



DAVID P. NORTON became vice president for research at the University of Florida in January 2012 after serving as associate dean for research in the UF College of Engineering since 2009. He is also a professor in the Department of Materials Science and Engineering.

Norton came to UF in 2000 after 11 years at Oak Ridge National Laboratory.

His research interests primarily focus on electronic, photonic and magnetic thin-film materials.

He conducted his undergraduate and graduate studies within the Department of Electrical and Computer Engineering at Louisiana State University, receiving his doctorate in 1989.

It is my distinct privilege to serve as vice president for research at the University of Florida. Building upon the achievements of my predecessor, Dr. Winfred Phillips, the UF Office of Research strives to enhance the success of researchers across the campus as they seek to explore unanswered questions, create new ideas, formulate new inventions and translate discoveries into new technologies.

The University of Florida continues to be a major player among research universities. In a recent survey conducted by the National Science Foundation, UF ranked 14th among public universities in the United States in total research expenditures. Despite the difficult economic climate, UF faculty secured more than \$619 million for research last year, the majority coming from federal agencies through competitive peer-reviewed processes. The talents and efforts of the faculty make it possible for UF to compete at the highest level.

Research at the University of Florida is advancing our fundamental understanding of the world in which we live, generating creative breakthroughs that lead to technologies with positive benefit, positively impacting the education of our students and creating opportunities for economic growth in Florida.

Our prowess as a research university is playing a significant role in attracting innovative companies to the Gainesville area. The recent announcement that the India-based software company MindTree Limited has chosen Gainesville for its U.S. development center with plans to create at least 400 jobs bears this out. Companies looking to be at the leading edge of ideas and innovation, whether an up-and-coming start-up or an established firm competing in a highly competitive and dynamic market, are attracted to UF in order to tap into our pipeline of ideas and creative people.

The recently opened Innovation Hub and associated efforts within the surrounding Innovation Square continue to be major catalysts for entrepreneurial pursuits that will reap significant benefits to the university, the city and the state. Activities in commercialization and technology transfer provide tangible benefits to society and the economy.

Interdisciplinary and cross-disciplinary efforts will remain key elements in competing at the forefront of most research fields. The Office of Research facilitates efforts by UF researchers to seek collaborations outside their own discipline to improve the effectiveness and impact of their own research and enhance competitiveness in securing funding. This requires cooperation and communication across boundaries that define traditional disciplines.

A large university such as UF, with 16 colleges on the same campus, provides for a significant advantage in facilitating interdisciplinary research as complementary expertise likely exists on this campus. We will continue to make investments into research infrastructure in order to maintain our competitive edge. The UF Research and Academic Center at Lake Nona and the Clinical and Translational Research Building, projects currently under construction, are just the latest examples of the type of interdisciplinary facilities needed to compete in research in the 21st century.

Moving forward, the importance of a highly skilled and educated workforce along with the research institutions that produce them has become evident and recognized. The University of Florida is uniquely poised to address this need to the benefit of the state and nation.

My previous experience as associate dean for research in the College of Engineering served me well in preparing for the position of vice president for research. Engineering is by its very nature highly interdisciplinary. Engineers don't typically care what sector a solution comes from, only that it works, and works well. I was fortunate to work with a collection of highly talented and motivated people whose interests range from developing unmanned vehicles to curing disease with engineered nanoparticles. This introduced me to many parts of campus well outside of engineering. Working to enhance the success of researchers in engineering was awesome, doing the same for the entire campus even more so.

PARKINSON'S TREATMENT SHOWS POSITIVE RESULTS IN CLINICAL TESTING

RESEARCHERS FROM THE UNIVERSITY OF FLORIDA AND 14 ADDITIONAL MEDICAL CENTERS REPORT THAT DEEP BRAIN STIMULATION (DBS) IS EFFECTIVE AT IMPROVING MOTOR SYMPTOMS AND QUALITY OF LIFE IN PATIENTS WITH ADVANCED PARKINSON'S DISEASE.

The study, sponsored by St. Jude Medical, Inc., tested the safety and effectiveness of a constant current DBS device developed by St. Jude Medical to manage the symptoms of Parkinson's disease. The device aimed to reduce tremors, improve the slowness of movement, decrease the motor disability of the disease and reduce involuntary movements called dyskinesia, which are a common side effect of Parkinson's drugs.

After treatment, analysis of 136 patient diaries revealed longer periods of effective symptom control — known as “on time” — without involuntary movements.

“On time” for patients who received stimulation increased by an average of 4.27 hours compared with an increase of 1.77 hours in the group without stimulation. Patients also noted overall improvements in the quality of their daily activities, mobility, emotional state, social support and physical comfort.

“This study validates the use of mild electrical currents delivered to specific brain structures in order to improve Parkinson's disease in select patients with advanced symptoms,” said Dr. Michael S. Okun, first author of the study, administrative director of the UF College of Medicine's Center for Movement Disorders and Neurorestoration, and the National Medical Director for the National

Parkinson Foundation. Only patients who have had Parkinson's disease for five years or more were included in the study. They were randomly assigned to a control group that delayed the onset of stimulation for three months, or a group whose stimulation began shortly after surgery. All patients were followed for 12 months.

The deep brain stimulation procedure involves surgeons implanting small electrodes into an area of the patient's brain that controls movement. The electrodes are connected to a device precisely programmed to use mild electrical current to modulate problematic brain signals that result in movement problems.

Today's voltage-controlled DBS devices deliver pulses of current that vary slightly with surrounding tissue changes. The DBS devices tested in this study are intended to provide more accurate delivery and control of the electrical pulses.

“We are committed to driving research that will provide solutions for physicians and their patients whose needs are currently unmet,” said Rohan Hoare, president of St. Jude Medical Neuromodulation Division. “These results are significant as they offer evidence that stimulation with the Libra constant current system enabled patients to have better motor control and an improvement in their quality



of life when compared to the control group.”

The U.S. Food and Drug Administration approved the use of DBS for Parkinson's disease in 2002. At least 500,000 people in the United States suffer from Parkinson's, with about 50,000 new cases reported annually, according to the National Institute of Neurological Disorders and Stroke. These numbers are expected to increase as the average age of the population rises.

“The study answered some very important questions concerning cognition and mood with lead implantation (alone) versus implantation with stimulation. It also refutes the hypothesis that DBS increases depressive symptoms,” said Dr. Gordon H. Baltuch, a professor of neurosurgery in the Perelman School of Medicine at the University of Pennsylvania and a study author.

Comparable with other large DBS studies, the most common serious adverse event

revealed was infection, which occurred in five patients.

Likewise, some participants also reported an increase in the occurrence of slurred speech, known as dysarthria.

“Technology is on the move, and we expect to see continued improvements to DBS approaches, equipment and materials,” said Okun, who is also affiliated with UF's McKnight Brain Institute.

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Scan the QR code with your smartphone to see video about this research.

UF ASTRONOMER PLAYS A ROLE IN KEPLER'S BIG FIND

USING DATA FROM NASA'S KEPLER MISSION, A TEAM INCLUDING A UNIVERSITY OF FLORIDA ASTRONOMER HAS DISCOVERED TWO NEW PLANETS ORBITING DISTANT DOUBLE-STAR SYSTEMS.

The team announced their discovery of the newly confirmed planets, Kepler-34b and Kepler-35b, at the 219th meeting of the American Astronomical Society and in the online edition of the journal *Nature*.

The two planets orbit a binary star — a pair of gravitationally bound stars that orbit each other. Theorists have long predicted the existence of such circumbinary planets, but none have been observed until the discovery of Kepler 16-b.

The new discoveries confirm that circumbinary planets are fairly common in our galaxy.

"We have long believed these kinds of planets to be

possible, but they have been very difficult to detect for various technical reasons," said Eric Ford, UF associate professor of astronomy.

Both planets are low-density gas giants, comparable in size to Jupiter, but with much less mass. Kepler-34 can complete a full orbit in 288 terrestrial days.

Kepler-35 completes its orbit around the stars much faster — just 131 days.

The astronomers believe the planets are made primarily of hydrogen and are too hot to sustain life.

"Circumbinary planets can have much more complex climates, since the distance between the planet and each star changes significantly

during each orbital period, the length of an alien planet's year," Ford said. "For Kepler-35b, the amount of incoming starlight changes by over 50 percent within a single Earth-year. For Kepler-34b, each Earth-year brings 'summers' with 2.3 times as much starlight as winters."

Compare that to Earth, where the amount of sunlight heating the Earth over the course of a year varies by only 6 percent, he said.

NASA's Kepler mission, which began in March 2009, uses a 1-meter space telescope trained on one small portion of the Milky Way for several years. Astronomers analyze data from the telescope for periodic dimming that indicates a planet crossing in front of its host star. The mission's goal is to find the frequency of Earth-size planets in the habitable zone of their

host stars — where a planet might have liquid water on its surface.

Most Sun-like stars in the galaxy are not alone, like the Earth's sun, but have a "dance partner," forming a binary system or binary star. Kepler has already identified about 2,165 eclipsing binaries, of the more than 160,000 stars being observed.

NASA originally planned to stop receiving data from the Kepler spacecraft in November 2012, but astronomers are practically begging NASA to extend the mission, Ford said.

"Kepler is revolutionizing so many fields, not just planetary science," he said. "It would be a shame not to maximize the scientific return of this great observatory.

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UF ENGINEERS USE MICROSURGERY TO STUDY THE MECHANICS OF A CELL

A TEAM OF RESEARCHERS IN UF'S CHEMICAL ENGINEERING DEPARTMENT HAVE TAKEN A NOVEL APPROACH TO EXPLORING THE INNER MECHANICS OF A LIVING ANIMAL CELL.

Using laser scissors to make a precise microscopic cut, Jun Wu, a doctoral student in chemical engineering, carefully sliced one of the stiff spindly spokes that grow out from a cell's architectural hub, the centrosome, to find out how a cell finds its center.

"There are really two schools of thought about how microtubules work together to move the centrosome to the center of the cell," explained Richard Dickinson, professor and chair of UF's chemical

engineering department, who is the senior author on the research paper. "One view is that the spokes, or microtubules, push the centrosome toward the center as they grow out from the hub and push against the cell's outer membrane. The other view is that the microtubules pull the centrosome into place using tiny molecular motors arranged in a series along the microtubules' length.

"When cut, one of the ends would always bend further

rather than snapping straight," said co-author Tanmay Lele, assistant professor of chemical engineering.

And that told the team they were onto something.

The reaction implied that the microtubules were under tension, a bit like a stretched rubber band, and that they were pulling rather than pushing the centrosome.

"It tells us something important about how cells locate their center," said Dickinson. "Like a game of tug-of-war, with the microtubules acting as the ropes, the motors pull on the microtubules extending from both sides of the centrosome."

When the centrosome is off-center, the longer microtubules on the side farthest from the cell edge pull harder and thereby always bring the centrosome back toward the center. And that can be important for understanding how cells replicate and carry out other biologically vital missions.

The full report on the team's study was published in the online edition of the journal *Molecular Biology of the Cell*.

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Scan the QR code with your smartphone to see video about the Kepler research.

College of Public Health and Health Professions

EDUCATION HELPS SOLDIERS BATTLE BACK PAIN

A PROGRAM OF CORE-STRENGTHENING EXERCISES WAS NO BETTER THAN TRADITIONAL SIT-UPS FOR PREVENTING BACK PAIN IN SOLDIERS, ACCORDING TO A NEW UNIVERSITY OF FLORIDA STUDY. BUT COMBINING EXERCISE PROGRAMS WITH A BRIEF EDUCATIONAL SESSION ON BACK PAIN MANAGEMENT DID LOWER THE INCIDENCE OF TREATMENT FOR BACK PAIN.

“It was our hypothesis that the core stabilization exercises would have some protective effect for back pain and maybe the combination of the core stabilization exercises and the education program would be the most effective, but as it turns out, adding the education to either of the exercise programs was the only place where we saw the benefit,” said lead investigator Steven George, an associate professor in the UF College of Public Health and Health Professions’ Department of

Physical Therapy.

Low back pain is among the most frequent causes of medical visits and lost-duty time in the Military Health System, said co-investigator Lt. Col. John Childs, director of musculoskeletal research at Keesler Air Force Base.

Core exercises target several muscle groups that support the spine, including abdominal muscles, back muscles, side muscles and muscles that attach to the pelvis. The military typically uses traditional lumbar

training, which exercises only the abdominal muscles through sit-ups and crunches, George said.

“Core stabilization exercises are considered to be a more balanced approach to lumbar training so that’s why we and others have thought that core exercises would be better at preventing back pain and that may be, but it just wasn’t the case in this study,” George said.

The Prevention of Low Back Pain in the Military, or POLM, study involved 4,325 U.S. Army soldiers stationed at Fort Sam Houston in Texas who were completing a program for combat medic training. Participants were randomized by company into one of four treatment groups of exercises alone, or exercises paired with educational sessions.

The exercise programs were completed as a group under the supervision of a drill instructor once a day, five days a week for 12 weeks. The education program consisted of one 45-minute group session led by study personnel that provided information on low back pain and strategies for recovering from mild back injury.

“Part of the education is just to get people to understand the difference between when pain indicates true injury, which is usually only in the very early stages, and when pain is just a lingering signal, but you can still be active,” George said. “We need to get people moving even when they’re in pain because if we wait until they’re pain-free they can become out of shape.”

The researchers tracked participants’ incidence of low back pain for two years following the intervention using a military health care utilization database. There was no difference in health care visits for back pain in the treatment groups who received exercises only, but among the groups who also received the education program, there was a 3-percent decrease in seeking health care for low back pain.

The decrease may seem small, researchers say, but because back pain is such a common health issue in the military, even a small decrease could lessen the burden on the health care system.

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Polyps growing in a UF laboratory.

Institute of Food and Agricultural Sciences

BENEFICIAL BACTERIA HELP KEEP FLORIDA CORAL HEALTHY

RESEARCHERS AT THE UNIVERSITY OF FLORIDA AND MOTE MARINE LABORATORY HAVE IDENTIFIED BACTERIA THAT COULD POTENTIALLY HELP CORALS RESIST THE DEVASTATING DISEASE WHITE POX.

The findings could help maintain the health of Florida's coral reefs, which bring in billions of dollars to the state annually and are important for tourism, fisheries, shoreline protection and pharmaceutical research.

"Coral reefs are a major attraction for tourists in Florida," said Max Teplitski, a microbiologist and an associate professor at UF's Institute of Food and Agricultural Sciences.

Unfortunately, in the past 20 years, they have been degrading due to global environmental changes and direct human impacts, like overfishing. Disease wipes out stressed corals in South Florida too, he said.

White pox is caused by *Serratia marcescens*, a bacterium commonly found in animal feces that is harmful to a variety of animals and plants.

To combat white pox, Teplitski and a team of researchers began studying the interactions between the pathogen that causes the malady and other microorganisms that live on corals.

Corals are ancient creatures that recruit microorganisms such as bacteria to protect themselves from disease. Animals known as polyps build their characteristic structure.

In the study, the researchers screened several hundred bacteria for their ability to

help ward off white pox and found four bacteria that stopped white pox disease progression under controlled laboratory conditions and, to some degree, protected the polyps from getting sick.

Based on these results, scientists may begin checking individual polyps for the presence of beneficial bacteria before introducing them into a reef system as part of coral reef restoration.

Kim Ritchie, senior scientist and manager for the marine microbiology program at Mote Marine Laboratory in Sarasota, said Florida's coral reefs are some of the sickest in the world.

"They seem to be in the worst shape," said Ritchie, a

co-author of the study. "But the more we can learn about the balance of beneficial bacteria and pathogenic bacteria, the easier it will be to help the coral reefs in the Keys become healthier."

The research was funded by sales of Protect Our Reefs specialty license plates, a statewide program administered by Mote Marine Laboratory Inc.

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Florida Museum of Natural History

HELLBENDER SALAMANDER STUDY SEEKS ANSWERS FOR GLOBAL AMPHIBIAN DECLINE

A NEW STUDY CO-AUTHORED BY UNIVERSITY OF FLORIDA RESEARCHERS ON THE ENDANGERED OZARK HELLBENDER GIANT SALAMANDER IS THE FIRST TO DETAIL ITS SKIN MICROBES, THE BACTERIA AND FUNGI THAT DEFEND AGAINST PATHOGENS.

Published in the online journal *PLoS One*, the study details changes in the salamander's declining health and habitat, and could provide a baseline for how changing ecosystems are affecting the rapid decline of amphibians worldwide.

"Scientists and biologists view amphibians as kind of a 'canary in the coal mine' and their health is often used as a barometer for overall ecosystem health, including potential problems that may affect humans," said study co-author Max Nickerson, herpetology curator at the Florida Museum of Natural History on the UF campus.

More than 2 feet long, the Ozark Hellbender is one of

the largest salamander species in the United States. Its unusual biological characteristics include the ability to regenerate injured or missing body parts.

In the new study, lead author Cheryl Nickerson, a professor at Arizona State University, along with NASA and UF scientists, cultured and identified microorganisms from abnormal and injured tissue on the salamanders searching for pathogens that may be causing the lack of regeneration and population decline.

The researchers found several potentially dangerous pathogens, including *Aeromonas hydrophila*, a bacterium scientists believe

is associated with disease and death in both amphibians and fish.

While many different pathogens were found in the injured tissue, no single organism was found to be responsible for the lack of regeneration. Researchers believe the occurrence of abnormalities and injury in the Ozark Hellbender may have many contributing factors, including disease and habitat degradation.

"If you don't understand an amphibian's skin you don't understand the amphibians," Nickerson said.

Scientists have known about the remarkable powers of salamander regeneration for more than 200 years, but beginning in the 1980s, researchers noticed a sharp decline in the Ozark Hellbender population. They also found a specific population from the North Fork

of Missouri's White River was declining dramatically and losing the ability to regenerate.

"We were finding animals with no legs that were still alive with flesh wounds or bones sticking out of limbs," Nickerson said.

"Looking at the microorganisms on their skin can help us understand why these animals aren't regenerating at the rate we're used to seeing, and may lead to conclusions about population declines," he said.

The U.S. Fish and Wildlife Service has now added the Ozark Hellbender to the federal endangered species list. Its species name is *Cryptobranchus alleganiensis bishopi*.

Stanley Trauth, curator of amphibians and reptiles in the department of biological sciences at Arkansas State University, said public awareness of the species is increasing, and Hellbenders have recently been successfully bred for the first time in captivity at the St. Louis Zoo.

Nickerson said the Ozark Hellbender's fossil record goes back 161 million years and it represents one of the most ancient lines of amphibian life.

"This is the most ancient group of salamanders that we know of," Nickerson said. "They have been through a lot and we want to find out what these changes mean."

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Logan Gerber

SATELLITE IMAGERY HELPS RESEARCHERS TRACK, POTENTIALLY CONTROL, DISEASE

USING SATELLITE IMAGES TO MEASURE NIGHT-TIME LIGHT LEVELS STREAMING FROM WEST AFRICAN CITIES COULD PROVE TO BE AN IMPORTANT NEW TOOL IN FIGHTING THE SPREAD OF MEASLES, ACCORDING TO A NEW STUDY.

Researchers say the method could be used to control other diseases such as meningitis that spread quickly through dense populations.

The research team, including a scientist from the University of Florida, analyzed nighttime satellite images of three cities in Niger taken between 2000 and 2004, and found that seasonal population surges correlated strongly with local measles epidemic outbreaks recorded for the same period. The epidemics kill thousands annually in West Africa, although the disease has been largely eradicated in the U.S. through longstanding immunization programs.

The research, published in the journal *Science*, shows that satellite images of city lights can reliably predict a likely outbreak by indicating where the highest concentrations of people are. In Niger, measles outbreaks occur when people crowd into the cities during the dry season each year to find work. Until now, there has been no way to assess how many people were moving into the cities and where the highest concentrations of people were.

"In the U.S., light levels would saturate satellite imagery to the point that it couldn't tell us much about the details of population distribution within a city," said study co-author Andrew Tatem, a UF assistant professor of geography who specializes in spatial data modeling and analysis. "But in Niger,

when people gather in numbers and turn on electric lighting or light fires at night, you can see it from outer space."

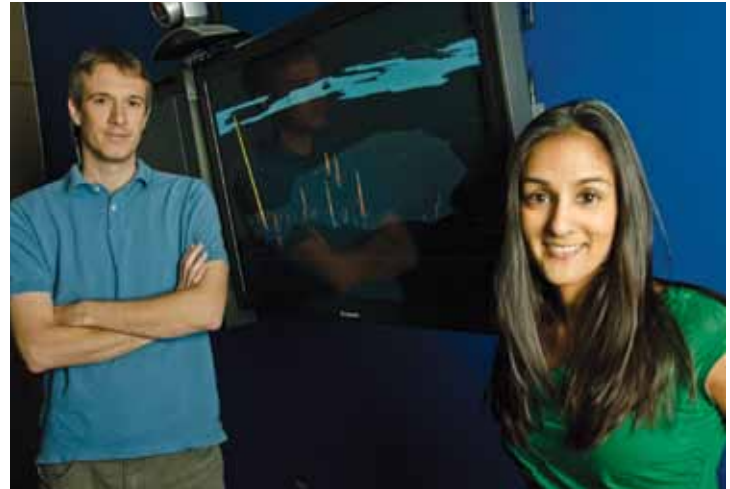
The researchers used data from the National Oceanic and Atmospheric Administration that is available to the public online, but finding enough moonless, cloud-free images of Niger's night sky was a challenge.

"The satellite data gave us an entirely different kind of information that we didn't have before," said Nita Bharti, the study's lead author and a postdoctoral researcher at Princeton University. Each of the 150 images chosen for the study was a snapshot in time. But viewed chronologically, the images showed how the concentration of people shifted from rural areas into the city.

The association between high population density and the spread of measles is well documented in pre-vaccination industrialized nations, but only suspected in Niger, where a lack of infrastructure and poorly understood migratory populations make traditional immunization programs a challenge, she said. Bharti and her team worked closely with Niger's minister of health during the study, and the measles vaccination unit leader from Epicentre, the research branch of Doctors without Borders, France.

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University of Florida researcher Andrew Tatem (left) and Nita Bharti of Princeton University pose with an image generated from light level data in their study of how measles were spread in three cities in West Africa.

GLOBAL WARMING DELAYS NATURAL PATTERNS OF GLACIATION

UNPRECEDENTED LEVELS OF GREENHOUSE GASES IN THE EARTH'S ATMOSPHERE ARE DISRUPTING NORMAL PATTERNS OF GLACIATION, ACCORDING TO A STUDY CO-AUTHORED BY A UNIVERSITY OF FLORIDA RESEARCHER.

The Earth's current warm period that began about 11,000 years ago should give way to another ice age within about 1,500 years, according to accepted astronomical models. However, current levels of carbon dioxide are trapping too much heat in the atmosphere to allow the Earth to cool as it has in its prehistoric past in response to changes in Earth's orbital pattern.

The research team, a collaboration among University College London, University of

Cambridge and UF, said their data indicate that the next ice age will likely be delayed by tens of thousands of years.

The study was published in the journal *Nature Geoscience*.

That may sound like good news, but it probably isn't, said Jim Channell, distinguished professor of geology at UF and co-author.

"Ice sheets like those in western Antarctica are already destabilized by global warming," said Channell. "When they eventually slough off and become a part



GO BIG OR STAY HOME?

UF AEROSPACE ENGINEERS BEG TO DIFFER.

Traditional satellites cost too much money and take too long to build, says Norman Fitz-Coy, director of the Advanced Space Technologies Research and Engineering Center at UF.

So much so, he says, that by the time we get them into space, they are old technology.

Fitz-Coy leads the team that has just put the finishing touches on a 4-inch cube satellite designed and built by researchers at UF's Small Satellite Design and Development Lab. It's the sort of technology that could be used in the future for everything from forestry management to national security.

But keeping a tiny little satellite "righted" as it orbits the Earth 300 miles away can be a challenge. Smaller satellites are cheaper to build and launch, but they also get knocked around in space. So UF's design team came up with an innovative system that allows Swamp-Sat to adjust its flight attitude as needed.

Systems are go for a July 2013 mission that will put the picosatellite's attitude control system through its paces.

Donna Hesterman

of the ocean's volume, it will have a dramatic effect on sea level." Ice sheets will continue to melt until the next phase of cooling begins in earnest.

The study looks at the prehistoric climate-change drivers of the past to project the onset of the next ice age. Using astronomical models that show Earth's orbital pattern with all of its fluctuations and wobbles over the last several million years, astronomers can calculate the amount of solar heat that has reached the Earth's atmosphere during past glacial and interglacial periods.

"We know from past records that Earth's orbital characteristics during our present interglacial period

are a dead ringer for orbital characteristics in an interglacial period 780,000 years ago," said Channell. The pattern suggests that our current period of warmth should be ending within about 1,500 years.

However, there is a much higher concentration of greenhouse gases trapping the sun's heat in the Earth's atmosphere now than there was in at least the last several million years, he said. So the cooling that would naturally occur due to changes in the Earth's orbital characteristics is unable to turn the temperature tide.

Over the past million years, the Earth's carbon dioxide levels, as recorded in ice core samples, have never

reached more than 280 parts per million in the atmosphere.

"We are now at 390 parts per million," Channell said. The sudden spike has occurred in the last 150 years.

For millions of years, carbon dioxide levels have ebbed and flowed between ice ages. Orbital patterns initiate periods of warming that cause ocean circulation to change. The changes cause carbon dioxide-rich water in the deep ocean to well up toward the surface where the carbon dioxide is released as a gas back into the atmosphere. The increase in atmospheric carbon dioxide then drives further warming, and eventually the orbital pattern shifts again and decreases the amount of solar heat that reaches the Earth.

"The problem is that now we have added to the total amount of CO² cycling through the system by burning fossil fuels," said Channell. "The cooling forces can't keep up."

Channell said that the study brings to the forefront the importance of atmospheric carbon dioxide because it shows the dramatic effect that it is having on a natural cycle that has controlled our Earth's climate for millions of years.

"We haven't seen this high concentration of greenhouse gases in the atmosphere for several million years," Channell said. "All bets are off."

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Institute of Food and Agricultural Sciences

BACTERIA THAT AID TOXIC CLEANUP COULD BOOST AG PRODUCTION

REMARKABLE BACTERIA THAT RESIST ARSENIC COULD IMPROVE TOXIC CLEANUPS AND BOOST AGRICULTURAL PRODUCTION, ACCORDING TO A NEW UF STUDY.

The bacteria were isolated from arsenic-contaminated soil surrounding the Chinese brake fern, a plant known for its ability to remove arsenic from the environment.

The carcinogen contaminates soils around the world and is deadly to most organisms.

Arsenic levels above state-set minimum standards were reported in residential areas in Miami and Gainesville, according to a 2003 study co-authored by Lena Ma, a UF soil and water science professor.

The findings, published in *Bioresource Technology*, could lead to improved phytoremediation — the process of using plants to remove environmental contaminants.

In the study, the bacteria broke arsenic down into a more easily absorbed form and increased the fern's arsenic uptake ability by more than 900 percent. The bacteria also caused the plant to grow bigger, with a nearly 100-percent increase in root size.

"I really didn't expect that the plant would grow better," said Ma, an author of the study. "But the arsenic-resistant bacteria increased plant biomass."

In 2001, Ma was the first to report the fern's extraordinary arsenic accumulation abilities. Wanting to further increase the plant's arsenic absorption capabilities, Ma, fellow UF Institute of Food and Agricultural Sciences member Bala Rathinasabapathi and soil and water science doctoral candidate

Piyasa Ghosh, began examining bacteria living in the soil around the plant. Ghosh is the study's lead author.

"We thought that there could be bacteria associated with the fern that could be useful in one way or another," said Rathinasabapathi, a UF horticultural sciences associate professor.

The researchers collected soil near the fern and the fern's root zone from different places in Florida contaminated with arsenic.

After the scientists isolated bacteria from the soil, they added it to the fern's growing environment in the laboratory where it broke arsenic down into a more available form readily absorbed by the fern. In addition to the increase in arsenic absorption, they also noted a gain in the uptake of the nutrient phosphorus by the fern, which led to better growth.

Rathinasabapathi said more studies are needed to explore whether the bacteria can be widely used in agriculture.

The fern is licensed to and sold by a company based in Manhattan, Kan.

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Tyler Jones

Florida Museum of Natural History

COPYCAT CATERPILLARS MIMIC CAUSTIC COUSINS TO SURVIVE

THE WORLD CAN BE A DANGEROUS PLACE FOR AN INSECT — ESPECIALLY IN THE LARVAL STAGE.

So it's a little surprising to some scientists that caterpillars don't use the same defense tactics that many butterfly species have evolved.

In particular, there are remarkably few documented cases of mimicry in caterpillar species. In mimicry rings, an edible species gains a defensive advantage by evolving to look like a noxious one. In the butterfly world, the most famous case is the viceroy's mimicry of the not-so-edible monarch.

But researchers from UF's Museum of Natural History say that mimicry may be more prevalent in caterpillar species than anyone realizes. In the *Annals of the Entomological Society of America* they

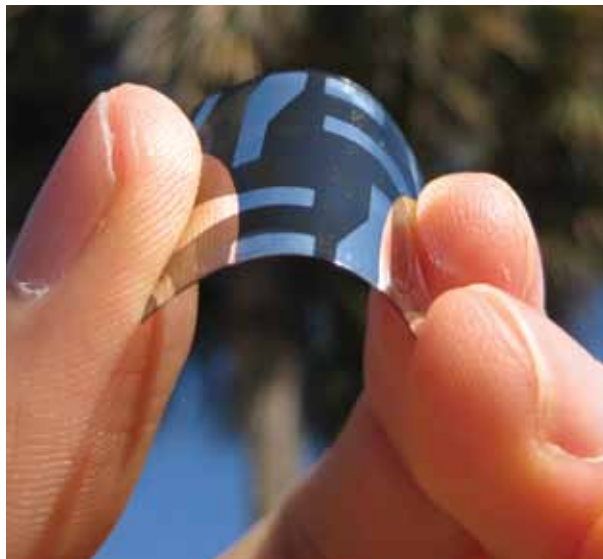
report finding two new possible examples of caterpillar mimicry rings: one on the Caribbean island of Hispaniola, and one in the upper Amazon.

The mimics are actually edible prey for birds and other predators, explains Keith Willmott, lead author for the study and associate curator at the museum. But their copycat coloration deceives predators into thinking they aren't. They get the protection without having to invest in the biologically expensive systems required to make them toxic.

Andrei Sourakov, study co-author and collection coordinator at the museum said that caterpillar mimicry



Keith Willmott and Kristen Grace



Piyasa Ghosh (far left) a doctoral student in soil and water science, inspects brake ferns and arsenic-resistant bacteria living near the roots of the fern. Researchers found the bacteria enhanced the arsenic-accumulating abilities of the fern and boosted plant growth.

These four different Neotropical caterpillar species (center) from eastern Ecuador have adapted the same warning color, a mimicry technique, to deter predators. Pictured are, from top to bottom: *Pseudoscada florula*, *Oleria sexmaculata*, *Ithomia amarilla* and *Forbestria olivencia*.

Solar energy cell (right).

College of Engineering

NEW BREAKTHROUGH SHOWS PROMISE FOR SOLAR ENERGY CELLS

UF RESEARCHERS REPORT THEY HAVE ACHIEVED A NEW RECORD IN EFFICIENCY WITH A PROTOTYPE SOLAR CELL THAT COULD BE MANUFACTURED USING A ROLL-TO-ROLL PROCESS.

“Imagine making solar panels by a process that looks like printing newspaper roll to roll,” said Franky So, a UF professor of materials science and engineering.

Industry has eyed the roll-to-roll manufacturing process for years as a means of producing solar cells that can be integrated into the exterior of buildings, automobiles and even personal accessories such as handbags and jackets. But, to date, the photovoltaic sheets cannot muster enough energy per square inch to make them attractive to manufacturers.

The UF team has crossed the critical threshold of 8 percent efficiency in laboratory prototype solar cells, a milestone with implications for future marketability, by using a specially treated zinc oxide polymer blend as the electron charge transporting material. The full report outlining the

details of their latest laboratory success in solar cell technology is published in *Nature Photonics*.

The researchers said the innovative process they used to apply the zinc oxide as a film was key to their success. They first mixed it with a polymer so it could be spread thinly across the device, and then removed the polymer by subjecting it to intense ultraviolet light.

John Reynolds, a former UF chemistry professor now at Georgia Tech who continues to collaborate on the project, said the cells are layered with different materials that function like an electron-transporting parfait, with each of the nano-thin layers working together synergistically to harvest the sun’s energy with the highest efficiency.

Reynolds’ UF chemistry research group developed an

additional specialized polymer coating that overlays the zinc oxide polymer blend.

“That’s where the real action is,” he said. The polymer blend creates the charges, and the zinc oxide layer delivers electrons to the outer circuit more efficiently.”

Reynolds was in an ongoing collaboration with So’s materials science team, which they call “The SoRey Group.” The most recent fruit of their collaboration will now go to Risø National Laboratory in Denmark, where researchers will replicate the materials and processes developed by the SoRey Group and test them in the roll-to-roll manufacturing process.

“This sort of thing can only happen when you have interdisciplinary groups like ours working together,” said Reynolds.

Their work is funded by a grant from the Office of Naval Research.

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examples may have been overlooked in the past because larvae must be raised to adulthood to identify these complexes, and that takes weeks of lab work. Also, relatively few institutions maintain insect collections that feature species at their immature stages, he said.

The researchers said that they hope this finding will inspire others to investigate more closely the ecological processes that influence insects at their immature stages — especially since immature stage insects are the most plentiful on the planet.

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