Inside:

THE WHISTLE

FACULTY/STAFF NEWSPAPER | Volume 32, Number 31 • October 1, 2007 | THE GEORGIA INSTITUTE OF TECHNOLOGY

Simulation reveals how body repairs balance

Could help rehabilitate patients, build robots with greater stability

Megan McRainey
Institute Communications and Public Affairs

Your body goes to a lot of trouble to make sure you stay upright. But when the brain's neural pathways are impaired through injury, age or illness, muscles are deprived of the detailed sensory information they need to perform the constant yet delicate balancing act required for normal movement and standing.

With an eye towards building robots that can balance like humans, researchers at Georgia Tech and Emory University have created a computer simulation that sheds new light on how the nervous system reinvents its communication with muscles after sensory loss. The findings could someday be used to better diagnose and rehabilitate patients with balance problems — through normal aging or diseases such as multiple sclerosis —

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Graduate student Stacie Chvatal (standing) and Assistant Professor Lena Ting set up a human balance test designed to measure muscle reaction to balance disturbance.

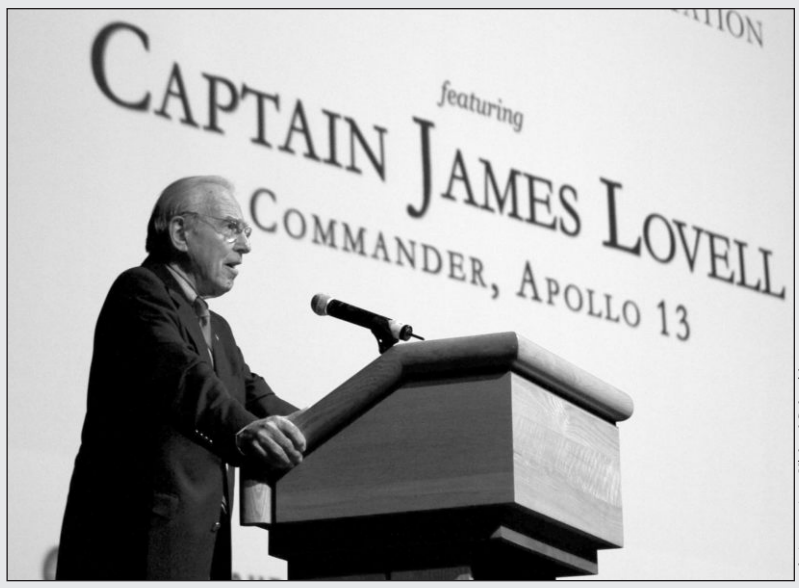

photo courtesy Michael Schneider

Speaking to a capacity crowd in the Ferst Center, retired astronaut James Lovell visited campus last week, recounting some of his experiences aboard each of his four space missions and expressing his profound admiration of Georgia Tech. As a representative of the Astronaut Scholarship Foundation, he also recognized undergraduate Nicole Larsen with a $10,000 scholarship.

Solar Decathlon team heads to D.C.

Georgia Tech's Solar Decathlon Team is celebrating another milestone as their solar powered house heads to Washington, D.C. Students, faculty and staff from every college on campus have been working on the house for more than a year and the competition is finally around the corner.

"Right now, I think we're all feeling a little bit of stress and a little panic, but mostly we're really excited about getting to D.C.," said Amelia Mendez, a senior in the College of Architecture. "I can't wait to see all of the components of the house assembled and working together."

The plan is for the house to arrive at the National Mall on October 3. That is when students will begin the final construction phase.

"Right now, we've been working on putting the big pieces put together, but when we get to Washington, we'll be focusing on the detail work," Mendez said.

Many of the participants say this has been the experience of a lifetime and they can't wait to see what other teams have done with their houses.

"I'm looking forward to seeing what other schools have done," said undergraduate Jonathon Schwartz. "I've seen so much of what we've done and I've been very impressed with my teammates work. I can't wait to see all the houses set up on the Mall and becoming a solar neighborhood."

Competition details and updates will be available at **www.solardecathlon.org**.

2007 State of the Institute Address

President Wayne Clough will deliver the annual State of the Institute Address to faculty and staff on Oct. 16 at 3 p.m. in the Student Center Ballroom. The address is the main agenda item for the fall meeting of General Faculty Assembly and Academic Senate. For more information, visit **www.facultysenate.gatech.edu**.

Associate dean Vito named vice provost

Michael Hagearty
Institute Communications and Public Affairs

Saying it is the best way he can contribute to Georgia Tech, School of Mechanical Engineering Professor Ray Vito has accepted the offer to become Tech's first vice provost of Graduate and Undergraduate Studies.

In the newly reorganized Office of the Provost, it means Vito will oversee curriculum development, educational technology and experiential learning initiatives such as the Honors Program and cooperative education.

Raymond Vito

Senior Vice Provost for Academic Affairs Anderson Smith pointed to Vito's relevant experience, having served both as associate chair for Undergraduate Programs in the School of Mechanical Engineering and associate dean for Academic Affairs in the College of Engineering, as a determining factor in his choice.

"He has been a significant figure in shaping undergraduate and graduate studies at both the school and college level," Smith said.

"I look forward to working with Ray as Georgia Tech moves to the next level of educational excellence," he continued. "With the development of the undergraduate learning center, the activities of the task force for curriculum reform and our goal of significantly increasing the number of doctoral students on campus, we have the mechanisms in place to define how the technological research university of the 21st century educates its students."

Vito made it clear during a public presentation in August that he views the role as a facilitator, offering resources where necessary and helping to smooth the road toward systemic improvements.

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"QUOTE-UNQUOTE"

"We know from our colleagues in psychology and sociology that there are gender differences that can be very important to take into account in human-computer interaction and software design. Projects like this can help us have a better impact, even at younger ages, where I believe interventions need to happen."
—Julie Jacko, a professor in the School of Interactive Computing and and president of the Association for Computing Machinery's group on human-computer interaction, on research that investigates why women and men interact differently with software programs. (Associated Press)

GTRI names new director of research security

Planning for and protecting classified information

Abby Vogel
Research News

Securing classified information is a tough job, but one that new Georgia Tech Research Institute (GTRI) director of research security Jim Ellington knows quite well.

Ellington has been protecting classified information for the past 35 years, with experience working for the federal government, state governments and corporations including Honeywell, The Aerospace Corporation, Rockwell International and Hughes Aircraft Company.

"This job is a challenging one. I have to understand each federal agency's requirements, implement those requirements, and assist and support laboratory personnel in performing the classified work," said Ellington, who left the University of California and the Lawrence Livermore National Laboratory to join GTRI this summer.

"Jim has extensive experience in the security community matched by impressive leadership and management skills. We are most fortunate to have someone of this caliber join us at Georgia Tech," said Stephen Cross, vice president and director of GTRI.

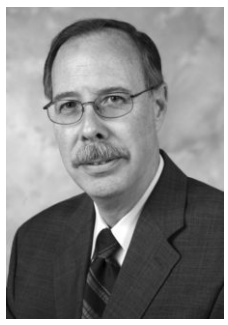
Ellington has an extensive background in managing security programs for the U.S. Department of Defense (DOD). He began his career as an industrial security specialist for the DOD and served as program security manager for two major contractor DOD programs (MILSTAR and the National AeroSpace Plane). He also managed the security program for the Port Authority of New York and New Jersey after the terrorist attacks of 9/11.

Beyond his duties for GTRI, Ellington also assists Georgia Tech's academic colleges in meeting the security needs of their classified research activities.

In GTRI, 51 percent of the total contract base consists of classified contracts and each contract has its own requirements for how classified information is received, utilized, reproduced, transmitted, stored and destroyed. In addition, classified contracts require laboratory personnel to receive personnel security clearances before the government trusts them to work on classified research.

"My office needs to be involved very early — as soon as a researcher thinks about submitting a proposal for classified research," said Ellington. "We need to help the researchers bid the contract correctly to include costs for protecting the classified information."

According to Ellington, security costs could range from spending time in a security briefing to spending several thousand dollars to build specially designed work areas, procure secure communications equipment or obtain specialized storage containers or safes.



Researchers who plan to submit proposals for classified research can look to Ellington's office as a resource.

"If we bid these contracts correctly from the beginning, the programs won't run out of money for security halfway through the term of the contract," added Ellington.

After a contract is awarded, Ellington's team will assist the researchers to appropriately implement the security requirements necessary for the contract and ensure that the policies are being followed.

Though Ellington has only been on the job for a short time, he already sees some room for improvement in planning and implementation.

"Strategically, I think we can definitely improve our security awareness and quality assurance efforts," noted Ellington. "I've been visiting all of the lab directors and they realize it's a team effort to secure our classified research and they know my office is here to help."

Ahuja appointed director of Georgia Tech-Ireland

Nancy Fulbright
Research News

Krishan Ahuja, a Regents' professor in the School of Aerospace Engineering, has been appointed director and general manager of Georgia Tech-Ireland (GTI). In this role, he will oversee GTI's work with Irish corporations and universities, the Georgia Tech research community and U.S. companies to provide companies on both sides of the Atlantic with industry-focused research and development.

"Georgia Tech is very well-respected here because of the intellectual brainpower that we can access across the pond in Atlanta," said Ahuja. "The goal is to make Georgia Tech-Ireland a raving success."

Prior to his appointment as GTI director Ahuja headed the Aerospace and Acoustics Technologies Division of Georgia Tech Research Institute's (GTRI) Aerospace, Transportation and Advanced Systems Laboratory.

Regents' Professor Krishan Ahuja will lead GTRI's first international research operation.

"Krish is a proven leader with outstanding technical abilities and sharp business sense. He has years of experience directing large research efforts for major government and corporate sponsors," said Stephen Cross, GTRI director and GTI executive director. "Having worked in both industry and education, he brings a unique perspective to Georgia Tech Ireland which will further our efforts to build strong bonds between academic discovery and commercial success."

Georgia Tech Ireland, located in Athlone, Ireland, focuses on industry research and development needs. GTRI receives support from IDA Ireland, the Irish Government's economic development agency. The new institute focuses on four technology areas that mirror Ireland's research strengths digital media, radio frequency identification (RFID), biotechnology and energy.

"We are dealing with the scholarship of application as well as the scholarship of integration, and there will be a lot of exchange and collaborative work between Georgia Tech in Atlanta and Ireland," observed Ahuja. "This effort helps Georgia Tech further its mission of defining the technological university of the 21st century, and when Georgia Tech Ireland is successful, we will be able to replicate the model in other countries."

Correction: *Last week's article regarding the endowment of a new Technology and Management Program was incorrectly attributed. The author was Brad Dixon.*

Georgia Tech

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by retraining their muscles and improving overall balance. The research will be published in the October issue of Nature Neuroscience.

"The ultimate goal of rehabilitation is for patients to find the best way to adapt to their particular deficit. This system may help predict what the optimum combination of muscle and nerve activity looks like for each patient, helping patients and doctors set realistic goals and speeding recovery," said Lena Ting, lead researcher on the project and an assistant professor in the Department of Biomedical Engineering.

Filling in the memory gaps

In a body without balance impairment, the nervous system collects sensory information from all over the body and transmits this information to the muscles that control balance. When that information changes through the introduction of something like a strong wind, a raised crack in the pavement or an accidental bump from a nearby stranger, the nervous system sends the new information to the muscles and they adjust accordingly to maintain the body's balance.

Impairments and injuries to the nervous system or the senses that report to the nervous system lead to balance problems. Experts traditionally have had little understanding of how the nervous system's communication with the muscles associated with balance changes when one or several pieces of necessary sensory information are missing.

Georgia Tech and Emory researchers set out to create an effective way to interpret how the electrical signals from the nervous system to muscles are changed by sensory impairment — similar to the numbing of feet experienced by diabetes patients — and how these changes affect balance control. The team started with data sets from animals. They were able to determine that, after a period of rehabilitation, subjects with some sensory damage were able to regain their balance despite the loss of some sensory information. So how do the nervous system and muscles fill in the information gaps?

The Georgia Tech and Emory team hypothesized that the nervous system relies on the relationship between the body's center of gravity and its environment to control balance. They reasoned that the best predictor of how muscles would be activated when the subject experienced a balance threat was not the motion of the individual body parts, but the horizontal motion of the body's center of gravity.

To test their theory, the researchers created a computer simulation that could accurately simulate standing balance and muscle reactions to balance disturbances by focusing on the relation of the subject's center of gravity to the ground. Rather than predicting neural control patterns for the multitude of sensory information processed by the body to maintain balance, the team instead tracked a small set of signals related to the body's control of its center of gravity.

The Georgia Tech and Emory team determined that subjects who had impaired sensory information were slowly using new sensory pathways to track the motion of the body's center of gravity, compensating for the loss of information from the damaged sensory pathways. In effect, the subjects' muscles were using different neural information to perform the same balance tasks, resulting in muscle activity patterns that looked "abnormal," but that were actually similar to the predicted optimum.

The best performance possible

The research team is now testing its center of gravity simulation with human subjects and a small robot with simulated muscles. They predict that the simulation could recognize impairment and pinpoint the optimum recovery points for each sensory-impaired subject — all based on the body's reliance on center of gravity information. When applied to a robot, these neural communication patterns allowed the robot to successfully move fluidly like an animal, in contrast to what its gears and motors might suggest. The robot demonstrates all of the different strategies that could be used by normal and sensory-loss patients.

"This finding will change the way we approach rehabilitation," Ting said. "We can't expect patients to mimic normal balance performance when they're using a different set of sensory information. Instead, our work can help identify the best performance possible given a patient's level and type of sensory impairment."

For more information...

Neuromechanics Group
www.neuro.gatech.edu/groups/ting

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"I've seen it many times and believe it in my heart: if you empower the faculty, good things will happen. In this position, that's the graduate and undergraduate coordinators. They are the people who make the academic programs at Georgia Tech work."

Citing the provost's task force that is reviewing Tech's undergraduate curriculum, Vito said some assessment was already under way. But he also drew upon the College of Engineering's strategic plan, promoting the exploration of "a new, innovative, rigorous and flexible bachelor's degree program that will serve as a foundation for advanced study."

He also hopes to advance a "culture of self-education," where professors engage students in the excitement of learning and motivate their desire to have a positive impact on society.

"We must encourage the kind of broad thinking that comes along with an integrated learning experience," he said. "I think this will encourage retention as well as additional study in the field."

In the drive to attract the best graduate students and prepare them for successful careers, Vito pointed in particular to improved metrics and mentoring. He emphasized his open door policy regarding student concerns as well as his desire to solicit their opinions.

"Student input is very important. I think we can learn a lot from them — we probably need to do more of it — and I would like to get them involved in some of the decisions that affect them."

Ultimately, Vito, whose research career has produced several patents and a commercial company, said he is intrigued by the opportunity to help define this new position.

"I have an active research program and I don't intend to give that up, but I think at this point in my career it is the best way I can contribute to Georgia Tech. I would like to thank Andy for the opportunity to work with him on issues important to the success of our undergraduate and graduate students."

For more information...

Office of the Provost
www.provost.gatech.edu

IN BRIEF:

DOT project to affect commute

The Georgia Department of Transportation has released an updated project schedule for the replacement of the 14th Street Bridge. The new schedule will allow the department to reduce the amount of time that residents, employees and visitors will be affected by construction activity.

Starting October 1, Williams Street between 10th and 16th Streets will be reduced to one lane until June 2009. Motorists are encouraged to bypass Williams Street at 10th Street by using West Peachtree Street.

Midtown Transportation Solutions, a program of the Midtown Alliance, will launch a Web site, **www.14thStreetBridge.com** that will act as a resource center for commuters and employers. This site will provide information on lane closures, detour routes, commute alternatives and solutions for employers.

For commuters, a flexible parking plan

The Department of Parking and Transportation has initiated a new program to accommodate members of the campus community who use Georgia Tech parking lots on an irregular basis.

For faculty and staff with limited parking requirements, a special discount program called SmartPark may be the answer. This pay-as-you-go program is valid at the Technology Square parking deck (E81), Visitor Parking Area 3 (adjacent to the Student Center parking deck), and the North Campus parking deck (W23) on Atlantic Drive between 5:30 a.m. and midnight.

Employees wanting to participate in SmartPark must first buy a $25 special permit from the Parking office. Participants' BuzzCards are automatically programmed for use in the designated areas. Each time SmartPark is accessed, $5 is debited from the BuzzCard account. Users may add additional BuzzCard funds at their convenience.

SmartPark is based on space availability, and does not permit any overnight parking. For more information, visit the "Parking on Campus" section at **www.parking.gatech.edu**.

Study projects Beltline's health impact

The Atlanta BeltLine is a visionary project of parks, trails, transit and urban redevelopment circling the city's core and connecting neighborhoods. It has the ability to reshape the city's urban fabric and provide much needed opportunities for recreation and active travel that can improve public health. But will it happen soon enough?

This summer, Georgia Tech's Center for Quality Growth and Regional Development released a report entitled the "Atlanta BeltLine Health Impact Assessment." Results concluded that the BeltLine would have a largely positive affect on the health of Atlantans by improving access to green space and healthy foods, creating opportunities for physical activity and increasing transportation options.

But one negative aspect shadows the project — time. Due to the funding mechanisms adopted to implement the BeltLine, some of the most health-promoting elements of the project will not be completed for decades. The study urges the City of Atlanta to continually seek alternative resources to allow elements of this project — especially parks and trails — to be realized sooner.