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Critical to
Understanding
Cancer



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Tax Dollars



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Than Going
'Green'



Focusing on the discoveries and innovations faculty and students are making at Florida Institute of Technology

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DISCOVERY: *Florida Tech*

▶▶ Lightning-produced Radiation a Potential Health Concern for Air Travelers

Scientists estimate high-dose events, but are likely rare

New information about lightning-emitted X-rays, gamma rays and high-energy electrons during thunderstorms is prompting scientists to raise concerns about the potential for commercial airline passengers and crews to be exposed to harmful levels of radiation.

Scientists at Florida Tech, University of California–Santa Cruz and the University of Florida conclude that airplane passengers could be exposed to a radiation dose equal to that from 400 chest X-rays if their airplane happens to be near the start of a lightning discharge or related phenomena known as a terrestrial gamma-ray flash (TGF).

The big unknown: How often—if ever—commercial airliners are exposed to these apparently rare thunderstorm events, since the bursts of radiation occur only over extremely brief periods and extend just a few hundred feet in the clouds.

"We know that commercial airplanes are typically struck by lightning once or twice a year," said **Joe Dwyer**, professor of physics and space sciences at Florida Tech. "What we don't know is how often planes happen to be in just the right place to receive a high radiation dose. We believe it is very rare, but more research is needed to answer the question definitively."

Dwyer is the lead author of a paper about the research appearing in the *Journal for Geophysical Research—Atmospheres*. Seven researchers from Florida Tech, UC–Santa Cruz and UF contributed to the paper, "Estimation of

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▶▶ Florida Tech Research Park Expands Horizons

The nation's collegiate research park infrastructure has a new innovator.

Through the creation of the Florida Tech Research Park at the Melbourne International Airport, Florida Tech and the Melbourne Airport Authority have joined in a 20-year partnership to encourage inquiry.

"This relationship is a logical next step for the university," said President **Anthony J. Catanese**. "Florida Tech has world-class professors leading important research in a range of areas, from aerospace to biological sciences to engineering and beyond. Collaborating with Melbourne International Airport to utilize its physical resources for the Florida Tech Research Park is a win-win scenario."

Approximately 100 acres of prime land is designated for the park, which will lie within the Airport Industrial Park. The airport has approximately 500 acres of available land that can be developed and added to the research park, about 30 acres of which are contiguous.

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the fluence of high-energy electron bursts produced by thunderclouds and the resulting radiation doses received in aircraft." It is free and downloadable online from the journal's "papers in press" page at www.agu.org/contents/journals/ViewPapersInPress.do?journalCode=JD.

The authors did not measure any high-radiation doses directly with airplanes. Instead, they estimated it based on satellite observations and computer models.

"We combined observations of lightning-produced X-rays and gamma rays with computer models of the movement of high energy particles to estimate the amount of radiation that could be produced within or very near thunderclouds during lightning storms," said **Hamid Rassoul**, a co-author and senior researcher at Florida Tech.

The observations included those made from orbiting satellites of terrestrial gamma-ray flashes (mysterious phenomena that appear to originate within thunderstorms at the same altitudes used by jet airliners). They also included measurements of X-rays and gamma rays from natural lightning on the ground, as well as artificial lightning triggered with wire-trailing rockets fired into storm clouds. Researchers believe the phenomena are linked, since both produce high levels of gamma rays and X-rays and occur along with the actual lightning flash.

The scientists concluded the radiation in a football-field-sized space around these lightning events could reach "biologically significant levels," according to their paper.

"If an aircraft happened to be in or near the high-field region when either a lightning discharge or a TGF event is occurring, then the radiation dose received by passengers and crew members inside the aircraft could potentially approach 10 rem in less than one millisecond," the paper says.

Ten rem is considered the maximum safe radiation exposure over a person's lifetime. It is equal to 400 chest X-rays, three CAT scans or 7,500 hours of flight time during normal conditions, the paper says. All airplane passengers are exposed to slightly elevated radiation levels due to cosmic rays.

While the research raises obvious concerns, the scientists stressed that they don't know how often the high-radiation events occur or how often planes are nearby enough to expose passengers and flight crews to potential danger.

David Smith, an associate professor of physics at UC-Santa Cruz, said recent airborne research suggests the events are rare. Flying aboard a National Science

Foundation/National Center for Atmospheric Research aircraft this past summer in Florida, Smith and several of the other researchers used a highly sophisticated instrument to measure gamma-ray flashes from thunderstorms. Over the course of several flights, he was only able to detect one such flash at a safe distance from the plane.

"These observations show that although thunderstorms do occasionally create intense gamma-ray flashes, the chance of accidentally being directly hit by one is small," Smith said.

Martin Uman, another author and a distinguished professor of electrical and computer engineering at UF, noted that airline pilots typically seek to avoid flying through storms.

However, he said, the fact that commercial planes are struck once or twice a year suggests more inquiry is needed. He said he would recommend to the Federal Aviation Administration that it place detectors aboard planes capable of measuring the storm-related brief and intense radiation bursts to determine how often they occur. He also said more research on the phenomena that generates the bursts is clearly needed.

"What we need to do is supply the right kind of detectors to a lot of planes, and see if this ever happens," he said. "We also need to spend more time looking at gamma and X-ray radiation from lightning and thunderstorms and trying to understand how it works."

The paper drew on data from numerous observations and experiments, including experiments involving artificial "triggered" lightning at the UF/Florida Tech International Center for Lightning Research and Testing at the Camp Blanding Army National Guard Base near Starke, Fla. University of Florida and Florida Tech researchers at the center were the first to identify X-ray emissions from triggered lightning.

Karen Rhine

DISCOVERY: *Florida Tech*

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▶▶ Cell Growth Studies Critical to Understanding Cancer

NIH Grant Renewed for Four More Years

The new year began on a high note for **Alan Leonard** and **Julia Grimmade**, professors of biological sciences at Florida Tech, when they learned their National Institutes of Health grant, which they have held for the last 11 years, had been renewed for four more years. The competitive renewal brings them \$1,024,944 to continue their research into the regulation of cell growth and division.

The reproduction of cells from all types of organisms, from bacteria to humans, is tightly regulated to ensure that cells grow and divide only when it is appropriate for them to do so. When the regulation fails, diseases such as cancer can arise.

"We study how cellular proteins and DNA join together to form a very small molecular machine that acts as an 'on' switch, telling cells that it is time to begin a new replication cycle," said Leonard. "Because bacteria have far fewer protein and DNA components acting as cell growth regulators than mammalian cells do, we use the rapidly growing human gut bacterium, *Escherichia coli*, as a model system. However, the studies should shed light on cell growth regulation in all organisms."

The researchers hope to use the information they collect about how the switch is assembled to develop inhibitors that would prevent the cellular components from coming together. Such inhibitors could be the precursors to novel antibiotics that would fight bacterial diseases that are resistant to existing therapies, or could even be used to discover new drugs to treat cancer.

The funding will create several new jobs for technical support personnel, as well as provide support for doctoral students who are completing their training in the lab.



Student researcher Jeffrey Kwesiga examines a sample of E. coli under the watchful eyes of Alan Leonard and Julia Grimmade.

Photos Courtesy Michael R. Brown, Florida Today



Student researcher Mikaela McKenny lowers a container of E. coli.

▶▶ Searching for Sustainability: Much More than 'Going Green'

"Sustainability," like "green," is a buzzword for something we understand as healthy and good. Unlike "green," however, sustainability has a clear meaning.

As defined at a 1987 United Nations conference, sustainability is "Meeting present needs without compromising the ability of future generations to meet their needs."

This ambitious and critical goal is an enormous global challenge. Survival of the planet as we know it is at stake.

To share knowledge and demonstrate what's happening in this area, Florida Tech's College of Science and Nathan M. Bisk College of Business have hosted or co-hosted six international sustainability forums. The university's partner is Budapest University of Technology & Economics. The next conference is set for June in Berlin.

Sustainability 2009: The Next Horizon was a showcase of the university's involvement as a global player in sustainability. Its focus was on practical solutions to emerging sustainability issues from business, science and socio-political viewpoints. "It was designed to appeal to a varied audience and to offer the latest academic research and perspectives for practitioners and policymakers," said **Gordon Nelson**, dean of the Florida Tech College of

Science. Nelson is the university's leader in the collaboration with the Budapest university.

With 175 registered for the lectures, it was standing room-only for some forum

sessions. Participants filled the Hartley Room to hear keynote presenter **Michael Sole '86**, secretary of the Florida Department of Environmental Protection. He spoke on "climate change, the most significant challenge of our lifetime," and related it to what's happening in Florida.

Sole discussed the Sunshine State's sustainability issues and how the state government has risen to meet the challenges. He has been involved in efforts to, among other things, increase energy efficiency in buildings, reduce greenhouse gas emissions from motor vehicles and increase the production and availability of renewable transportation fuels.

"Both our economy and our way of life depend on our ability to preserve and maintain a healthy and sustainable marine and terrestrial ecosystem for Florida's future generations," he said.

Speakers came from all over the United States as well as Hungary, Germany, China—the largest producer of greenhouse gases—and Mexico.

A researcher at Mexico's National University, Medardo Tapia Uribe, spoke frankly on sustainability in Mexico. His country's economic growth rate is among the world's lowest.

"The economy is always a factor in the ability to attain sustainability. Where resources are few and people are poor, it's difficult to make the necessary investments. The need for sustainability is real; the question is can or will people pay for it?" asked Nelson.

More than a dozen Florida Tech researchers presented their sustainability research. They have published their work on such issues as abrupt climate change and history, climate change and coral reefs,



Michael Sole '86, secretary of the Florida Department of Environmental Protection



Juice Your Ride—Frank Leslie and Gordon Nelson inspect an electric car.

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▶▶ ABTA Tracks Tax Dollars, Eyes Accountability

How can citizens know that their taxes are used wisely for what is intended?

The Nathan M. Bisk College of Business is addressing this issue and breaking new ground in strengthening spending oversight. With the help of a 2008–2009 \$752,000 grant from the Florida Department of Education, the college developed a system to make government more accountable.

The college invested the funding to create the Activity Based Total Accountability (ABTA) Institute for government oversight. The institute collected and analyzed data to produce consistent reports on how each of the 50 states spends valuable tax dollars in a variety of areas.

Led by **Deborah Sater Carstens**, associate professor in management information systems, the prototype system was up and running after just six months in development. This could be a major step toward transparency in government spending.

"Accountability in government is achieved only when total costs are considered in light of all activities performed by agencies. To successfully track total costs requires a standard system of measurement," Carstens said.

The originator of activity based total accountability is Florida Congressman William J. Posey. When he was a Florida state senator, serving on the Joint Government Appropriations Committee, he led the charge to find waste and cut the fat in government spending. He campaigned to promote simplified accountability measures and cost/performance comparisons for effective decision making by government leaders. In fact, he literally wrote the book on ABTA.

Speaking about Florida Tech's ABTA Institute, he said, "At long last, citizens will be able to find comparable data all in one place to see how efficiently their money is being spent. And in these uncertain economic times, state governments will be able to accurately compare their priorities against not just budgetary spending but on how efficiently those monies are spent."

The institute focused on five major efforts: first was a best practices data repository for identifying strengths and weaknesses of existing programs; second was Web resources and services, which offer links to government performance data, agency Web sites, benchmarking sources, white papers, shared data sources, and measurement and learning tools; third was training and seminars; fourth was a national

database of open standards and metrics for government and public use; and fifth was the 2009 ABTA National Conference on Innovations in Government Accountability and Performance, which took place on May 18.

The ABTA Institute has collected data for the 50 states from government agencies focused on health, corrections, public protection, welfare, education and transportation. The system has been converted to public-access ABTA tables, which present the costs for spending activities in each agency. The tables are accessible on the ABTA Institute Web site at <http://abta.fit.edu/about>.

"We are continuing our benchmarking effort to close the gap between costs and outcome and to provide rankings for all 50 states in our target areas," said Carstens.

Working with her was Bisk College of Business faculty **Annie Becker, LuAnn Bean, Mardi Sale, Roger Manley** and information technology manager **John Clarke '05, '08 M.A.** There are two additional staff members, a graduate student and six undergraduates that assist with data collection and analysis.

Fulfilling a funding commitment, the ABTA Institute presented the 2009 National Conference on Innovations in Government Accountability and Performance last May. The conference not only drew professionals and researchers in local, state and federal government, industry, nonprofit organizations and academia, but scored a major success in confirming the keynote speaker.

The institute presented the top United States official on government accountability, Earl Devaney. Appointed by Vice President Biden, Devaney is chair of the Recovery Accountability and Transparency Board. His job is to ensure that the money spent under the Recovery Act is maximized with transparency and accountability to the taxpayer. The ABTA Institute is seeking additional funds to continue their efforts.

For more information, visit <http://abta.fit.edu>.



Deborah Carstens works with her students to review project data.

Karen Rhine



or other related, sustainable energy systems.

"We believe that the Florida Tech Research Park will be very attractive to both start-up businesses as well as more established enterprises," said **Cliff Bragdon**, vice president for strategic initiatives.

Bragdon said the park will provide a wealth of research, educational, professional development, intellectual property and consulting opportunities through Florida Tech.

Research parks are well-established economic engines worldwide. A 2007 study by the Battelle Memorial Institute and the Association of University Research Parks found that 2.57 jobs are created in the general economy for every job created within a research park.

For more information on the Florida Tech Research Park, visit www.fit.edu/researchpark.

Wes Summer

Continued from front page

"We couldn't ask for a better partner to establish this new research park," said Airport Executive Director Richard Ennis, CPF0. "The impressive work already being done at Florida Tech, combined with the number of high-tech and defense-related airport tenants, create the ideal atmosphere for innovation and development."

Florida Tech's Emil Buehler Center for Aviation Training and Research and its Applied Research Laboratory will be important components of the park, which will include a 25-acre joint-use research compound for applications such as solar collection,

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predicting climate in Florida, sustainable tourism, economic drivers of sustainability, opportunities in reclaimed asphalt pavement, and the legal and policy developments of the United Nations on climate change.

From the conference came three keys to sustainability. "The first is that everyone must have clean water. There can't be good health without it, and we have to figure out how to make that happen," said Nelson. "Second, sustainability is a global issue because everyone on the planet is affected by the decisions of individual countries. Third, sustainability involves new technology. We need to use it correctly and cost-effectively."

Nelson summed up a major learning from the forum as "you can have the best environmental

science, but it's of no use unless you have the proper economic and political climate."

This year's forum in Berlin will focus on the impact of culture on sustainability. The Institute for Technology Assessment in Karlsruhe, Germany, will host the event.

"This forum will involve cultural personalities," said Nelson. "What we value as a country, in our culture, is what we want to protect."

Karen Rhine

►► **Durrance Joins Suborbital Researchers Group**

Professor of Physics and Space Sciences **Sam Durrance** has been tapped to join the Commercial Spaceflight Federation’s Suborbital Applications Researchers Group (SARG).

“We are very happy to have Sam aboard SARG to contribute his expertise as a two-time NASA payload specialist on the space shuttle,” said S. Alan Stern, chairman of SARG, a space scientist and previous head of the Science Mission Directorate at NASA headquarters.



Sam Durrance

With Durrance, SARG consists of 11 researchers and educators whose aim is to increase awareness of commercial suborbital spacecraft in the science and R&D communities, work with policymakers to ensure that payloads can easily access these vehicles and further develop ideas for the uses of vehicles currently under development by commercial enterprises.

Before becoming a Florida Tech professor in 2004, Durrance was executive director of the Florida Space Research Institute and director of the Florida Space Grant Consortium.

His career as an astronaut payload specialist, from 1984 to 1996, was preceded by work as a research scientist at Johns Hopkins University, which he continued through 1996. He earned a doctoral degree from the University of Colorado in astro-geophysics.

►► **National Fatigue Survey Chronicles Illness**

The Fatigue Management Institute of Florida Tech is finalizing the National Chronic Fatigue Survey, an Internet-based survey of fatigue related to chronic illness. The survey is designed to gather information on the nature and impact of fatigue associated with chronic medical disorders.

The institute will use survey findings to better describe the experience and severity of fatigue related to chronic medical conditions. This effort is expected to contribute to the development of improved techniques for managing fatigue. The survey is open to adults with a chronic medical condition and can be completed anonymously. It may be accessed at <http://research.fit.edu/fmi>.

The Fatigue Management Institute serves as a focal point for integrating emerging research

findings on illness-related fatigue with techniques for day-to-day management of fatigue. The institute conducts research on fatigue and fatigue management interventions, provides fatigue management training, and disseminates summaries of research findings related to fatigue and its management in chronic medical conditions. The initial report from the National Fatigue Survey will be posted on the institute’s Web site in Spring 2010.



Thom Harrell

For further information, contact Professor **Thom Harrell**, Florida Tech School of Psychology, at tharrell@fit.edu.

►► **Reichard Lauded for Lunar Rover Research**

Ronnal Reichard, Doherty Visiting Professor in the department of marine and environmental systems, knows something about the environment of our moon as well as the Earth. His work on the lunar rover, developing a lightweight composite blade to convert it to a bulldozer and road grader, won him a NASA Group Achievement Award. He earned the award for his development and testing work as a member of the Human Robotics Systems Moses Lake, Wash., Field Test Team in 2009.



Ronnal Reichard

When NASA returns to the moon, the need to build a lunar base is expected. This includes building roads to access various sites of interest. The converted lunar rover, called the Chariot, was tested by Reichard and his team in the basalt desert of Moses Lake, a terrain similar to that on the moon.

“NASA selected this area to test the ability of the rover and the durability of the lightweight composite blade to create and maintain roads,” said Reichard.

“The tests were completed on time, within budget and were 100 percent successful. Apparently, this is not common.”

Reichard, who holds the department’s visiting professor post for this academic year, is also chief executive officer and chief engineer of Structural Composites, Inc., and COMPSYS, Inc. His specialty field is composite materials and structures.

DMES offers undergraduate and graduate degrees in earth remote sensing, environmental science, including environmental resource management, meteorology, ocean engineering, oceanography and coastal zone management.

►► Florida Tech Focus: Joshua Rokach Professor of Medicinal Chemistry

Since **Joshua Rokach** arrived as a professor focusing on research at Florida Tech in 1989, he and many graduate students have quietly worked toward increasing the understanding of chronic inflammatory diseases. A giant among the university's grant-getters, Rokach has earned more than \$6.38 million in funding for his university projects.



Joshua Rokach

His grants have come primarily from the National Institutes of Health (NIH) and what was the Monsanto Co. He continues work today under his most recent grant, \$1.25 million from the NIH.

Rokach's goal is to stop chronic inflammatory diseases before they start. His research focuses on the enzymatic reaction of 5-hydroxyeicosanoid dehydrogenase in certain types of white blood cells, or leukocytes, which contributes to such diseases as asthma, inflammatory bowel disease and psoriasis. Some of his research is done in collaboration with Professor William S. Powell, Meakins-Christie Laboratories, and the McGill University department of medicine in Montreal, Canada.

This work centers on the design and synthesis of radio- and photo-affinity ligand molecules (substances that bind to and form a complex with a

biomolecule) that can bind to the enzyme catalytic cavity. Such molecules, when irradiated with ultraviolet light, become permanently bound to the disease-causing enzyme but not to other proteins. When the enzyme is radioactively labeled, it is possible to isolate and determine its structure.

Rokach has received worldwide recognition for the first syntheses of major inflammatory mediators such as leukotrienes and lipoxins, which are responsible for allergies affecting the lungs and nose. The availability of these synthetic mediators has opened the field to medical research in the areas of allergy and inflammation.

His collaborative effort with University of Pennsylvania Medical Center researchers led to the 1998 development of an innovative measurement technique, which caused a breakthrough in Alzheimer's disease research. He continues to collaborate with that institution.

Among his notable previous accomplishments was the development of Singulair while working at Merck & Co. Inc. Rokach and his team of almost 200 scientists were responsible for the allergy-fighting drug, a leukotriene-D4 antagonist. It is used by millions of sufferers to relieve asthma and rhinitis symptoms.

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