to Georgia Tech and Emory University to

create one of four national Clean Air Research Centers addressing the public health impacts of air pollution.

The Georgia Tech/Emory center, named the Southeastern Center for Air Pollution and Epidemiology, will characterize ambient air pollution mixtures and determine their specific role in human health risks, using new measurement and modeling approaches. The overall goal of the center is to contribute to improved management of air quality for the benefit of human health in the United States.

The center is co-directed by Civil and Environmental Engineering Professor Ted Russell, and Paige Tolbert, professor and chair of environmental health at Emory's School of Public Health.

"This center is the culmination of a ten-year collaboration between Emory and Georgia Tech on air pollution research," said Russell. "By coalescing into a center, we can take this work to a new level—the integrated and trans-disciplinary research will lead to more effective methods for protecting the public from the harmful effects of air pollution."

In a separate project aimed at improving air quality, Georgia Tech researchers are using funding from the Advanced Research Projects Agency-Energy to pursue two different, but related, approaches for removing carbon dioxide from the flue gases of coal-burning power plants.

Power plants produce approximately one-third of all carbon dioxide emitted in the United States each year. The researchers are attempting to use the unique high-density properties of hollow fibers to develop cost-effective techniques for removing large volumes of the greenhouse gas from the emissions.

In one project, awarded directly to Georgia Tech, researchers are developing hollow-fiber composite membranes that will use nanoporous metal-organic framework materials to separate carbon dioxide from the flue gases. In the other project, Georgia Tech researchers are assisting colleagues at Oak Ridge National Laboratory in developing hollow-fiber sorbents that will soak up carbon dioxide like a sponge, then release it when heated.

"The challenge with this is to have a technology that not only physically works, but that can be built on a large scale and operated inexpensively," said Chemical and Biomolecular Engineering Professor David Sholl, who leads the membrane project.

Corporate environmentalism can both help, hurt stock performance

While pleasing to green activists, some corporate efforts to be environmentally friendly play better on Wall Street than others, according to a new study by College of Management researchers.

They found that while announcements of major philanthropic gifts to benefit environmental causes tend to improve companies' stock price performance, the reverse is true when it comes to announcing voluntary emission reductions.

"Philanthropy can generate positive publicity and goodwill among various stakeholders and can create value through more loyal customers and highly motivated employees," the researchers wrote in the study. "But the market reacts negatively to voluntary emission reductions. Therefore, announcements of voluntary emission reduction efforts should be accompanied by formal justifications as to why these efforts are being conducted (for instance, preparing for future legislation, competitive lobbying, or anticipated carbon trading) and what the expected value from these efforts is likely to be."

The study was conducted by Management faculty members Vinod Singhal and Ravi Subramanian in collaboration with Brian Jacobs of Michigan State University, a recent graduate of Tech's Management PhD program.

The researchers studied the effects on stock prices of two types of environment-related announcements: corporate environmental initiatives and environmental awards and certifications. On the whole, they found that most announcements have little effect on stock prices.

"Most of the time the effect is neutral," said Singhal. "A lot of people think environmental initiatives are win-win situations, but that doesn't necessarily seem to be the case financially. The good news is that it's not hurting companies in most instances. So from a social perspective, they might still want to pursue opportunities to be environmentally friendly."

Ongoing policy uncertainty is detrimental for stem cell scientists

While there is no doubt that the ethical controversy surrounding human embryonic stem cell (hESC) research has given rise to an uncertain policy environment, the true impact of years of frequent policy changes has not been fully assessed. Now, a recent survey of several hundred stem cell scientists in the United States begins to reveal the substantial negative impact that this uncertainty has had on them, including both those who work directly with hESCs and those who work with less contentious types of stem cells.

"In the United States, scientists have faced several hESC policy changes with changing administrations," said author and Public Policy Professor Aaron Levine. "Most recently, a legal challenge to the Obama Administration's new stem cell policy led the federal government to briefly stop funding hESC research and to ongoing questions about the future of federal funding for this field."

To better understand the impact of this ongoing policy uncertainty, Levine conducted a survey of stem cell scientists in November 2010 that assessed how the temporary funding ban and uncertainty about the future of federal funding for hESC research was impacting their work. Scientists reported a range of negative impacts associated with both the temporary funding ban and the ongoing policy uncertainty, but were more likely to indicate that the continued policy uncertainty had a substantial impact on their research plans.

Levine recommends that lawmakers who aim to support stem cell research strive for policies that reduce uncertainty for stem cell scientists and provide a clear legal basis for federal funding of hESC research.

Professor David Sholl (top left) has developed a membrane (bottom) to reduce carbon emissions from coal combustion.

"If we are successful, this technology could have a very significant impact on trying to reduce carbon emissions from the combustion of coal."

Of equal concern to air pollution is the issue of water pollution, and new research questions the effectiveness of the standard fecal coliform test used to monitor water quality.

Fecal pollution of surface waters is measured by the concentration of E. coli bacteria in the water because E. coli is believed to live only in the intestines and waste of humans and other warm-blooded animals, and quickly dies outside its host. The presence of E. coli in water also serves as a marker for other potentially more harmful organisms that may accompany it. Positive E. coli tests may lead to the summertime closing of beaches and other recreational bodies of water.

A new study has identified sources of E. coli bacteria that might not indicate an environmental hazard. In the study, researchers report identifying and sequencing the genomes of nine strains of E. coli that have adapted to living in the environment independent of warm-blooded hosts. These strains are indistinguishable from typical E. coli based on traditional tests and yield a positive fecal coliform result though researchers say they may not represent a true environmental hazard.

Research Associate Jennifer DuBose helped create guidelines for selecting and installing flooring in hospitals.

"The basis for E. coli's widespread use as a fecal pollution indicator is the traditional thinking that E. coli cannot survive for extended periods outside a host or waste, but this study indicates that's not true," said Civil and Environmental Engineering Professor Kostas Konstantinidis. "These results suggest the need to develop a new culture-independent, genome-based coliform test so that the non-hazardous environmental types of E. coli are not counted as fecal contamination."

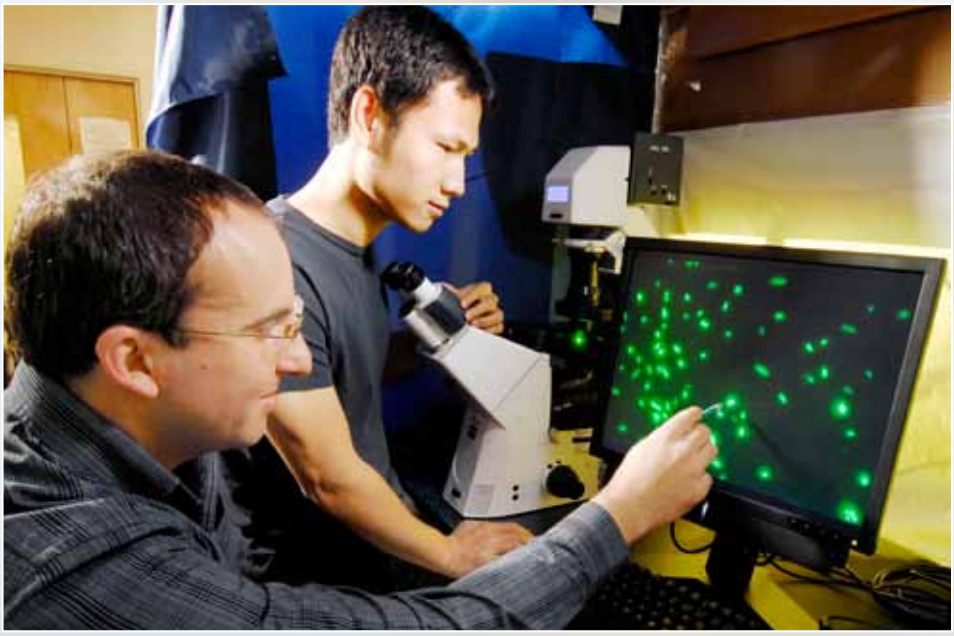
In addition to mitigating the health effects of environmental threats, Georgia Tech researchers are also focused on increased development of sustainable building materials.

Sustainability in construction and design continues to gain traction as stakeholders become more aware of the benefits of sustainable materials. The healthcare design industry, in particular hospitals, is putting a greater emphasis on how flooring materials can deliver benefits over the life cycle of their facilities.

A recent study by Research Associate Jennifer DuBose and Graduate Assistant Amaya Labrador, both from the College of Architecture, shows that several elements need to be considered when choosing the correct floor for a hospital environment.

"We were able to create some guidelines for ensuring proper selection and installation of resilient flooring for hospitals," said DuBose. "The feedback was essential as we looked at different floor materials in a variety of settings."

DuBose said the research examined six hospitals that had selected and implemented sustainable resilient flooring, as well as survey responses from more than 600 people. The study investigated the experience that architects, installers, facility managers, and users had with alternative, green resilient flooring materials in hospital settings, focusing on several types of resilient flooring materials, including rubber, polyolefin, and linoleum.



Research conducted by Professor Kostas Konstantinidis (left) recommends development of a new coliform test that will more accurately identify hazardous E. coli bacteria.

Electronics

Georgia Tech researchers are leading the transformation of electronics technology to serve the needs of the twenty-first century.

One such transformational initiative is a five-year effort to power conventional electronic devices with nanoscale generators that harvest mechanical energy from the environment using an array of tiny nanowires. Led by Materials Science and Engineering Professor Zhong Lin Wang, the project powers nanogenerators with the mechanical energy that can come from activities such as a heartbeat, the pounding of a hiker's shoe on a trail, the rustling of a shirt, or the vibration of a heavy machine. While these nanogenerators will never produce large amounts of electricity for conventional purposes, they could be used to power nanoscale and microscale devices—and even to recharge pacemakers or iPods.

"By simplifying our design, making it more robust, and integrating the contributions from many more nanowires, we have successfully boosted the output of our nanogenerator enough to drive devices such as commercial liquid-crystal displays, light-emitting diodes, and laser diodes," said Wang. "If we can sustain this rate of improvement, we will reach some true applications in healthcare devices, personal electronics, or environmental monitoring."

Another five-year project led by Georgia Tech researchers has developed a novel approach to space electronics that could change how space vehicles and instruments are designed. The new capabilities are based on silicon-germanium technology, which can produce electronics that are highly resistant to both wide temperature variations and space radiation.

The $12 million project was funded by the National Aeronautics and Space Administration (NASA).

"The team's overall task was to develop an end-to-end solution for NASA—a tested infrastructure that includes everything needed to design and build extreme-environment electronics for space missions," said Electrical and Computer Engineering Professor John Cressler, who served as principal investigator and overall team leader for the project.

The entire electronics industry could be revolutionized, thanks in large part to work being pursued on a material known as graphene, extremely thin layers of ordinary carbon atoms arranged in a "chicken-wire" lattice. These layers, sometimes just a single atom thick, conduct electricity with virtually no resistance, very little heat generation, and less power consumption than silicon.

Bellamkonda named associate vice president for research

Biomedical Engineering Professor Ravi Bellamkonda has been named associate vice president for research. The three-year appointment enables Bellamkonda to divide his time evenly between his own research and his new administrative responsibilities.

"I worked closely with Ravi during the strategic planning process and was pleased to learn of his continued interest in supporting Georgia Tech research on an institutional level," said Executive Vice President for Research Stephen E. Cross. "Ravi is a first-rate scientist with excellent intellectual curiosity and temperament, and I am excited about his joining our leadership team."

A Georgia Cancer Coalition Distinguished Scholar, Bellamkonda directs the Neurological Biomaterials and Cancer Therapeutics Laboratory and a National Institutes of Health T32 training program in the Rational Design of Biomaterials. He also served as deputy director for research at the Georgia Tech and Emory University Center for Regenerative Medicine.

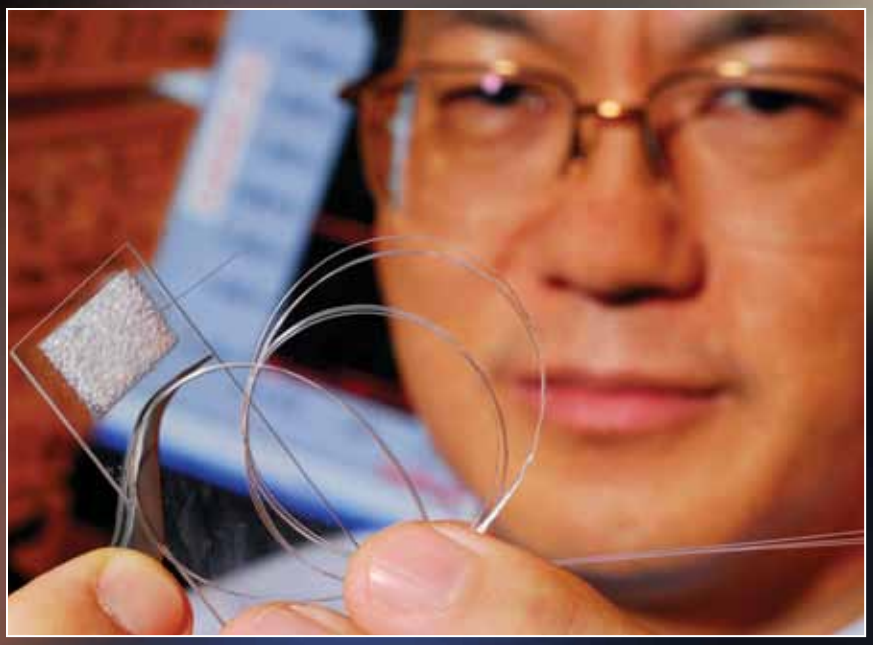
"The breadth of expertise at Georgia Tech, and the associated research converging at the intersection of disciplines, has created a unique opportunity." Bellamkonda said. "I am grateful for the opportunity to have direct involvement in shaping our research program and in helping build an institutional culture that will define the technological research university of the twenty-first century."

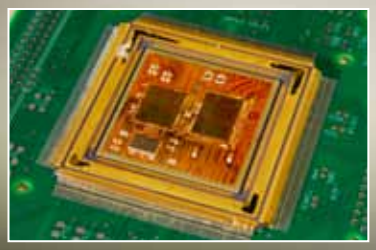
New center's research could shed light on origins of life

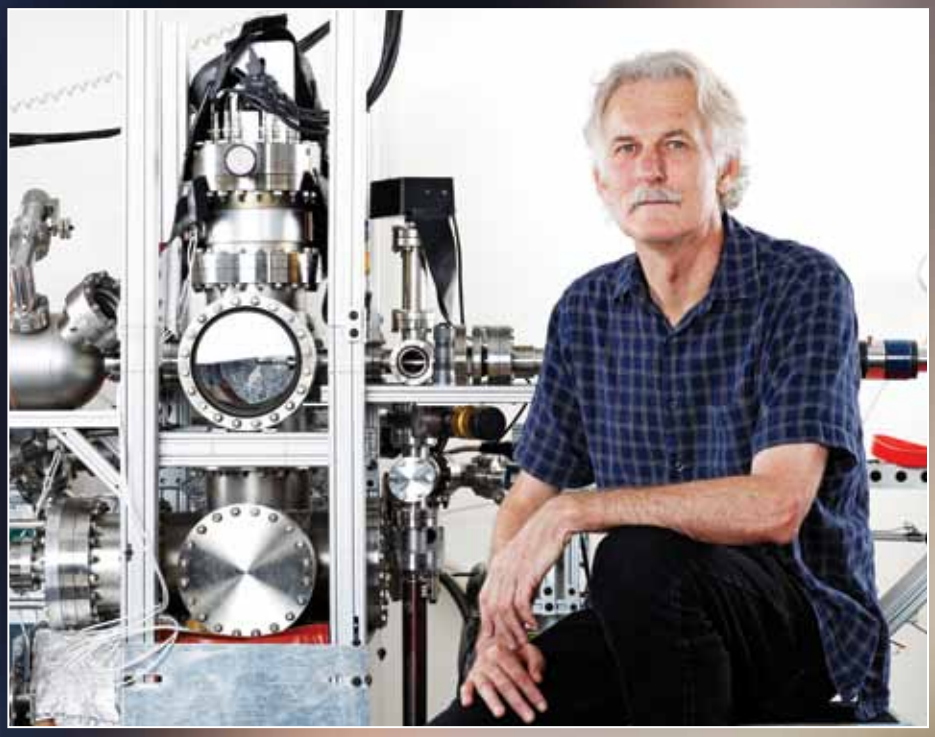
A team of institutions led by Georgia Tech was awarded a $20 million grant from the National Science Foundation and the National Aeronautics and Space Administration to pursue research that could lead to a better understanding of how life started on Earth. Researchers are focusing their efforts on exploring chemical processes that enable the spontaneous formation of functional polymers—such as proteins and DNA—from much smaller and simpler starting materials.

"Our research team seeks to understand how certain molecules in a complex mixture can work together to form highly ordered assemblies that exhibit chemical properties similar to those associated with biological molecules," said Chemistry and Biochemistry Professor Nicholas V. Hud. "Such a process was likely an essential and early stage of life, so we are also working to understand what chemicals were present on the prebiotic Earth and what processes helped these chemicals form the complex substances ultimately needed for life."

Hud is directing the effort, which is known as the Center for Chemical Evolution. The five-year grant will support research in more than fifteen laboratories at various institutions.





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With silicon device fabrication approaching its physical limits, many researchers believe graphene can provide a new platform material that would allow the semiconductor industry to continue its march toward ever-smaller and faster electronic devices. Though graphene will likely never replace silicon for everyday electronic applications, it could take over as the material of choice for high-performance devices.

And graphene could ultimately spawn a new generation of devices designed to take advantage of its unique properties.

Since 2001, Georgia Tech has become a world leader in developing epitaxial graphene, a specific type of graphene that can be grown on large wafers and patterned for use in electronics manufacturing. Last year, Georgia Tech researchers reported fabricating an array of 10,000 top-gated transistors on a 0.24 square centimeter chip, an achievement believed to be the highest density reported so far in graphene devices.

In creating that array, they also demonstrated a clever new approach for growing complex graphene patterns on templates etched into silicon carbide. The new technique offered the solution to one of the most difficult issues that had been facing graphene electronics.

"This is a significant step toward electronics manufacturing with graphene," said Physics Professor Walt de Heer, who pioneered the development of graphene for high-performance electronics. "This is another step showing that our method of working with epitaxial graphene grown on silicon carbide is the right approach and the one that will probably be used for making graphene electronics."

Another elusive goal of the electronics industry is the development of flexible plastic electronics, and one of the stumbling blocks in that quest has been creating transistors with enough stability for them to function in a variety of environments while still maintaining the current needed to power the devices.

Georgia Tech researchers have developed a new method of combining top-gate organic field-effect transistors with a bilayer gate insulator. This allows the transistor to perform with incredible stability while exhibiting good current performance. In addition, the transistor can be mass produced in a regular atmosphere and can be created using lower temperatures, making it compatible with the plastic devices it will power.

The research team used an existing semiconductor and changed the gate dielectric because transistor performance depends not only on the semiconductor itself, but also on the interface between the semiconductor and the gate dielectric.

"Rather than using a single dielectric material, as many have done in the past, we developed a bilayer gate dielectric," said Electrical and Computer Engineering Professor Bernard Kippelen, director of the Center for Organic Photonics and Electronics.

The bilayer dielectric is made of a fluorinated polymer known as CYTOP and a high-k metal-oxide layer created by atomic layer deposition. Used alone, each substance has its benefits and its drawbacks. Kippelen and his team wondered what would happen if they combined the two substances in a bilayer. Would the drawbacks cancel each other out?

"When we started to do the test experiments, the results were stunning," said Kippelen. "We were expecting good stability, but not to the point of having no degradation in mobility for more than a year."

The team performed a battery of tests to see just how stable the bilayer was. They cycled the transistors 20,000 times, tested it under a continuous bias stress where they ran the highest possible current through it, and even stuck it in a plasma chamber for five minutes, all of which resulted in no degradation. The only time they saw any degradation was when they dropped it into acetone for an hour. There was some degradation, but the transistor was still operational. No one was more surprised than Kippelen.

"I had always questioned the concept of having air-stable field-effect transistors, because I thought you would always have to combine the transistors with some barrier coating to protect them from oxygen and moisture," said Kippelen. "We've proven ourselves wrong through this work."

Top row: Professor Zhong Lin Wang (left) is leading efforts to power conventional electronic devices with nanoscale generators that harvest mechanical energy from the environment. Professor John Cressler and student researcher Eleazar Kenyon are working on a novel approach to enable space electronics to withstand extreme space environments.

Center row: Researchers explore the potential of epitaxial graphene (left), which has shown great promise for partially replacing silicon in electronics. Professor Walt de Heer (right photo) pioneered the development of epitaxial graphene for high-performance electronics.

Bottom row: Professor Bernard Kippelen (right photo) is working to develop flexible plastic electronics.

ECONOMIC DEVELOPMENT DRIVEN BY INNOVATION

Improving the human condition is the predominant force behind Georgia Tech's innovation agenda, and one of the most crucial of those improvements is the development of new economic opportunities.

Rapidly bringing the results of its innovative research to the marketplace is a hallmark of the Georgia Tech ethos. A prime example is the Georgia Tech/Emory University medical device startup company Apica Cardiovascular, which developed a system to simplify and standardize the technique for opening and closing the beating heart during cardiac surgery.

U.S. Secretary of Commerce Gary Locke.

Playing a leadership role

At a U.S. Department of Commerce innovation forum held on campus last year, Secretary of Commerce Gary Locke praised Georgia Tech for its leadership in driving economic progress. The forum was the fourth in a series sponsored by the Department of Commerce to bring together university leaders and key stakeholders to discuss the role of universities in innovation, economic development, and job creation.

"Georgia Tech has long provided America with some of its top technological talent," said Locke. "It is quickly turning Atlanta into a magnet for innovators and entrepreneurs."

He gave as an example Georgia Tech's critical role in a decision by HydroPhil Technology, a hydrogen energy company, to establish its headquarters, research and development center, and factory in the Atlanta area, creating 300 jobs.

Locke also discussed the important role that research universities have as drivers of economic activities. "The challenge is to make this high level of performance of commercialization and job creation the standard nationwide," he said.

A report released over the summer validates Locke's appraisal. The report indicates that Georgia Tech made a $2.15 billion economic impact during fiscal year 2010, the highest of any institution in the University System of Georgia. The

"Georgia Tech has long provided America with some of its top technological talent. It is quickly turning Atlanta into a magnet for innovators and entrepreneurs."

—Gary Locke

Selig Center for Economic Growth in the University of Georgia's Terry College of Business also found that Georgia Tech generated 18,127 full- and part-time jobs.

The annual study showed that with a $12.6 billion economic impact on the state's economy in FY2010, Georgia's public university system remains a powerful economic engine for the state, generating 130,738 full- and part-time jobs statewide during the same time period.

A separate survey conducted by Georgia Tech's Enterprise Innovation Institute, the Georgia Tech School of Public Policy, and Kennesaw State University concluded that the recession has expanded the business advantages of Georgia manufacturers that compete on the basis of innovation in new or technologically improved products, processes, organizational structures, or marketing practices. These innovative companies are more than twice as profitable as firms competing on the basis of low price.

The 2010 Georgia Manufacturing Survey also found that companies are preparing for post-recession growth, expanding export capabilities, addressing sustainability issues—and still dealing with outsourcing and insourcing. The survey, which included nearly 500 manufacturers, found a widening profitability gap between manufacturers that compete on the basis of innovation compared to those that use other competitive strategies. That gap has grown in each survey conducted since 2002.

"Companies that compete on the basis of innovation are much more profitable, pay higher wages, and are more likely to benefit from insourcing opportunities than firms that compete on low price," said Jan Youtie, the survey's director and a principal research associate in the Enterprise Innovation Institute. "Adoption of an innovation strategy can be useful to manufacturers regardless of industrial segment, and is especially important during difficult economic times."

Commercializing vital technology

In partnership with leading medical education and healthcare institutions, Georgia Tech is paving the way for critical new medical devices to not only improve and save countless lives, but also to create numerous high-end jobs.

For instance, Georgia Tech is a partner in the Southeast's first comprehensive medical device innovation center, which was awarded a total of $2.6 million to build and equip a prototyping design and development facility that will accelerate the commercialization of next-generation medical devices and technology.

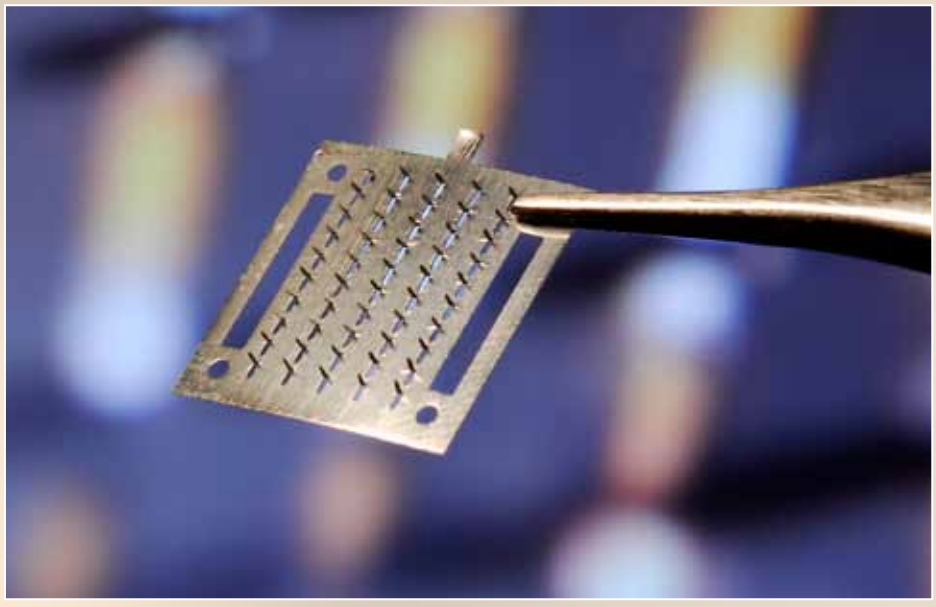
The Global Center for Medical Innovation (GCMI) received $1.3 million from the Economic Development Administration, part of the U.S. Department of Commerce. That funding was matched by $1.3 million from the Georgia Research Alliance (GRA), a public-private organization that supports development of the technology industry in Georgia.

GCMI is a partnership of four of Georgia's leading research and healthcare organizations: Georgia Tech, Saint Joseph's Translational Research Institute, Piedmont Healthcare, and the GRA. The Center will bring together the core members of the medical device community, including universities, research centers, and clinicians; established drug and device companies; investors; and early-stage companies.

"One of Georgia Tech's major research strengths is the ability to bring engineering together with the biosciences to create new solutions for healthcare problems," said Stephen E. Cross, executive vice president for research. "The Global Center for Medical Innovation will help move innovations from the laboratory through the functional prototype stage, while coordinating the other commercialization activities necessary to bring them to market."

To be located in an existing building on 14th Street near the Georgia Tech campus, the new facility will advance innovations that can be the basis for new products and new life-science companies. By providing comprehensive support services in one location, the Center will reduce the cost of developing and converting innovations into functional prototypes and clinical products.

A Georgia Tech and Emory University medical device startup has developed just the kind of technology that GCMI



Developing sophisticated medical advances such as the microneedle patch is the goal of the Global Center for Medical Innovation, in which Georgia Tech is a partner. Microneedles allow painless delivery of vaccines directly through the skin.

Stem cell biomanufacturing explored by Tech researchers

The National Science Foundation (NSF) has awarded $3 million to Georgia Tech to fund a unique research program on stem cell biomanufacturing. The program is specifically focused on developing engineering methods for stem cell production, in order to meet the anticipated demand for stem cells. The award comes through the NSF's Integrative Graduate Education and Research Traineeship (IGERT) program, which supports innovation in graduate education in fields that cross academic disciplines and have broad societal impact.

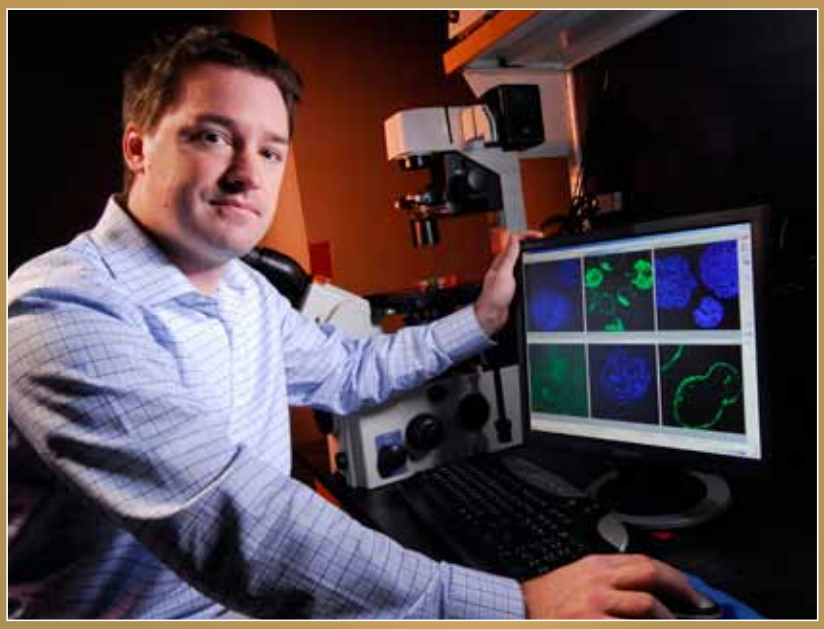
While stem cell research is on the verge of broadly affecting many elements of the medical field—regenerative medicine, drug discovery and development, cell-based diagnostics, and cancer—the bioprocess engineering that will be required to manufacture sufficient quantities of functional stem cells for these diagnostic and therapeutic purposes has not been rigorously explored.

"Successfully integrating knowledge of stem cell biology with bioprocess engineering and process development into single individuals is the challenging goal of this program," said Todd McDevitt, associate professor of biomedical engineering and a Petit Faculty Fellow in the Parker H. Petit Institute for Bioengineering and Biosciences.

McDevitt is leading the IGERT with Robert M. Nerem, professor emeritus of mechanical engineering. Nerem is also director of the Georgia Tech/Emory Center for Regenerative Medicine, which will administer this award.

PhD students funded by IGERT will receive interdisciplinary educational training in the biology, engineering, enabling technologies, commercialization, and public policy related to stem cells. Their research efforts will focus on developing innovative engineering approaches to bridge the gap between basic discoveries made in stem cell biology and therapeutic stem cell-based technologies.

"This program provides a unique opportunity for engineers to generate standardized and quantitative methods for stem cell isolation, characterization, propagation, and differentiation," said Nerem. "These techniques must be developed in a scalable manner to efficiently produce sufficient numbers of stem cells and derivatives in accessible formats in order to yield a spectrum of novel therapeutic and diagnostic applications of stem cells."



Biomedical Engineering Associate Professor Todd McDevitt leads the NSF stem cell project.

Researchers at CardioMEMS, a graduate of Georgia Tech's ATDC, have developed a new class of monitoring devices for heart patients.

hopes to foster—a system to simplify and standardize the technique for opening and closing the beating heart during cardiac surgery. And the startup, Apica Cardiovascular, recently received a $5.1 million investment.

The company has licensed the Georgia Tech/Emory technology and will further develop the system, which will make the transapical access and closure procedure required for delivering therapeutic devices to the heart more routine for all surgeons. The goal is to expand the use of surgery techniques that are less invasive and do not require stopping the heart.

"Our company has leveraged the expertise in cardiovascular technology at Georgia Tech and the clinical experience of surgeons at Emory University to develop a technology that has the potential to revolutionize the delivery of different types of medical devices to the heart, including aortic and mitral valves," said Apica's CEO, James Greene.

With research and development support from the Coulter Foundation Translational Research Program and the Georgia Research Alliance VentureLab program, the company has already completed a series of pre-clinical studies to test the functionality of the device and its biocompatibility.

Another firm, CardioMEMS, a graduate of Georgia Tech's Advanced Technology Development Center startup accelerator, is a rising star in the medical device industry. Pioneering a new class of monitoring devices for heart patients, the company completed a successful clinical trial last year for its latest product, a sensor that measures intracardiac pressure in people who suffer from congestive

heart failure. That success resulted in a $60 million equity investment and purchase option from St. Jude Medical Inc., a large medical device company based in St. Paul, Minnesota.

That investment earned the company a 2011 "Deal of the Year" award from Georgia Bio, a nonprofit association that represents Georgia's pharmaceutical, biotechnology, and medical device community.

CardioMEMS, which has more than sixty employees, grew out of Georgia Tech research. The company's products combine wireless communications technology with microelectromechanical systems (MEMS) fabrication, providing doctors with more information while making monitoring less invasive for patients.

MEMS uses micro-machining fabrication to build electrical and mechanical systems at the micron scale—one-millionth of a meter. Using technology originally developed for the integrated circuit industry, MEMS is an attractive platform for medical devices because mechanical, sensing, and computational functions can be placed on a single chip.

While it's about as far removed from the medical device field as possible, the Georgia Tech Center for Music Technology is hitting the right chord by blending research with technology that meets industry needs while creating tools for new and memorable performances.

Launched in 2008, the Center has attracted funding in excess of $3 million, primarily from National Science Foundation grants, but also from sponsored research industry partners such as Google and Turner Broadcasting.

"I think we are in a unique position here at Georgia Tech," said Gil Weinberg, director of the Center. "We are fortunate that engineering, technology transfer, and funding are all in the DNA of the Institute. Georgia Tech has an appreciation for the type of research we are doing and entrepreneurship is encouraged. We really have the freedom and encouragement from the administration."

The Center has already had two companies launched from technologies developed from its research. Zoozbeat and LaDiDa are mobile apps that utilize different technology to allow the public easier access to the music creation process.

Professor Gil Wienberg (left) directs the Center for Music Technology, which has had two companies launched from technologies developed through its research.

Advanced Technology Development Center

The Advanced Technology Development Center (ATDC), Georgia Tech's renowned technology business accelerator, has helped launched numerous companies during its three-decade history.

Last fall, the presidents of Georgia Tech and the University of Georgia launched ATDC's new presence in Gwinnett County. ATDC will offer educational programs and hold regular office hours to meet with area entrepreneurs at the University of Georgia's Gwinnett campus in Lawrenceville. The launch of ATDC Gwinnett is a result of strategic collaboration between the two universities and Partnership Gwinnett, the community and economic development initiative led by the Gwinnett Chamber of Commerce and more than 160 public and private partners.

"Creating new jobs and bringing innovation to market are top of mind for just about everyone," said Georgia Tech President G. P. "Bud" Peterson. "At Georgia Tech, we focus on innovation and serving as an economic engine for Georgia, and we are honored to collaborate with the University of Georgia and economic development organizations in Gwinnett County to expand our reach."

Peterson noted that fourteen ATDC graduate companies have located in Gwinnett County over the years, including Suniva, the Southeast's first solar energy company. Using technology developed in Georgia Tech's University Center of Excellence in Photovoltaics, Suniva has been expanding its production and now has 150 workers at its manufacturing facility in Norcross.

ATDC also began a new era last year with the appointment of veteran biosciences entrepreneur Nina Sawczuk as its general manager. Sawczuk had served ATDC as assistant director for biosciences since October 2009. Prior to that, she was CEO of Zygogen LLC, an Atlanta-based biotechnology company that advanced the use of zebra-fish for drug screening. Before co-founding that company, she served in drug discovery, biotechnology consulting, and business development roles for several organizations in the Boston, Research Triangle Park, and Southern California areas.

"It is an exciting time to be part of ATDC as this successful startup accelerator begins its fourth decade of helping Georgia entrepreneurs launch and build science and technology companies," Sawczuk said. "With the economy encouraging more people to start companies and ATDC's membership now open to a broader group of enterprises, the organization has never been more important to the state's entrepreneurs."

INTERNATIONAL OUTREACH AND PARTNERSHIPS

While Georgia Tech is a public university focused on supporting the interests of the state and the nation, the Institute is also one of the most globally oriented and connected universities in the world. With education and research platforms in Europe, Asia, and Central America, Georgia Tech is renowned for the quality of its international programming and outreach efforts.

Georgia Tech's student body and curriculum are among the most internationalized of any American university.

Academic alliances and platforms

Strategically partnering with prestigious educational and research institutions around the globe has earned Georgia Tech a reputation for embracing and capitalizing on the potential of such agreements. As a case in point, Georgia Tech and the Korea Advanced Institute of Science and Technology (KAIST) have established dual bachelor's and master's degree programs in electrical and computer engineering (ECE). The new programs will be offered at Georgia Tech's main campus in Atlanta and at KAIST in Daejeon, Republic of Korea.

"One of the goals in our strategic plan is to support Georgia Tech's objective to become a global university," said Gary S. May, newly appointed dean of the College of Engineering and former chair of Electrical and Computer Engineering. "We feel that these dual degree programs will help prepare our students to become leaders who will contribute to cultural, political, educational, economic, and high-tech concerns in their home countries. In addition, collaborations between the two institutes will create opportunities to educate students who possess the skills for excelling in a dynamic global environment."

"KAIST's proximity to many governmental research facilities, funding agencies, and headquarters of many high-tech companies provides a rich resource for student internships and faculty research collaboration opportunities," said Sung Kyu Lim, ECE associate professor and KAIST dual degree program director. "In addition, KAIST is near the National Research Foundation of Korea, which is comparable to our National Science Foundation. This symbolizes the strategic importance of KAIST as the leading national research institute in Korea."

Georgia Tech's leadership views the Persian Gulf as another part of the world with vast potential for educational and research advances. To capitalize on that potential, the Institute formalized a partnership agreement with Khalifa University of Science, Technology, and Research (KUSTAR) to develop cutting-edge, engineering-based education and research initiatives in the United Arab Emirates (UAE) and the United States.

The agreement between the two institutions focuses on establishing a framework for exploring KUSTAR-sponsored research, cooperative joint research opportunities, and joint educational programs.

Georgia Tech has developed strategic academic and research partnerships with the Korea Advanced Institute of Science and Technology (left) and Khalifa University of Science, Technology, and Research (right) in the United Arab Emirates.

The two parties will explore areas where Georgia Tech may provide assistance with short- and long-term faculty and administrative needs and encourage exchange experiences for students and faculty.

The agreement, which is valid for an initial period of five years, will cover the bilateral exchange of information and experience in education and research, and the exploration of opportunities for submitting proposals for joint projects. This includes integrating content for course material, identifying joint collaborative research projects between faculty and/or research groups, and offering world-class lectures or seminars provided by both institutions.

"We feel that alliances such as this not only enrich our research focus areas, but also leverage our expertise on an international platform," said recently retired Dean of Engineering Don P. Giddens. "Our strengths and interests align well with KUSTAR, and this partnership—in both research and developing new educational programs—gives our faculty the opportunity to operate in a global context while helping our students, and the students of KUSTAR, prepare to thrive in a global economy."

"Partnerships such as this one with Georgia Tech allow us to enhance the technological, social, and cultural relations of both countries from an international perspective, and provide exciting new educational opportunities for the students of all participating institutions," said KUSTAR President Tod Laursen. "From KUSTAR's point of view, this relationship provides a great stimulus to our teaching and research efforts aimed at cultivation of a new generation of technically advanced students in the UAE."

While many of Georgia Tech's institutional relationships in Asia are relatively new, the Institute's European education and research platform—Georgia Tech-Lorraine (GTL)—celebrated its twentieth anniversary this past year. The culmination of the twentieth anniversary of GTL's presence in Metz, France, was the announcement that Georgia Tech will expand the GTL campus in the northeast region of the country with a new resource center for industry and academic research laboratories, the Lafayette Institute.

Last fall, Georgia Tech leaders and a delegation of French officials signed an agreement creating the Lafayette Institute.

"By providing our industrial partners and academic research laboratories access to state-of-the-art facilities, we will be creating an environment where solutions to global challenges, ranging from energy to medical technology, can be developed,"

President G. P. "Bud" Peterson helped Georgia Tech-Lorraine celebrate its twentieth anniversary.

Provost names faculty advisory group in support of international partnerships

With the renewed emphasis on global engagement articulated in Georgia Tech's new strategic plan, the Institute's leadership has formed an advisory group that will provide additional focus in forging future international partnerships. Provost Rafael L. Bras appointed an International Advisory Group, a faculty committee that will serve to support and advise both the provost and the vice provost on issues related to Georgia Tech's strategy for global engagement.

"In Georgia Tech's strategic plan, a stated goal is the expansion of our global footprint and influence," said Steve McLaughlin, vice provost for International Initiatives and chair of the advisory group. "Not only will this foster research collaborations and promote economic development both at home and abroad, but it will also ensure Georgia Tech graduates good global citizens who are prepared to assume leadership positions with multinational institutions."

The International Advisory Group will meet at least once per quarter with the agenda centered on pending issues and advice/assistance in shaping Tech's global engagement. Immediate tasks for the group include finalizing Tech's global strategic plan and developing a set of guidelines for reviewing Institute-level opportunities for international partnership.

Georgia Tech-Ireland (above) is a highly regarded research collaborator with Irish corporations, universities, and research centers, as well as U.S. companies. Georgia Tech-Shanghai (below) provides Tech students with the opportunity to live and study in rapidly growing China while providing Shanghai Jiao Tong University students valuable exposure to a world-class technological education.

said Georgia Tech President G. P. "Bud" Peterson. "This institute also underscores Georgia Tech's commitment to expand our global partnerships."

French authorities will finance 23 million euros, the equivalent of roughly $31 million, to create the Lafayette Institute. The institute will provide access to state-of-the-art nanofabrication facilities for optoelectronics, technology transfer, and commercialization services. It will focus on technologies at the intersection of materials, optics, photonics, electronics, and nanotechnology.

"This European innovation hub will strengthen Georgia's global footprint in technological innovation and serve as a link between research laboratories and industry, where technological solutions and prototypes can be developed rapidly to stimulate economic development," said GTL President Yves Berthelot.

An integral part of Georgia Tech's influence in France, the United Arab Emirates, Korea, and other nations is the presence of American students studying in those locations. As valuable as such experiences are, any student who has ever landed on foreign soil for an extended period of time knows the overwhelming feelings of disorientation and confusion upon arrival. To change that experience for international students coming to Tech, the Office of International Education (OIE) is asking Tech students who have studied abroad to serve as ambassadors to those arriving to study at the Institute from other countries.

OIE's Land@GT program matches Tech students with exchange students arriving on campus each fall semester, and asks participants to play a role in helping these students feel connected to Tech and the U.S. during their time here. All Tech students who have studied abroad are invited to participate.

"The role of friends in an international student's experience cannot be undervalued, and the students are so grateful," said Sheri Beyer, international student advisor for OIE. "Tech students' ability to chat with the exchange students about American culture and to learn about their cultures will offer them a rich experience outside their coursework and lectures."

Tech student Brooke McDaniel felt the benefit of assistance from local students when she studied for a semester in China. Approximately thirty Tianjin University students hosted and took classes with their American visitors.

"Having them around was incredibly helpful," McDaniel said. "I was met at the airport by one of the students to help find my way. Once we got to the university, they helped us find things to do in the city, learn to communicate with taxi drivers, purchase

train tickets, and get cell phones." McDaniel still keeps in touch with one student who was particularly helpful during the experience.

Land@GT participants are asked to greet their assigned students at the airport or soon after their arrival, help them get settled, attend a welcome reception for all exchange students, and coordinate a few other activities throughout the semester. OIE provides Tech students with their exchange counterpart's name, and from there asks Tech students to introduce themselves and use OIE as a resource for questions along the way.

Global outreach

Augmenting Georgia Tech's international education and research initiatives is a commitment to provide assistance in locations ravaged by natural disasters and other crises.

The devastating March 2011 tsunami and terrifying nuclear disaster that followed have perhaps changed the nation of Japan forever. The Georgia Tech community responded to the disaster with characteristic compassion and efficiency.

The Student Government Association's Tech Cares for Japan initiative enabled students to make donations online. Funds collected through the initiative and other efforts were consolidated into a single check and presented to the American Red Cross on behalf of Georgia Tech students.

Tech Cares for Japan also launched a "1,000 cranes" fundraising effort in which volunteers collected minimum $1 donations for each crane that was created. The folded cranes were later displayed in the Student Center.

Several weeks after the disaster, Georgia Tech experts participated in a faculty-led conversation to discuss the causes, response, and consequences of the catastrophe in Japan. The discussion was moderated by Brian Woodall of the Sam Nunn School of International Affairs and the faculty panel included Pinar Keskinocak, Industrial and Systems Engineering; Usha C. Nair-Reichert, Economics; Glenn Rix, Civil and Environmental Engineering; and Glenn Sjoden, Mechanical Engineering. Guests included representatives of the Consulate-General of Japan in Atlanta.

In a separate global initiative, researchers at the Georgia Tech Research Institute (GTRI) are helping to automate human resource information systems for healthcare professionals in the African nations of Kenya and Zimbabwe.

In collaboration with Emory University's Lillian Carter Center for International Nursing and the Task Force for Global Health, GTRI is evaluating and advising on computer systems developed to provide information for better human resource management, policy development, and health planning.

GTRI researchers (l-r) Heyward Adams, Ed Clarkson, and Christopher Skeels discuss software being used by the Kenya Health Work Force Project to move information on healthcare professionals to a computer database.

The aim of the Kenyan effort, called the Kenya Health Work Force Project (KHWFP), is to move information on the nation's healthcare professionals from a decentralized paper system to a computer database. This human resources information system would help Kenyan authorities manage and deploy critical personnel such as nurses, physicians, and others. That capability, in turn, would bolster the nation's battle against multiple heath challenges, including HIV/AIDS, tuberculosis, and malaria.

The KHWFP is supported by the U.S. Centers for Disease Control and Prevention (CDC) and implemented through the Lillian Carter Center. It is funded through the CDC by the President's Emergency Plan for AIDS Relief (PEPFAR).

In another project also sponsored by the CDC and PEPFAR, GTRI is working with Judith Wold, a clinical professor at the Emory School of Nursing's Lillian Carter Center for International Nursing, to help establish a healthcare workforce database system in Zimbabwe. A GTRI team first traveled to Zimbabwe in 2009 with Wold, who is principal investigator on the Zimbabwe project, to discuss the work with government officials there.

A team of students developed a plan for CrossPath Music, a globally connected, virtual collaboration space.

While Georgia Tech's institutionally sponsored global outreach efforts are numerous, individual students frequently conceive of and execute their own ideas.

Last June, three Georgia Tech women convened in Hong Kong to compete as semifinalists in the Hong Kong Polytechnic University Innovation and Entrepreneurship Global Student Challenge.

A team comprised of third-year students Elizabeth Blumer, Joy Buolamwini, and Sarah Vaden was chosen as one of five from the U.S. to compete in the challenge for its proposed business plan for CrossPath Music. Their idea was to create a place for musicians to practice and collaborate with each other without disturbing the people around them—and to do it virtually.

"It enables you to creatively interact all over the world and links creative people together," Buolamwini said. CrossPath would take advantage of existing technology and allow musicians to use an Xbox or laptop to host and join virtual jam sessions and play with musicians all over the world. It envisions a platform that allows users to play a line of music and instantly be presented with a list of musicians with whom they could collaborate online.

FACULTY/STAFF ACHIEVEMENTS AND CONTRIBUTIONS

Georgia Tech's faculty are among the most renowned educators and researchers in the United States and around the world. The number of faculty elected to the National Academy of Engineering now stands at twenty-seven, placing Tech among the top ten universities in the nation; and 162 faculty members have won National Science Foundation CAREER awards, among the highest number received nationally by any institution.

Both staff and faculty achievements are recognized each spring at the Faculty/Staff Honors Luncheon.

Faculty assist federal government in varied roles

In 2010-11, Georgia Tech faculty members continued their longstanding tradition of assisting the federal government by providing expert testimony as well as serving on key advisory and regulatory bodies.

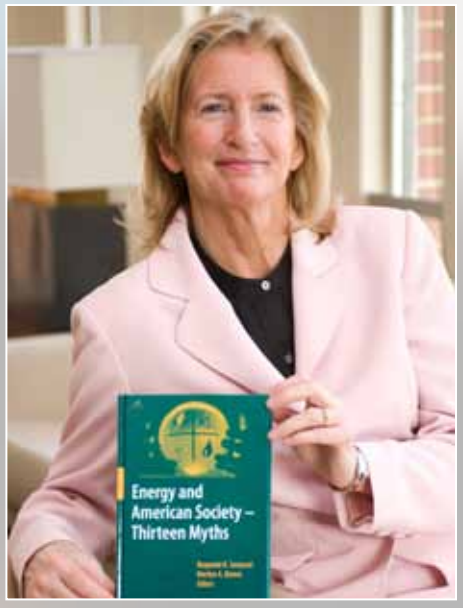
Civil and Environmental Engineering Associate Chair and Professor Reginald DesRoches testified before the Senate Ad Hoc Subcommittee on State, Local, and Private Sector Preparedness and Integration. He was one of seven witnesses who spoke before the subcommittee and the only presenter representing a university.

DesRoches was invited to share his expertise on earthquake resilience in the United States focusing on the risks associated with and the effects of a potential catastrophic earthquake event. His testimony highlighted his background on the performance of built infrastructure in the central and southeastern United States and his firsthand experience with the 2010 earthquake in Haiti.

Judith Curry, chair and professor of Earth and Atmospheric Sciences, offered her testimony before the House Committee on Science and Technology. Curry spoke about how a potential change in the earth's climate may have many effects, some beneficial to people of certain regions and some catastrophic. She urged that climate scientists need to engage with

The possible effects of climate change were the focus of Judith Curry's congressional testimony.

Reginald DesRoches testified before Congress on earthquake risks.



Marilyn Brown was appointed to the TVA board.

citizen scientists, social scientists, and engineers to confront the challenges that may lie ahead.

In addition to providing congressional testimony, faculty members also serve on a wide variety of federal oversight agencies.

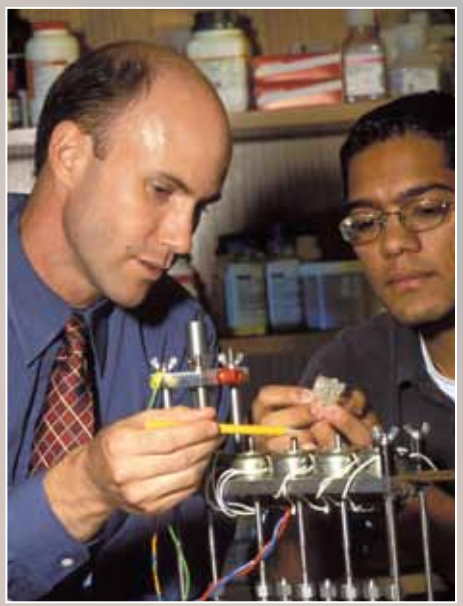
Last September, the U.S. Senate confirmed Public Policy Professor Marilyn Brown to the Tennessee Valley Authority Board of Directors. An internationally renowned expert on energy policy, Brown is pursuing a research agenda that addresses the development and deployment of sustainable energy technologies, the design of policy options to reduce carbon dioxide emissions, and the evaluation of energy programs and policies.

At Georgia Tech, her research has included an assessment of the $3 billion-per-year, multi-agency research and development portfolio comprising the U.S. Climate Change Technology Program, analysis of the geography of metropolitan carbon footprints, development of a national climate change technology deployment strategy, and an assessment of the cost and availability of supply- and demand-side electricity resources in the Southeast.

Brown's Public Policy colleague, Susan Cozzens, who also serves as associate dean of research and faculty development in the Ivan Allen College of Liberal Arts, was appointed to the Board of Scientific Counselors (BOSC) at the U.S. Environmental Protection Agency (EPA).

BOSC was established by the EPA to provide advice, information, and recommendations about the Office of Research and Development (ORD) research program. BOSC members evaluate science and engineering research programs and practices, advise the EPA on ORD peer review, and review ORD's program development and progress, its research planning process, and implementation of the ORD Strategic Plan.

Robert Guldberg, director of Georgia Tech's Parker H. Petit Institute for Bioengineering and Bioscience, was appointed chairperson of the Musculoskeletal Tissue Engineering Study Section in the Center for Scientific Review, part of the National Institutes of Health (NIH).



Robert Guldberg (left) was named chair of an NIH study section on musculoskeletal tissue engineering.

Guldberg, whose primary research interests include musculoskeletal growth and development, is serving as chairperson of the study section through June 2013. The study section will contribute to the national biomedical research effort and assure the quality of the NIH peer review process. According to the NIH, Guldberg was selected because of his demonstrated achievement in his scientific discipline, quality of research accomplishments, publications in scientific journals, and overall judgment and objectivity.

Amir Rahnamay-Azar named senior vice president for administration and finance

When he accepted a new position in Georgia Tech's administration, Amir Rahnamay-Azar knew he was taking on a challenging role: overseeing and managing a wide range of business and financial functions including financial systems planning, disbursement services, budgeting, and sponsored project accounting that support the agenda of the Division of Administration and Finance and the Institute as a whole.

Rahnamay-Azar, Georgia Tech's new senior vice president for administration and finance, is certainly up to the challenge.

Before arriving at Tech, Rahnamay-Azar served as associate senior vice president for operations at the University of Southern California (USC). He came to USC in 1997 and served in progressively more responsible roles until his most recent appointment in 2005.

One initial goal at Georgia Tech is to streamline and formalize the decision support infrastructure used by the President's Office, which provides information that allows for data-driven, informed decisions. This goal directly addresses one of the primary goals of the Institute's new strategic plan: pursuing institutional effectiveness by improving support functions and processes.

"Under Steve Swant's leadership, I look forward to working with him and his team in evaluating our existing processes, implementing improvements, and instituting new key initiatives, such as decision support," Rahnamay-Azar said.

GTRI scientist named WIT Woman of the Year

Margaret Loper, chief scientist at the Georgia Tech Research Institute (GTRI) Information and Communications Lab (ICL), was named 2010 Woman of the Year in Technology in the Medium Business category (251 to 2,500 employees) by Women in Technology.

"It is a great compliment to be included with so many talented Georgia women as a Woman of the Year recipient," Loper said. "I have been extremely fortunate to work for people who understand the value of mentoring, education, and community service and who have supported my commitment to working with students, teachers, STEM [science, technology, engineering, and mathematics] groups, and researchers. My desire is to be a positive role model and help people see that this career path can enable them to have a positive impact on the lives of others."

With more than twenty-five years of experience in modeling and simulation, Loper created the Georgia Tech Modeling and Simulation Research and Education Center, bringing together both academic faculty and GTRI researchers for the advancement of simulation technology. She joined GTRI as a research scientist in 1995 and earned her doctorate in Computer Science from Georgia Tech in 2002.

"We are very proud of Margaret's Women of the Year in Technology award," said ICL Director Jim McGarrah. "In addition to playing a critical role in ICL by her being my chief scientist and chief strategist, she has a passion for stimulating interest in STEM education. It's exciting to see that her contributions to both GTRI and to society are recognized by this award."

Women in Technology, one of three organizations that merged to form the Technology Association of Georgia in 1999, recognized fifty-two honorees at the event.

Associate Professor Ian Bogost (right) received two awards from IndieCade, an annual festival dedicated to independent games.

Prestigious honors awarded to faculty

The Georgia Tech faculty is among the most distinguished of any research university, as evidenced in part by the vast number of highly regarded awards and honors they receive each year.

The Institute's younger faculty received some especially noteworthy honors, including Ian Bogost, director of Digital Media and associate professor in the Ivan Allen College of Liberal Arts. Bogost took home two awards from IndieCade, an annual festival dedicated to independent games. His "game poem," *A Slow Year*, won the Virtuoso and the Vanguard awards.

A Slow Year is actually a collection of four games, one for each season. The games, Bogost says, are neither action nor strategy. Each of them requires a different kind of sedate observation and methodical input.

"As games, they rely on the procedural representation of an idea that the player manipulates," Bogost explained. "As poetry, they rely on the condensation of symbols and concepts rather than the clarification of specific experiences. As images, they offer visually evocative yet obscure depictions of real scenes and objects. They are inspired by ideas or experiences I encounter, as attempts to capture something fundamental about how they work. Game poems aspire, perhaps, toward a kind of video game version of Imagism, if we expand 'image' to include a logic or behavior as its subject."

Another younger faculty member,

Assistant Professor of Computer Science Nick Feamster, was recognized by *Technology Review* magazine as one of the world's top innovators under the age of thirty-five for his research in computer networks. Selected from more than 300 nominees by a panel of expert judges and the editorial staff of *Technology Review*, the TR35 is an elite group of accomplished young researchers who exemplify the spirit of innovation. Their transformational work spans medicine, computing, communications, nanotechnology, and more.

"I am extremely honored to be recognized with a TR35 award," said Feamster, who runs the Network Operations and Internet Security Lab in the School of Computer Science. "I owe much of the credit for this award to my graduate students, all of whom work tirelessly on this problem and many others related to improving the availability and security of communications networks."

Feamster's colleagues in the College of Computing, Mark Guzdial and Barbara Ericson—the husband-and-wife pair who together are reinvigorating computing education for a generation of Georgia students—received the Association for Computing Machinery's 2011 Karl V. Karlstrom Outstanding Educator Award.

Guzdial, professor in the School of Interactive Computing, and Ericson, director of computing outreach in the College of Computing, are the driving forces behind Georgia Computes!, a nationally recognized program intended to enhance computing instruction throughout Georgia's primary and secondary schools. The program is one of the National Science Foundation's "Broadening Participation in Computing" alliances and has been emulated by other states looking to make advances in computer science education.

"I am thrilled for the recognition from the ACM for the work that my partner and wife, Barbara Ericson, and I have been doing for the last decade," Guzdial said. "Our work has been about making computing more accessible to a broader audience, by teaching computing in terms of how people want to use computing—a 'context' for using computing."

Faculty in the College of Sciences garnered an impressive array of prestigious awards last year.

Two professors in Chemistry and Biochemistry, Mostafa El-Sayed and Jean-Luc Bredas, were included by Thomson-Reuters in its lists of the top scientists of the decade. El-Sayed was listed as number 17 in Thomson-Reuters' listing of the top chemists of the past decade, while Bredas was listed as number 84 among the top materials scientists.

Mark Guzdial and Barbara Ericson in the College of Computing were named outstanding educators by the Association for Computing Machinery.

El-Sayed is director of Georgia Tech's Laser Dynamics Laboratory, which studies the conversion of electronic energy in a wide variety of structures such as semiconductors (quantum dots) and metallic nanostructures. Among his most promising current areas of research are using lasers and gold nanorods to fight cancerous tumors under the skin.

Bredas is a member of Georgia Tech's Center for Organic Photonics and Electronics (for which he is in charge of international relations) and a co-director of the Center for Computational Molecular Science and Technology. His work seeks to uncover the chemical and physical properties of novel organic materials and includes research on organic solar cells as well as organic light-emitting diodes for potential use in visual displays and lighting.

Zhigang Peng, assistant professor in Earth and Atmospheric Sciences, has made seismological discovery a regular occurrence early in his career. Peng has written thirty-five peer-reviewed papers that have contributed much to the understanding of the physics of earthquakes and faults. For his work, the thirty-five-year-old Peng was awarded the Seismological Society of America's (SSA) Charles F. Richter Early Career Award. The award recognizes outstanding contributions to the goals of the Society by a member early in his or her career.

Computer Science Assistant Professor Nick Feamster (second from right) was named one of the world's top innovators under the age of thirty-five.

Chemistry and Biochemistry Professors Mostafa El-Sayed (left) and Jean-Luc Bredas (right) were included in Thomson-Reuters' lists of the top scientists of the past decade.

Peng's contributions to earthquake seismology have showcased the traits that have made him an impressive researcher. He identified many important physical problems that could be addressed by careful analysis of seismic data while also contributing to the understanding of earthquake triggering, non-volcanic tremor, and fault zone structure.

Physics Professor Walter de Heer was awarded the Materials Research Society Medal. De Heer was cited for his "pioneering contributions to the science and technology of epitaxial graphene." The MRS Medal, which recognizes an exceptional achievement in materials research in the past ten years, is awarded for a specific outstanding recent discovery or advancement that has a major impact on the progress of a materials-related field.

"I am very pleased and encouraged that our research to develop epi-graphene for electronics is recognized already in this early stage," said de Heer. "This will certainly stimulate others to join us in this important endeavor."

The faculty of the College of Engineering, the nation's largest and one of the most highly ranked, consistently earns highly visible honors.

Manu Platt, assistant professor of biomedical engineering, received a $1.5 million National Institutes of Health (NIH) Director's New Innovator Award to support a project aimed at reducing the incidence of stroke in children with sickle cell disease.

Assistant Professor Manu Platt received an NIH Director's New Innovator Award for his work in reducing strokes in children with sickle cell disease.

Platt will use the funding to develop models for identifying which children with the disease are at risk for stroke.

Approximately 10 percent of children with sickle cell disease suffer a stroke. Having experienced one stroke, they are at high risk of having another.

"Current therapies to prevent strokes in children with sickle cell disease have substantial side effects, so we need to create better ways to predict which patients need intervention," said Platt. "My goal is to use experimental and clinical data to develop a mathematical model for predicting stroke risk in pediatric patients with sickle cell disease to allow for earlier intervention."

Platt's colleague Tim Lieuwen, a professor of both Aerospace Engineering and Mechanical Engineering, was awarded the George Westinghouse Silver Medal by the American Society of Mechanical Engineers (ASME). Lieuwen, who maintains an active teaching and research program in the area of clean combustion, was honored for his "outstanding contributions to combustion science and technology for low-emission gas turbines."

The George Westinghouse Medals were established by ASME to recognize eminent achievement or distinguished service in the power field of mechanical engineering. The silver medal is given to an individual under the age of forty-five.

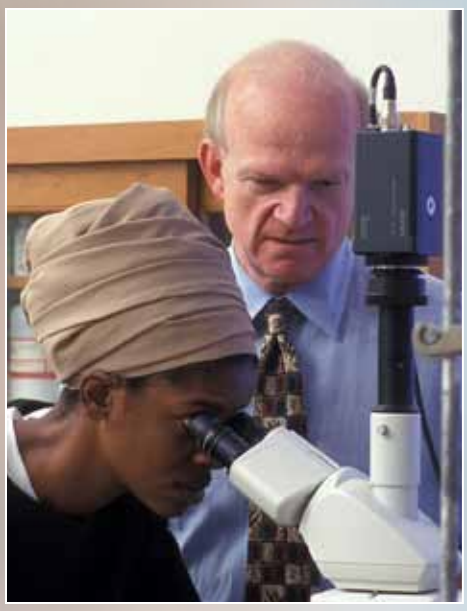
Karim Sabra, assistant professor of Mechanical Engineering, was awarded the R. Bruce Lindsay Award from the Acoustical Society of America for his work on time-reversal acoustics and ambient noise cross-correlations.

The R. Bruce Lindsay Award is presented to a member of the society who is under thirty-five years of age and who, during a period of two or more years immediately preceding the award, has been active in the affairs of the society and has contributed substantially, through published papers, to the advancement of theoretical and/or applied acoustics.

Sabra's research emphasizes an interdisciplinary approach to applied and theoretical problems in acoustics, structural health monitoring, biomechanics, and seismology based on common wave propagation physics features.

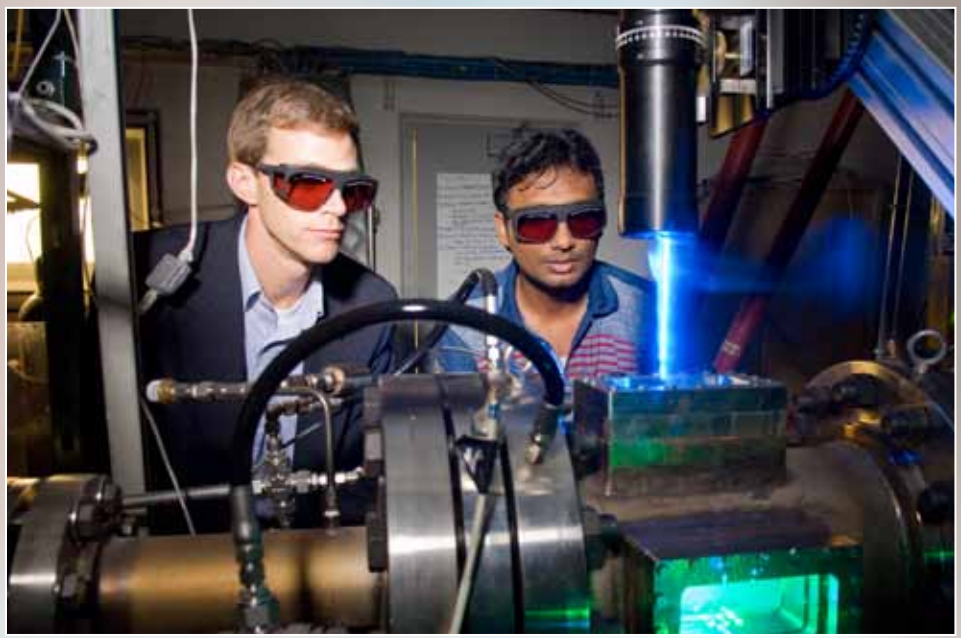
Ronald Rousseau, longtime chair of Chemical and Biomolecular Engineering, received the Council for Chemical Research 2011 Malcolm E. Pruitt Award.

Given annually since 1985, the Malcolm E. Pruitt Award recognizes outstanding contributions to research progress in the chemical sciences and engineering while interacting among industrial, academic, and government research sections. Rousseau is the third Georgia Tech engineering professor to receive the award.



Chemical and Biomolecular Engineering Chair Ronald Rousseau received the Council for Chemical Research Malcolm E. Pruitt Award.

Mechanical Engineering Assistant Professor Karim Sabra received the R. Bruce Lindsay Award from the Acoustical Society of America.



Professor Tim Lieuwen (left) received the George Westinghouse Silver Medal from the American Society of Mechanical Engineers.

COMMUNITY OUTREACH AND SUPPORT

While Georgia Tech students and faculty are renowned for their brain power, they are also guided by their hearts to apply their intellect and work ethic to helping those in need, in Atlanta and throughout the world.

Team Buzz volunteers helped clean up Piedmont Park and the Bright Futures Center in conjunction with Hands on Atlanta, a non-profit organization that celebrated its twentieth anniversary last October.

Expertise, talents have global impact

When a 7.0 magnitude earthquake struck Haiti on January 12, 2010, the images of mass destruction and chaos touched millions of hearts around the world. As the death toll rose and the agony of survivors grew, many people were inspired to take action. Graduate student James K. Holder II was one of those moved to help. With creativity and commitment, Holder raised $10,000 in donations through his "Your Face HERE: Haitian Earthquake Relief Effort" project.

Holder, who earned a bachelor's in architecture from Georgia Tech in 2008 and is currently working on a master's in building construction, remembers hearing the news stories and being filled with determination to help the people of Haiti.

"I knew I wanted to do something that would have a significant impact on their situation, and I wanted to start immediately," Holder said. "After talking with one of my friends about things that I could do to raise awareness and money, I figured through simple arithmetic that I could raise $10,000 by getting 200 people to donate $50 to the cause."

A talented photographer, Holder came up with the idea for the "Your Face HERE" project. In exchange for making donations of $50 or more to the American Red Cross or Yele Haiti, people could have Holder shoot their portraits. Through previous work for the *Technique* and undergraduate classes, Holder already had a solid portfolio and an established reputation on campus for his photography.

Members of Georgia Tech's Engineers Without Borders (EWB) chapter were similarly motivated to help those in dire need when they designed a latrine that uses solar energy to take active disease-causing pathogens in waste and render it safe to use as fertilizer. The project was a collaboration of EWB students, the Georgia Tech Research Institute (GTRI), Emory University's Rollins School of Public Health, and community leaders in Bolivia, where the team has worked on installing protoypes of the system.

Georgia Tech's EWB chapter was honored last March for its creation of the sustainable solar sanitation system at the National Collegiate Inventors and Innovators Alliance's Open Minds competition. The team won first place in the event's video competition and was named runner-up for the People's Choice award.

"In many communities, water is too precious to use for transporting waste,"

said Kevin Caravati, research scientist at GTRI, which led to the group's investigation of dry sanitation methods. The sanitized waste "can be used as fertilizer for biofuel crops or cotton, but people do use it for food, so we must make sure it's safe — that's where Emory and the Centers for Disease Control helped us out."

In addition to the solar latrine project, EWB currently has projects in Honduras and Cameroon. Last December, the Cameroon group began implementing a water distribution system in the village of Mungoa-goa by starting the installation of a solar-powered well.

Students and faculty with computing skills have also applied their expertise for the greater good.

Last December, the GTRI Conference Center served as one of thirteen global locations for the third Random Hacks of Kindness (RHoK), a global community-of-innovation competition. During the two-day marathon hacking session, the best and brightest hackers formed a volunteer global network—which included Tech students and faculty as well as developers and software engineers—and created software solutions to critical challenges relating to natural disaster risk and response.

RHoK sessions worked with collaborators at Crisis Commons to identify immediate problems, which were refined further through various small groups. These groups worked simultaneously across the globe in a "codejam"—a fast-paced competition where each group had a set amount of time to solve the challenges they were given. At the end of the two-day event, a panel reviewed each hack, with winners walking away with prizes.

"This was a unique opportunity to connect the critical needs of nonprofits who help in times of great need with application developers, systems engineers, and other technical and creative experts who wouldn't typically work on these problems," said Betsy Plattenburg, GTRI's director of Corporate Relations.

For a third consecutive year, four Georgia Tech students spent two straight days of playing "Zelda," sacrificing sleep for charity as they played.

Ryan Adams, Joey Dolensky, Ryan Hoffman, and Peter Sohl, all third-year undergraduates, started the 4/48 Zelda Marathon, named for its original concept of playing four Zelda games in forty-eight hours, in the fall of 2008.

"We had just played a long game and I was thinking back on it, and I'd read about gaming marathons raising amounts like $10,000 at a time," Sohl said. "It was around October I really presented the idea to the other three."

Student James Holder (right) used his photography skills (left photos) to raise $10,000 for Haitian earthquake relief.

Members of Georgia Tech's Engineers Without Borders chapter designed a latrine that uses solar energy to convert waste to fertilizer.

The team set up a website and video stream, and scheduled the marathon for the first weekend after finals in December. The fundraising strategy was to stream the marathon online and entertain viewers while playing, hopefully prompting donations to the chosen charity. Between 2008 and 2009, the marathon raised around $1,000 for Invisible Children.

In 2009, an Australian student contacted Sohl via Facebook. He had seen the team's website and had a group of friends who wanted to race Sohl's team. Hoffman, who manages the technical aspects of the event, set up a video feed enabling them to watch and chat with the Australians as the two teams raced. The Tech students "blew them out of the water," said Sohl, playing all four games in around forty-one hours—a three-hour improvement from 2008.

In 2010, Adams spent much of the summer revamping the website. He added a widget that tracks the amount of money given through the marathon, while still allowing donors to give directly to this year's charity, Child's Play.

"We thought it was wise to choose a charity related to what we were doing," said Sohl. Child's Play distributes toys,

Researchers find method for recycling rubble, rebuilding Haiti

A year following the devastating earthquake in Haiti, Georgia Tech researchers developed a method to recycle rubble into a strong construction material, which could be a possible solution for safely and inexpensively rebuilding Haiti's structures.

Professors Reginald DesRoches and Kimberly E. Kurtis from the School of Civil and Environmental Engineering (CEE), along with CEE graduate students Joshua J. Gresham and Brett Holland, say the concrete is made from recycled rubble and indigenous raw materials using simple techniques. And it meets or exceeds the minimum strength standards defined by the American Concrete Institute for concrete used in the U.S.

This new method for developing concrete could be a sustainable strategy for clearing the "logjam that is blocking reconstruction," the Georgia Tech research team wrote in the article "Breaking the Reconstruction Logjam: Progress through Rubble Reuse," which appeared in the Bulletin of the American Ceramic Society.

"The commodious piles of concrete rubble and construction debris form huge impediments to reconstruction and are often contaminated," said DesRoches. "There are political and economic dilemmas as well, but we have found we can turn one of the dilemmas—the rubble and debris—into a solution via some fairly simple methods of recycling it into new concrete."

The 7.0-magnitude earthquake that hit Haiti in January 2010 caused an estimated 300,000 deaths and caused more than 300,000 homes and 30,000 businesses to collapse. A year later, many of the damaged areas remained covered with a vast amount of debris, estimated to be about 20 million cubic yards.

Born in Haiti, DesRoches traveled to Port-au-Prince eight times last year to collect samples of typical concrete rubble and available sand types that could be used in concrete preparation. He and his colleagues made concrete samples from the collected materials.

"Based upon these results, we now believe that Haitian concrete debris, even of inferior quality, can be effectively used as recycled coarse aggregate in new construction," said Kurtis. "It can work effectively, even if mixed by hand. One key is having a consistent mix of materials that can be easily measured."

Tech eDemocracy project wins CASE grant

The Campus Community Partnership Foundation honored a group of Tech students with its Community Academic Service Entrepreneur (CASE) grant for their proposal of Project Redistrict.

The project's objective is to generate public awareness of political issues related to voting districts, proposing a mathematical algorithm to automatically redistrict regions using census data. Project Redistrict, a project of Georgia Tech eDemocracy, has the long-term goal of constructing an intuitive website that redistricts areas based on parameters such as population equality, density, and contiguity.

"The team worked very hard throughout the term and is very excited to be awarded this grant," said Sheetul Hassan, a third-year materials science and engineering student and team leader for the project. "The grant money will be used primarily for improvement of our innovation through community outreach programs and in much-needed software. This is a great honor and we look forward to the future success of this project."

Team members include industrial and systems engineering students Charlotte Huang, Swetha Krishnakumar, and Xiaotong Yang; computer science student Himani Manglani; and public policy student Stephanie Noble.

For a third consecutive year, a group of Georgia Tech students spent two straight days playing "Zelda," raising $1,000 for the charity Invisible Children.

games, and other donations to children in hospitals worldwide.

A group of fraternity members embraced a much more personal method of helping those in need. In solidarity with each other and those suffering from childhood cancers, more than 150 fraternity men shaved their heads at an Irish pub in Midtown Atlanta a week before St. Patrick's Day.

Georgia Tech and Emory University received a $50,000 Ford College Community Challenge grant to develop a shared bicycle program. Tech students have supported the program by developing a device that attaches to shared bicycles, enabling them to be reserved and locked remotely.

The men collectively raised more than $55,000 for St. Baldrick's Foundation and childhood cancer research, more than half the $107,043 total raised from their efforts and those of other local businesses.

The Georgia Tech baseball team also got in on the action, committing one player to shave his head for every $200 donated during the project's ten-day duration.

City Planning students lend expertise to neighborhood in need

Students from the School of City and Regional Planning offered their expertise last year by working with Atlanta-area communities to develop a long-term plan for their neighborhoods.

Professor Nancey Green Leigh (right photo) and her class of graduate students partnered with Georgia Conservancy and community leaders of Neighborhood Planning Unit (NPU) G located on the west side of Atlanta close to the intersection of Interstate 285 and Hollowell Parkway to improve the area.

"The neighborhood has many challenges," said Leigh. "It is one of Atlanta's neighborhoods with the least amount of development, most neglected green space, and greatest socioeconomic challenges. The major source of employment and business in NPU-G is the Atlanta Industrial Park, which is separated from the rest of the community by I-285. The neighborhood once housed four public housing projects, all of which have been demolished, but only one of which has been redeveloped."

Georgia Tech students met with community members, leaders, and elected officials to develop a comprehensive analysis of the area and learn more about the neighborhood's history.

"We were really pleased to hear what the community saw as its needs," said Erin Rosintoski, a graduate student working on her master's degree in city planning with a specialization in land use and urban design. "Many of the items that they brought to our attention verified what our research had told us."

The neighborhood has some significant natural resources and a history of community that can serve as foundations for redevelopment planning.

"The residential portion of the community borders the Chattahoochee River and it has Proctor Creek running through it," said Leigh. "The neighborhood has proximity to the Beltline, and these amenities could help bring new life to the area."

"The older residents who had lived there for thirty, forty, and even fifty years told us how prosperous this neighborhood had once been," said Rosintoski. "They spoke about the dairy farms that used to cover the area and how there was a tremendous sense of community. It was interesting to hear how the roots of the neighborhood started."

For these young city and regional planners, their semester-long project culminated with the seeds of how to repair and grow the community going forward.

"We are trying to create a better understanding of the community's challenges and innovative approaches to those challenges," said Leigh. "We provide students with a strong city and regional planning education and the ability to apply their skill sets to a community challenge, but as an educator at a major research university, I also want to push the field further. This project has presented some excellent possibilities for doing that."

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