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# THE WHISTLE

FACULTY/STAFF NEWSPAPER

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THE GEORGIA INSTITUTE OF TECHNOLOGY

## Technology predicts outcome of pediatric heart surgery

*Image-based planning leads to optimal procedures for congenital defects*

Megan McRainey  
Institute Communications  
and Public Affairs

Georgia Tech and Emory University researchers have developed an innovative new technology that will help pediatric cardiac surgeons design and test a customized surgical procedure before they ever pick up a scalpel. With a better understanding of each child's unique heart defect, surgeons could greatly improve the likelihood that children with complex defects requiring multiple surgeries over a period of several years could have smoother recoveries and an improved quality of life after their operations.

The technology, known as image-based surgical planning and developed with the help of pediatric cardiologists and pediatric surgeons at The Children's Hospital of Philadelphia and Emory University, creates a three-dimensional model of the child's heart with data from the child's MRI scans at different times in the cardiac cycle, also called a 4-D MRI. The models allow surgeons to visualize the direction of blood flow and determine any energy loss in the heart. So if a surgeon were planning a certain correction to an area of a child's heart, a model created by the system would show the surgeon how well blood would flow through the newly configured heart.

The goal of the Georgia Tech/Emory project is to create a complete system that allows surgeons to get a detailed look at the child's heart functions with the new MRI system, design surgical procedures for optimum postoperative performance and evaluate the heart's performance with a sophisticated blood flow computer simulation.

The work was presented last month at the American Heart Association's Scientific Sessions meeting in Chicago and has been published in *Circulation* and the *Annals of Thoracic Surgery*.

"We use the MRI images and time

data to create models of these children's vascular systems and hearts to simulate how they currently work and how they could work after surgery," said Ajit Yoganathan, a co-principal investigator on the project and associate chair of the Department of Biomedical Engineering. "The goal is to improve the quality of life for these children by understanding their current physiology and finding the best way to optimize the surgery for that particular child."

While the program isn't yet ready for use by surgeons outside the project, it could be available in about three to five years, Yoganathan said.

### Devising new strategies

Although the normal heart has two ventricles, or lower chambers, of the heart used for pumping blood through the body, two out of every 1,000 babies in the United States are born with just one lower chamber. Considered one of the most complex congenital heart defects, a single-ventricle heart often leads to congestive heart failure if not repaired.

Patients with this defect often undergo multiple surgeries to reconfigure the pulmonary and systemic systems in operations called Fontan repairs, a reconfiguration that diverts the blood flow coming to the right side of the heart directly to the lungs so that the heart no longer has to pump blood to the lungs. Staged over several years, these surgeries are a common, but not always successful, option used to treat a single-ventricle defect.

After a less-than-optimal operation, children sometimes experience a reduced capacity to perform physical activities and may experience blood clotting and ventricle arrhythmias. The Georgia Tech/Emory surgery planning system could eliminate the need for additional surgeries by optimizing early surgeries.

"The research is meant to get at the root of the 'failing' Fontan, investigating why these pumping chambers fail in the hopes of devising new strategies to give these children a second chance in life. Using advanced imaging and bioengineering

4-D MRI continued, page 3

### Jackets come up short in Jacksonville



With Buzz and the campus community cheering them on, members of the Georgia Tech football team leave for the ACC Championship game in Florida. Soggy field conditions and tough defensive play kept the game in doubt until a late field goal by Wake Forest University earned the Demon Deacons a 9-6 victory.

## Senate approves streamlining of student judicial process

Dan Treadaway  
Institute Communications  
and Public Affairs

Students accused of violating the Student Code of Conduct should have their cases adjudicated in a more timely manner, thanks to revisions adopted by the Academic Senate at its Nov. 28 meeting.

Ericka McGarity, assistant dean of students and director of the Office of Student Integrity, said the process of revising the Code of Conduct began in 2002, but the arrival of Vice President for Student Affairs William Schafer presented an opportunity to consider more substantial changes.

In addition to rewriting and clarifying much of the language in the Code

and bringing a better organizational structure to it, McGarity said the main benefit of the revisions is a streamlined judicial process for students accused of academic and nonacademic violations of the Code. The revised Code outlines the judicial process for four scenarios:

- Academic Misconduct, Low Level: The case can be resolved through a conference between the student and the faculty member. If this fails, the student must participate in an investigation conference with the Office of Student Integrity, which includes a student conduct administrator rendering a decision on the case's outcome. If the student chooses, that decision

Senate continued, page 2

QUOTE

UNQUOTE

"For robotics to really make an impact in the world, we have to get lots of robots into people's hands. The two barriers to that are cost and utility, but it becomes feasible with the swarm idea, which would allow households to buy several inexpensive robots that could work together. The view of swarms consisting of all identical robots just isn't going to take off."

—Tucker Balch, associate professor in the College of Computing, on the view that various types of robots working together will be the most practical way to ubiquity. (Wired News)

## McDermott named director of GTRI's Electronic Systems Laboratory

John Toon  
Research News

When Tom McDermott envisions fiber-optic local area networks, he thinks about systems that can travel faster than the speed of sound and withstand multiple G-forces.

The new director of the Georgia Tech Research Institute's (GTRI) Electronic Systems Laboratory (ELSYS), McDermott specializes in the design and development of high-performance avionics hardware and software systems that make modern aircraft and other weapons systems do their jobs.

"Everything involves computer architectures today," said McDermott, who has 22 years of technical and managerial experience at both GTRI and Lockheed-Martin Aeronautical Systems. "When I went to work for Lockheed, the first project I worked on was a local area network that ended up in the F-22 Raptor."

Computer hardware and software for military systems are the bread and butter of ELSYS, which focuses on systems architecture, defensive avionics and command-and-control systems. The lab is perhaps best known for modernization programs aimed at updating military systems such as the venerable C-130 transport, the first variant of which flew more than 50 years ago.

But updates to radar and defensive systems aren't the lab's only vital defense work. McDermott sees growth areas ahead in command-and-control systems, part of the military's efforts to move information closer to



Tom McDermott has been with GTRI for four years, following 18 years with Lockheed-Martin.

the people who need it.

"There is a general focus in the Department of Defense to push the information flow out to the users at the tip of the spear. We are seeing a lot of initiatives to take traditional command-and-control information and put it onto the systems in the field – aircraft, tanks and even soldiers' backpacks," he said. "Because we have such broad experience with the systems that are in users' hands today, GTRI has unique capabilities to offer that can help quickly transition information technologies from the command centers to the field."

He figures his experience with Lockheed can help ELSYS in its

collaborations with large defense contractors.

"I was in senior management at Lockheed, so I understand the business models that these large commercial companies use," he said. "When they ask us to do something, I understand why. It may make a large contractor more comfortable if the person they're working with in GTRI has been in their shoes."

But ELSYS researchers have become known for much more than defense work. Through a long-term collaboration with the state of Georgia, its researchers help Georgia companies understand what they must do to meet OSHA regulations. And the lab's program on accessibility for the disabled recently won national acclaim that has fueled interest from organizations worldwide.

For McDermott, joining GTRI after an 18-year career at Lockheed was like going home. With a master's degree in electrical engineering and a bachelor's degree in physics – both from Georgia Tech – he was comfortable among Yellow Jackets, and had even played drums in the marching band.

"One of the things that attracted me back to Georgia Tech was the opportunity to teach," he said. "Being involved in the academic process helps bring us closer to the schools and colleges that make up Georgia Tech."

For more information...

**Electronic Systems Laboratory**  
[www.gttri.gatech.edu/elsys](http://www.gttri.gatech.edu/elsys)



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may be appealed to the dean of students.

- Academic Misconduct, High Level: If the student chooses a faculty conference and that fails to resolve the case, the student must participate in an investigation conference with the Office of Student Integrity. The student may choose to have a student conduct administrator render a decision, or the administrator or the student may choose to have a student conduct panel render a decision. In either case, the student may appeal the decision to the vice provost for Undergraduate Studies and Academic Affairs.

- Nonacademic Misconduct, Low Level: Following an investigation conference with the Office of Student Integrity, a student conduct administrator renders a decision. The student may appeal the decision to the dean of students.

- Nonacademic Misconduct, High Level: Following an investigation conference with the Office of Student Integrity, the student may choose to have a student conduct administrator render a decision, or the administrator or the student may choose to

have a student conduct panel render a decision. In either case, the student may appeal the decision to the vice president for Student Affairs.

Low-level disciplinary actions could include a warning or possible suspension, while high-level disciplinary actions could include probation, suspension or expulsion.

"This will be a much-improved system over what we currently have," said President Wayne Clough. "The delays that we experienced with the old system caused a good deal of problems and frustration. Student Affairs has done an excellent job of streamlining and updating this process."

"We should be updating the Code of Conduct every three years or so," said McGarity. "That will allow us to stay current with changing legal requirements and with national trends in the student judicial process."

In other business, the Senate heard a second reading of a proposal that would give library archivists equal faculty status to their librarian counterparts and add professors of the practice to the ranks of the General Faculty. The motion to approve the proposal passed unanimously.

Student Jonathan Sangster, secretary of the Interfraternity Council (IFC), gave a presentation to the Senate on a Habitat for Humanity home being constructed near campus. The project, dubbed the House That Tech Built, is a joint effort of the IFC and the entire Greek community at Tech.

"This is a new type of project that's being led by students, but we want the entire Tech community to participate," said Sangster. "Over the past six months, we raised about \$100,000, mostly from alumni and corporations. The Bradley-Turner Foundation gave money to film a documentary of the project."

Sangster encouraged all faculty and staff to help complete the Habitat project on the remaining work days of Dec. 8 and 9. He said volunteers should meet at Peters Park at 7:15 a.m., where a Stinger will transport them to the work site. Lunch and a T-shirt will be provided.

For more information...

**GT Habitat for Humanity**  
[www.greekhabitat.gatech.edu](http://www.greekhabitat.gatech.edu)

**Faculty governance**  
[www.facultysenate.gatech.edu](http://www.facultysenate.gatech.edu)



## Study suggests state coastal population to grow 50 percent

A new report projects that by 2030, more than 840,000 people will live along the Georgia coast. If that estimate proves correct, it will be a 50 percent increase from the roughly 558,000 people living there in 2000.

These findings are the result of a recently released study commissioned by the Coastal Georgia Regional Development Center (CGRDC) and conducted by the Center for Quality Growth and Regional Development (CQGRD) a research arm of the College of Architecture.

Between 1990 and 2000, the population of the Georgia coast increased by 17.5 percent, according to the U.S. Census Bureau. Since 2000, immigration and development have continued in the 10-county coastal area, causing population numbers to continue to rise. Many believe this growth will persist.

The impetus for this study was the impression among local communities that commonly used projection methods did not adjust for the unique context of coastal Georgia. Therefore, CGRDC asked Georgia Tech researchers to apply a modeling strategy that considered recent growth in the region.

CQGRD Director Catherine Ross noted that “This project is an example of the coastal region’s leadership in assessing the growth in this very important area of our state.”

Tech used a scientific and context-specific methodology to arrive at population projections by age and sex for each county. The model measures the three components of population change: birth, death and migration as they relate to different age and gender groups. Because this method primarily uses 1995 and 2000 data, researchers had to adjust the process to reflect more recent trends.

So the research team conducted interviews with local representatives, leading to the examination of additional data such as building permits, certificates of occupancy, military base personnel changes and school enrollment. This information was used to adjust the projections to reflect the most recent activity on the coast.

For example, local stakeholders cited the region’s proximity to the International Airports in Savannah, Georgia, and Jacksonville, Florida; the ports of Savannah and Brunswick; interstate access; three military bases and growing local colleges as some of the key economic drivers in the region. Local representatives also pointed to the transition of former timber lands to residential and commercial uses as additional significant forces in regional population growth.

Based on the study, the population in all 10 counties and its 35 incorporated cities are projected to increase between now and 2030.

## Trading floor to prepare students for financial careers

Wall Street now intersects with Technology Square, where the College of Management has built a new high-tech, \$1 million trading floor to prepare students for careers in investment banking and financial services.

The College dedicated the 2,000-square-foot Ferris-Goldsmith Trading Floor last month in a private ceremony honoring the donors who made the facility possible: Joyce Ferris, widow of Dakin Ferris Jr., who earned his bachelor’s degree in management from Tech in 1950; and Barbara and Jere Goldsmith, a 1956 graduate of Tech’s business school and former chairman of the Georgia Tech Foundation’s Development Committee. The gifts were augmented by Georgia Tech Foundation funds.

“We are tremendously grateful to Mrs. Ferris, Mr. and Mrs. Goldsmith, and the Georgia Tech Foundation for their support,” says Steve Salbu, dean of the College of Management. “The Ferris-Goldsmith Trading Floor will go a long way toward

truly differentiating our business school from the competition.

“Attracting students who are interested in brokerage and investment banking careers, and engaging our alumni who are already actively working in those fields, will result in graduates who are better prepared for Wall Street-type careers, as well as those related to issues of energy strategy and its financing,” he added.

A trading floor is a tool common at the best business schools. It will include 54 dual-display computers as well as electronic stock information on the walls, training all levels of management students to use financial analysis and electronic trading tools. Management faculty will use the facility to research improved human performance in trading environments, as well as the creation of new financial service models.

The trading floor will house Tech’s new Quantitative and Computational Finance program, an interdisciplinary master’s program ranked 12<sup>th</sup> in the nation.

4-D MRI, cont’d from page 1

tools, the project hopes to describe how blood flows in this type of circulation and how this blood flow might be altered to extend the life of the patients,” said Mark Fogel, director of Cardiac MRI at Children’s Hospital and a key collaborator on the project.

**Planning for better outcomes**

The Georgia Tech/Emory team began work on a system to help surgeons address the unique challenges of Fontan repair. In essence, the system determines how any geometric change in the current heart configuration will change blood flow and strength.

To perfect their system, researchers combined computational and experimental studies to create

a method of assessing an optimum vessel configuration. The group worked heavily with fluid dynamic studies in the lab to get the most accurate simulation of blood flow.

Another tool, developed by a team led by College of Computing Professor Jaroslaw Rossignac is a program that allows for manipulation of a 3-D model of a patient’s cardiovascular system to try out different configurations with a mouse. Once the surgeon has the desired configuration, the new vascular configuration can then be tested to see how well the new surgical procedure would perform.

While the patient MRI database is currently only accessible to project participants, researchers are working with the National Institutes of Health, which funded the project, to open the database to other pediatric cardiologists and cardiac surgeons.

# IN BRIEF:

### OOD celebrates Employee Learning Week

The week of Dec. 4-8 is designed to increase awareness about the strategic value of workplace learning and provide an opportunity for both campus leaders and staff to recognize the importance of employee learning and development, and to close the gap between worker’s skills, job requirements and professional growth. For more information visit [www.training.gatech.edu](http://www.training.gatech.edu).

### Singapore university forms academic partnership with Tech

Singapore’s Nanyang Technological University (NTU) and Georgia Tech are collaborating on two integrated programs where a student can earn both a bachelor’s degree from NTU and a master’s degree from Georgia Tech.

Students will be able to pursue degrees in either computer science or electrical and computer engineering, spending the first three years at NTU and the next 12 to 18 months at Georgia Tech. The program aims to encourage top students to pursue a career in information technology, and support Singapore’s strategy to build a pool of professionals in leadership positions.

Selected students will be supported by Infocomm Development Authority of Singapore (IDA) National Infocomm Scholarships. IDA will provide up to 100 scholarships over five years.

The first group of students are expected to begin next fall.

### Holiday book drive

The Staff Activities Committee at the Library and Information Center is once again sponsoring a holiday educational book drive to benefit local organizations. Donations of new or gently used children’s books pre-K through 12<sup>th</sup> grade (including audio and video) will be accepted through Dec. 18. Past generosity has been greatly appreciated providing much needed educational and informational materials. Decorative boxes will be located in the Library’s rotunda. For more information call 894-7600.

### Volunteers needed for LEGO challenge

Student, faculty, staff and alumni volunteers are needed to assist at the State of Georgia FIRST LEGO League Challenge, to be held on Saturday, Jan. 20, from 7 a.m. - 5 p.m. at the Georgia Tech Student Center. The School of Electrical and Computer Engineering and the Center for Education Integrating Science, Mathematics and Computing are co-hosting this event.

FIRST (For Inspiration and Recognition of Science and Technology) is an organization that was founded to inspire interest in science and engineering among young people. Through hands-on experience and working in teams, children have a chance to explore real world issues through research and robotic programming.

During last year’s Challenge, 70 teams — including more than 500 elementary and middle school students — participated in qualifier tournaments held prior to the final competition. This year, 135 teams are competing in qualifiers; organizers expect 48 teams to advance to the Jan. 20 event.

For more information, contact Associate Professor Jeff Davis at 894-4770 or [jeff.davis@ece.gatech.edu](mailto:jeff.davis@ece.gatech.edu).