2011 // 2012

Office of the Vice President
for Research ***Annual Report***

PEOPLE PLANET RESERVATION

PURDUE
UNIVERSITY

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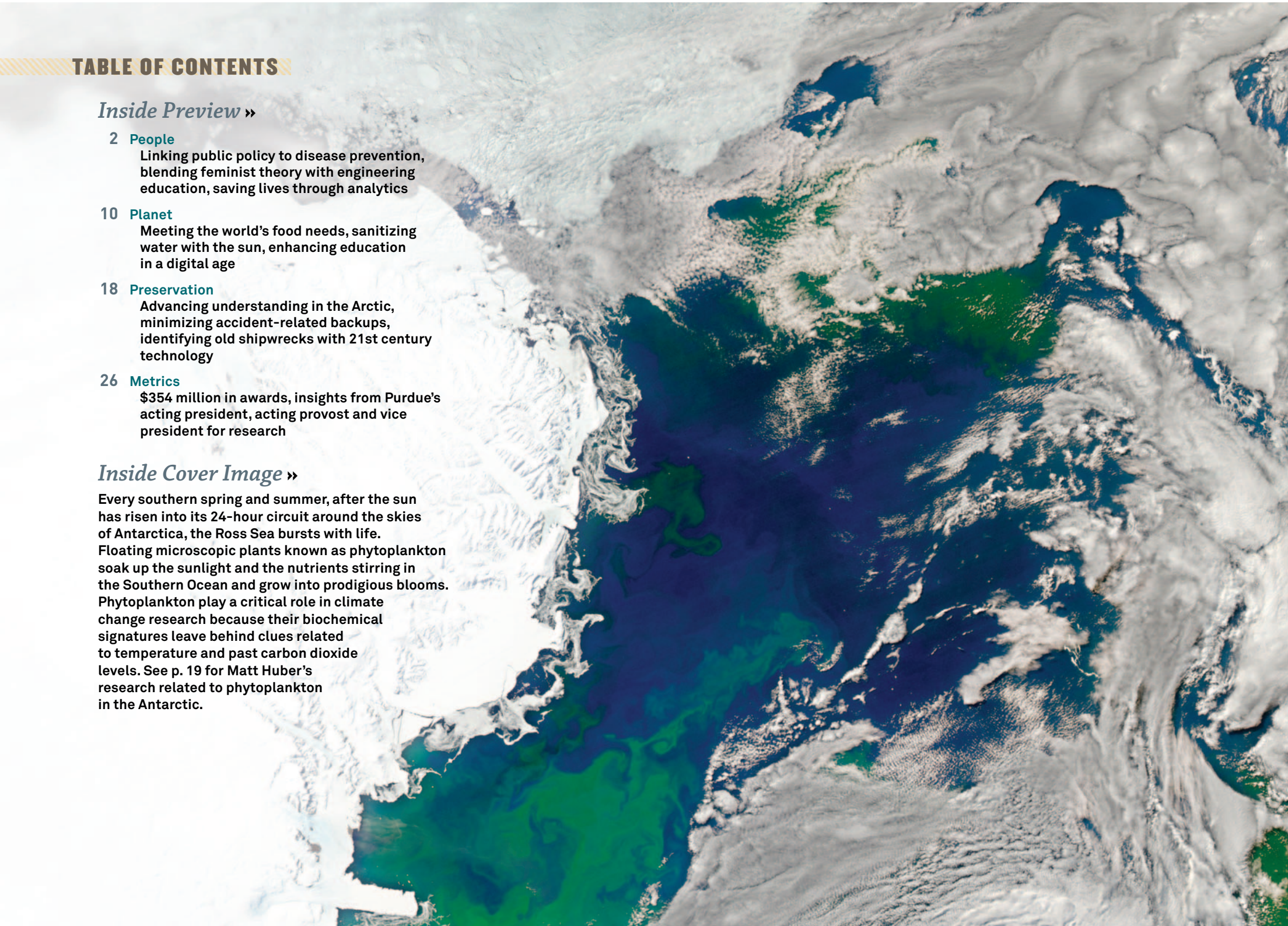
Every southern spring and summer, after the sun has risen into its 24-hour circuit around the skies of Antarctica, the Ross Sea bursts with life. Floating microscopic plants known as phytoplankton soak up the sunlight and the nutrients stirring in the Southern Ocean and grow into prodigious blooms. Phytoplankton play a critical role in climate change research because their biochemical signatures leave behind clues related to temperature and past carbon dioxide levels. See p. 19 for Matt Huber's research related to phytoplankton in the Antarctic.



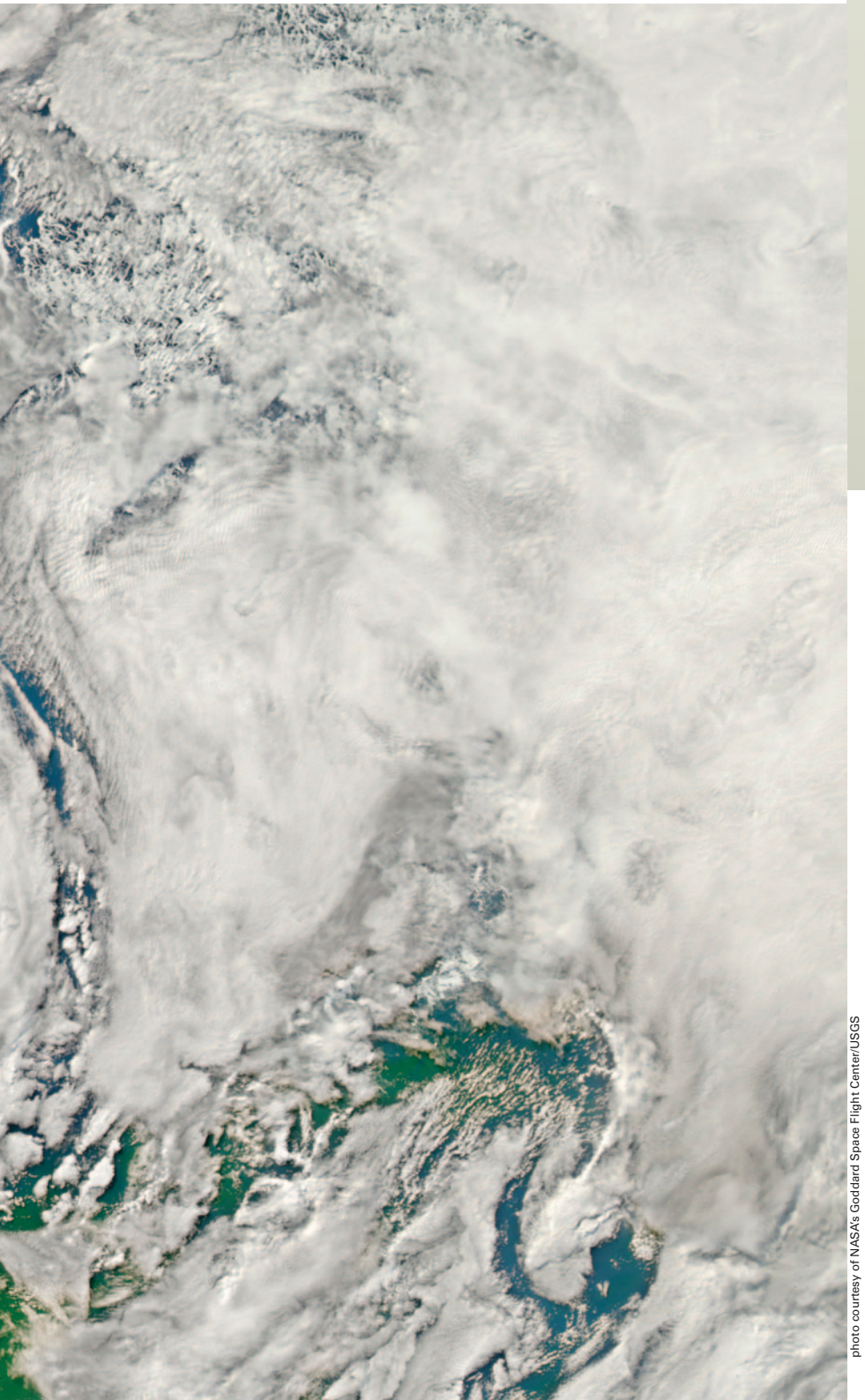


photo courtesy of NASA's Goddard Space Flight Center/USGS

"We are continually faced with great opportunities which are brilliantly disguised as unsolvable problems."

— Margaret Mead

WE LIVE IN A TIME

of significant social and environmental challenges, in which the consequences of indecision and inactivity can be devastating. What our world needs is bold decision-making, fueled by ingenuity and focused on long-term objectives: the health and welfare of people, the sustainability of our planet and the preservation of cultural values to maintain the great diversity of humanity. Here at Purdue University, our researchers are on the forefront of these initiatives, making discoveries with transformative potential. Read on to discover how their ideas are informing policy makers and how their innovations are being brought into the marketplace, turning possibilities into reality.


"My humanity is bound up in yours,
for we can only be human together."
— Desmond Tutu

PEOPLE

PEACE, LOVE AND BREAST CANCER PREVENTION

Silai Mirzoy

Sophie Lelièvre

photo courtesy of Ellen Gruenbaum

Purdue University IBCN researchers visited Peace and Love Hospital to forge research collaborations on breast cancer. ***(pictured left to right)*** Professor Ellen Gruenbaum; Nana Florence Amisah, queen mother of the Fante community in Kumasi; Professor Sophie Lelièvre; a traditional dancer; Laurence Gabriel, legal counselor and lecturer, Rennes, France; and Adwoa Afriyie Beniako, public relations officer of Breast Care International in Ghana.

Stepping out of the van in Kumasi, Ghana, on a hot day in January, Ellen Gruenbaum faces a four-story concrete building, its turquoise exterior gleaming against a sky dulled by the dusty West African trade winds. It's a homecoming of sorts for the medical anthropologist, who has lived in both Sudan and Botswana and has come to Peace and Love Hospital to collaborate as part of the International Breast Cancer and Nutrition (IBCN) program.

"Many African women are dying from breast cancer mainly because of a lack of understanding about the disease's early symptoms and beliefs about the effects of breast cancer," says Gruenbaum, whose previous research in Africa had focused on infectious disease and female genital cutting practices. "While the country's fatality rate from breast cancer is 10th highest in Africa, Ghanaian health-care leaders, including both private initiatives and government officials, are working to raise awareness and educate women about how lives can be saved by early screening and treatment."

IBCN, cooperating with goals of the World Health Organization and the International Agency for Research on Cancer, is bringing together experts in nutrition, basic medical sciences, statistics, cancer epidemiology, communication, public policy, economics, health law, anthropology and medicine to study such issues as how cellular mechanisms in breast cancer development link to diet, and how public policy affects access to food sources and disease prevention. Teams of researchers are focusing initial efforts on the United States, Ghana, France, Japan, Uruguay and Lebanon.

Globally, breast cancer is ranked second in terms of incidence after lung cancer, and breast cancer is usually the number one cause of mortality of all cancers in women. In the United States, pink-ribbon campaigns emphasize breast self-exam and mammograms, with advocacy groups pushing for insurance coverage and no-cost screenings for impoverished women. But in countries like Ghana, where the majority of residents live in rural areas with no easy access to radiography, and where the discussion of cancer is still relatively taboo, many women don't seek help until their tumors are visible and much more advanced.

Gruenbaum, who heads Purdue's Department of Anthropology, is teaming up with African clinicians and researchers to study cultural and religious practices affecting breast health. She's also looking at dietary patterns. "Culture and the study of human values about food have a lot to offer the research on breast cancer," she says. "There's more and more evidence that how you eat and how you maintain your body impacts breast cancer development."

SURVEYING WOMEN Three thousand miles away, Silai Mirzoy takes a break from her field work, watching the palm trees sway in the breeze against the backdrop of the Mediterranean Sea. Here at American University of Beirut, Lebanon, she's spending her summer studying eating patterns and body images of women. Working in groups of two or three, she and her fellow research interns are surveying mothers of young children as part of a larger research project investigating Middle Eastern diets.

"I've been working with IBCN for a couple of years, making profiles of several different countries and how Mediterranean diets possibly influence epigenetics and breast cancer," says Mirzoy, who graduated from Purdue last spring and began medical school this fall. "Lebanon had the highest level of breast cancer, while Iran had the lowest, in comparison to all six Middle East

countries we studied." A native of Afghanistan, Mirzoy hopes her work will lead to breast cancer prevention programs targeted at specific subpopulations based on such factors as body image and diet.

FOCUSING ON HERITAGE Deep in the heart of a 2,000-year-old fortified city with cobblestone streets and half-timbered houses, Sophie Lelièvre welcomes an international group of researchers to the second IBCN symposium in Rennes, France. An associate professor of basic medical sciences in the Purdue University College of Veterinary Medicine and associate director, discovery groups, of the Purdue University Center for Cancer Research, Lelièvre co-founded IBCN in 2010.

"We wish to investigate how disease and prevention are related to women's heritage and environment. Of particular concern is the rapid rise of breast cancer in low- and middle-income countries where aggressive forms of the disease are seen in young women," she says.

"Experts believe we are on the verge of an international breast cancer epidemic, and the World Health Organization has labeled cancer prevention an urgent priority. But this form of cancer is not a communicable disease, so it does not attract as much attention as diseases such as influenza or tuberculosis when it comes to primary prevention. However, it is not acceptable to let this disease progress everywhere insidiously." ■

Luciana de Oliveira

photo by Vince Walter

BRIEF // STRENGTH IN NUMBERS It's easy to talk about diversity, but how do we truly embrace multiculturalism in the classroom? That's especially challenging in places like Indiana, which has seen a 400 percent growth in the number of English Language Learners—students who speak English as an additional language—over the last 10 years.

"Kids may live in linguistic communities where only the home language is spoken, and so the first time they get in touch with the English language is in kindergarten," says Luciana de Oliveira, an associate professor and director of the College of Education's English Language Learning licensure program, which she developed. In her research, she asks teachers how they identify and manage inequities, from school calendars that don't accommodate long winter-break trips to Mexico or Spanish-language tests that are more difficult than their English versions.

De Oliveira shares these insights with her students, suggesting how to promote positive change. "A lot of times, there's strength in numbers. Instead of having one person voice an opinion, teachers can engage other co-advocates," she says. "We don't want them to lose their jobs or be in trouble, so I tell them 'See who's on your side, who are the others raising their voices so that you can talk to them and advocate for the needs of the multilingual students in the school.'" ■

"KIDS MAY LIVE IN LINGUISTIC COMMUNITIES WHERE ONLY THE HOME LANGUAGE IS SPOKEN."

LIBRARY PROFESSORS EARN BEST PUBLICATION AWARD

photo by Vince Walter

Megan Sapp Nelson, Jacob Carlson and Michael Fosmire

An article by Purdue Libraries professors Jacob Carlson, Michael Fosmire, Chris Miller and Megan Sapp Nelson published in portal: Libraries and the Academy won the American Society for Engineering Education's 2012 Best Publication Award, Engineering Libraries Division.

Titled "Determining Data Information Literacy Needs: A Study of Students and Research Faculty," the article introduces the concept of data information literacy and provides preliminary insights on how it might be defined.

The award committee praised the article's "very realistic overview of how data could be managed at many academic institutions," stressing success in exploring the roles of all players in the research process—graduate students, faculty members and librarians.

Publication led to an Institute of Museum and Library Services grant, allowing librarians from four universities to continue developing data information literacy concepts and programs to teach the concepts. More information is at www.datainfolit.org. ■

BRIEF // FEMINISM, ENGINEERING AND ACADEMIA When it comes to underrepresented populations in academia, words matter—so much so that Alice Pawley has been collecting metaphors among Purdue faculty members on their perceptions of career pathways toward tenure.

"Snowstorm. Tightrope. Slightly oval pea in a pea pod, didn't quite fit," says Pawley, an assistant professor of engineering education, rattling off just a few of the phrases she's accumulated. Her conclusion: That when describing the experiences of women, African Americans, Native Americans and others in academia, perceptions vary widely depending on gender, race and ethnicity.

Pawley—who blends feminist theory with engineering education research to better understand underrepresentation in science, technology, engineering and mathematics disciplines at the undergraduate and faculty levels—hopes her ongoing research will help to improve institutional structures that seek to support more diversity but don't fully embrace the varied needs of underrepresented populations.

"Most engineering schools require students to be full time at least as undergraduates, so, for example, people who need to work full time and be a student part time, or people who have kids may do poorly in engineering," she explains. "We need to change from an institutional structure that allows homogeneous groups of people to succeed to one that helps heterogeneous groups of people succeed." ■

Alice Pawley

photo courtesy of Alice Pawley

photo by Vince Walter

Petronio Bendito

photo by Vince Walter

Jue Chen

BRIEF // MERGING ART AND DIGITAL MEDIA

Experiencing rather than simply viewing color was the goal of a seven-piece art exhibit in the Lawson Computer Science Building last year by Petronio Bendito, associate professor of art and design.

"The exhibition reflected my research about color and interdisciplinary collaborations," he says. "Unlike the Impressionists, who painted the nuances of light, I paint with light, controlling it via computational processes. I use computer technology to create visual and participatory experiences."

One piece in the exhibit changed color, shape and music based on movement in the room captured by a live webcam. Two works shared the same color algorithm, which Bendito compared to DNA code.

"I am interested in looking at computational color processes and turning them into expressions," says Bendito, whose next series will be titled "Color Code." It will explore the convergence of color, identity, order and chance.

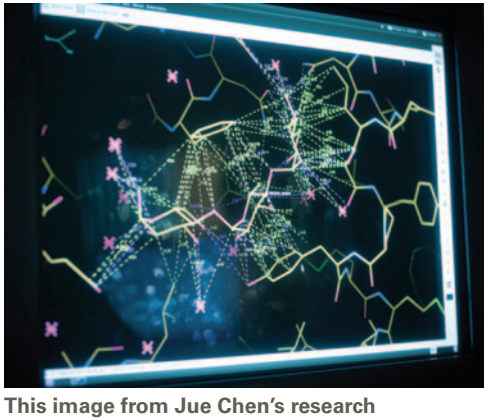
He's also developing a body of work funded by an Indiana Arts Commission grant. In it, he is investigating natural disasters as source material, and color and form as mechanisms of contemplation and reflection. ■

BRIEF // UNDERSTANDING DRUG RESISTANCE

P-glycoprotein—a cellular protein found mainly deep inside our bodies in places such as the gastrointestinal tract and kidneys—protects us from environmental damage by pumping toxins outside the cells. But this normally helpful structure can be lethal when it comes to treatment for diseases such as cancer and depression, because its ability to eject hundreds of different molecules means that sometimes helpful drugs are sent away before they can do their life-enhancing work.

Jue Chen, a professor of biological sciences and investigator for the Howard Hughes Medical Institute, is on a quest to better understand the mechanisms by which p-glycoprotein creates drug resistance. By crystallizing the protein and bombarding it with x-rays, her lab is building a three-dimensional model of the protein structure.

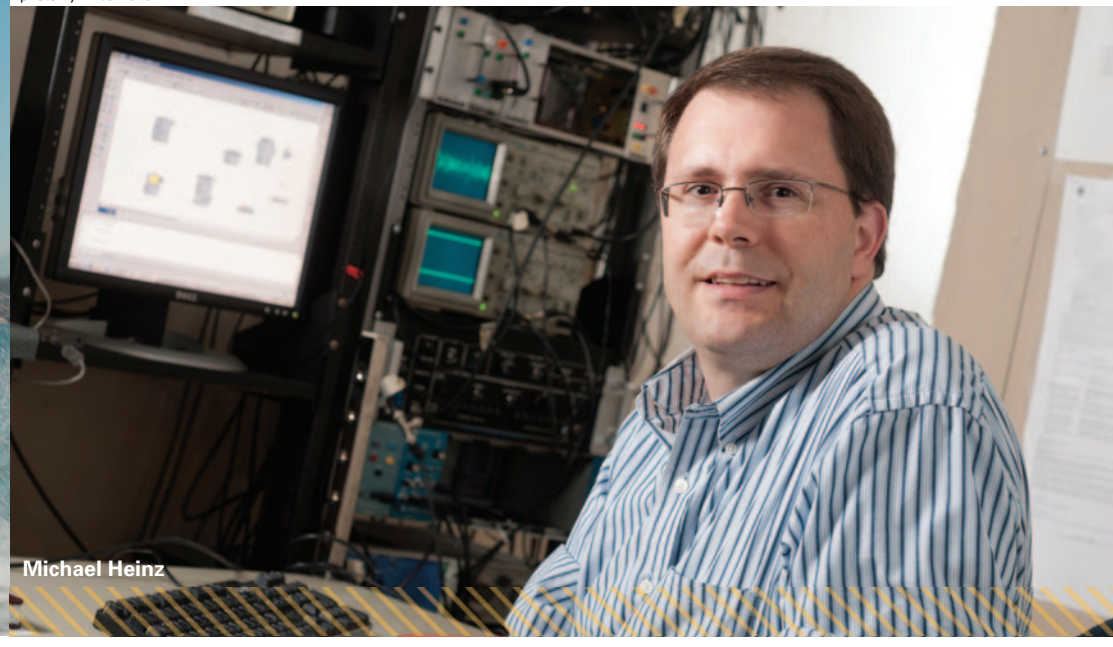
"It's a very interesting scientific question," says Chen, adding that, to date, researchers have identified more than 200 drugs that p-glycoprotein recognizes and reacts to. "Long term, a better understanding of it will benefit drug design and help improve chemotherapy." ■



This image from Jue Chen's research shows a transmembrane substrate binding site of the maltose transporter. Chen's lab builds 3-D models of structures to better understand the building blocks of disease.

photo courtesy of United States Coast Guard

photo by Vince Walter



Michael Heinz

Dave Ebert *(left)* receives a plaque from Vice Admiral Robert Parker recognizing the valuable long-term partnership between Purdue and the U.S Coast Guard. The plaque includes a copy of the program from the dedication of the USCGC Stratton, named after former Purdue Dean and Coast Guard WWII Women's Reserve Director Dorothy Stratton. Ebert continues to lead development of new visual analytic tools presently used by the United States Coast Guard.

BRIEF // LIFE-SAVING ANALYTICS

Traveling in their characteristic orange-red watercraft through the cold blue waters of the Great Lakes, U.S. Coast Guard Auxiliary members come to the aid of countless mariners each year. But with dwindling numbers of volunteers, Coast Guard officials need ways to assess the potential impact of closing small-boat stations staffed by volunteers.

Enter researchers with the Purdue-based VACCINE (Visual Analytics for Command, Control and Interoperability Environments) center, whose computer-based modeling tool, Coast Guard Search and Rescue Visual Analytics (cgSARVA), runs on an ordinary computer or laptop. Analyzing hypothetical station closures on response time, potential lives saved and property loss, the tool also highlights regions that would be exposed to greater risk.

"You can simulate who would respond, whether the responding station has enough capacity and visualize the data with color-coded maps," says David Ebert, VACCINE director and Silicon Valley Professor of Electrical and Computer Engineering.

Coast Guard analysts used data analyzed with cgSARVA as part of the Great Lakes Recreational Boating and Water Safety Campaign Plan, and there was a decrease in water-related deaths and an increase in lives saved in 2011.■

BRIEF // HOW NOISE AFFECTS PERCEPTION

Understanding the importance of neural slow-fluctuation cues in hearing proved to be a breakthrough for the research team led by Michael Heinz, associate professor of speech, language and hearing sciences and biomedical engineering.

Currently, cochlear implants provide acoustic slow-component cues, but not all neural slow-fluctuation cues. That can limit hearing, but improved implants may soon be developed, thanks to Purdue's Auditory Neurophysiology and Modeling Lab.

"To study the effects of noise on perception, human listeners with normal hearing were tested in a sound attenuating booth with varying degrees of background noise added," Heinz says. "A computational auditory nerve model predicted the degree of neural coding associated with slow and fast components of sounds. Regression models quantified the ability of fast and slow neural components to account for perceptual responses."

That led to the new understanding: "By factoring in how the cochlea processes sound, the significance of these components for listening in noisy situations is different than has been commonly assumed," Heinz says.

He'll next examine how improved hearing aids and implants influence neural coding sounds.■

UNDER-AGE DRINKING EXPERT NAMED TO NATIONAL COUNCIL

Linda Chezem, J.D., was a judge in Lawrence County, Ind., when she first saw the devastation alcohol misuse could cause to the defendant, family and community. "So I started asking questions to understand how to better adjudicate alcohol-related cases," says Chezem, who turned to research for answers.

Today, the Purdue professor of youth development and agriculture education studies the nexus of law and policy around health and justice, with alcohol the underlying focus. And now, her expertise in the perils of underage drinking, impaired driving, alcohol abuse and alcoholism have earned her a position on the National Advisory Council on Alcohol Abuse and Alcoholism.

The 15-member council is part of the National Institute on Alcohol Abuse and Alcoholism, the primary agency that conducts and supports research on the causes, consequences, prevention and treatment of abuse and addiction. Chezem will advise on program and policy matters, research, grants and cooperative agreements. ■

NIAAA Advisory Council Members newly appointed in March 2012. *(from left)* Dr. Craig McClain, Hon. Linda Chezem, NIAAA Acting Director Dr. Kenneth Warren, Mimi Fleury, and Dr. Fulton Crews.

photo courtesy of National Institutes of Health

BRIEF // IMPROVING CONSTRUCTION SITE SAFETY

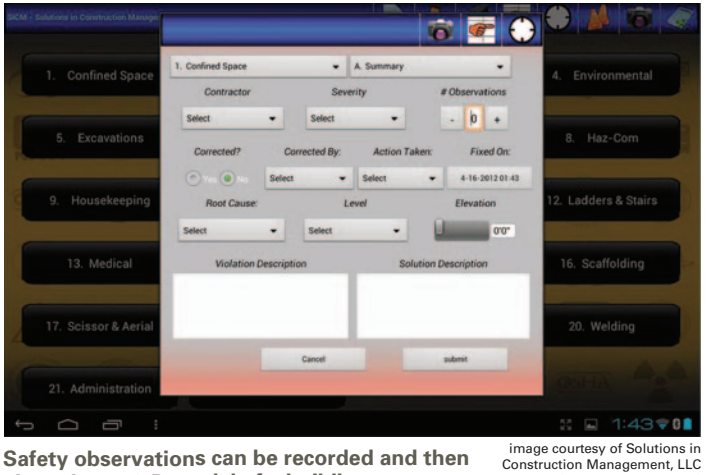
A mobile app developed by four seniors to improve construction site safety landed the first-place Student Selection Award at Purdue's 2012 Undergraduate Research Poster Symposium. The event featured research from the colleges of Technology, Science, Engineering and Agriculture.

"The app is based on the android operating system, and it is used to record information about safety observations—what was seen, where and how it was fixed," says team member Matthew Huff. "This information can then be viewed on a three-dimension model of the building."

He was joined in the project by Tony Campos, David Foreman and Jeremiah Miller; all four have since earned degrees from the College of Technology.

Their project was sponsored by the Indianapolis office of Pepper Construction, which "gave us a direction to head in," Huff says.

Their app was part of the class, Contemporary Problems in Applied Computer Graphics in the College of Technology, which required identifying, designing, qualifying, managing, creating and presenting a project addressing existing or emerging issues. Oral, written and media presentations of the projects were evaluated by faculty, peers and practicing professionals. ■



Safety observations can be recorded and then viewed on a 3-D model of a building.

image courtesy of Solutions in Construction Management, LLC (sicmapp.weebly.com)

BRIEF // APPS FOR AUTISM "Frustrating" describes children unable to verbalize.

"Fantastic" describes the SPEAKall! app developed by a Purdue EPICS service learning student group and available free from iTunes.

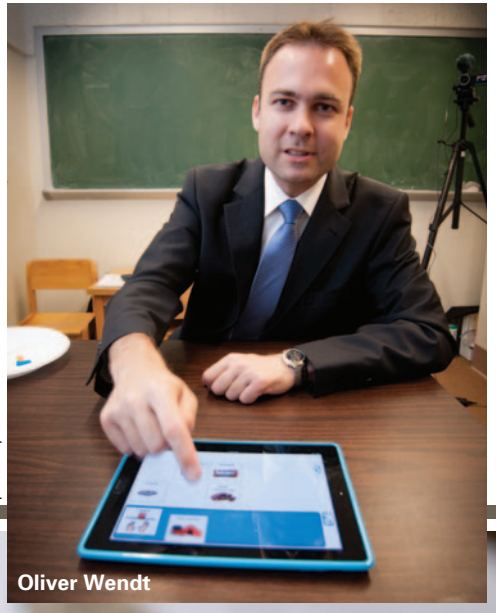
The idea originated in the speech, language and hearing sciences lab of Professor Oliver Wendt, who found existing devices cumbersome.

"We discussed an app that would be easy to use and not overload beginning communicators with autism," says Wendt, who turned to EPICS to develop it.

A team of 15 students from Wendt's department, along with computer science, electrical and computer engineering, management and industrial design created the app, which provides pre-loaded pictures that users can activate to produce speech. Other pictures can be added using the iPad camera and pre-recorded voices.

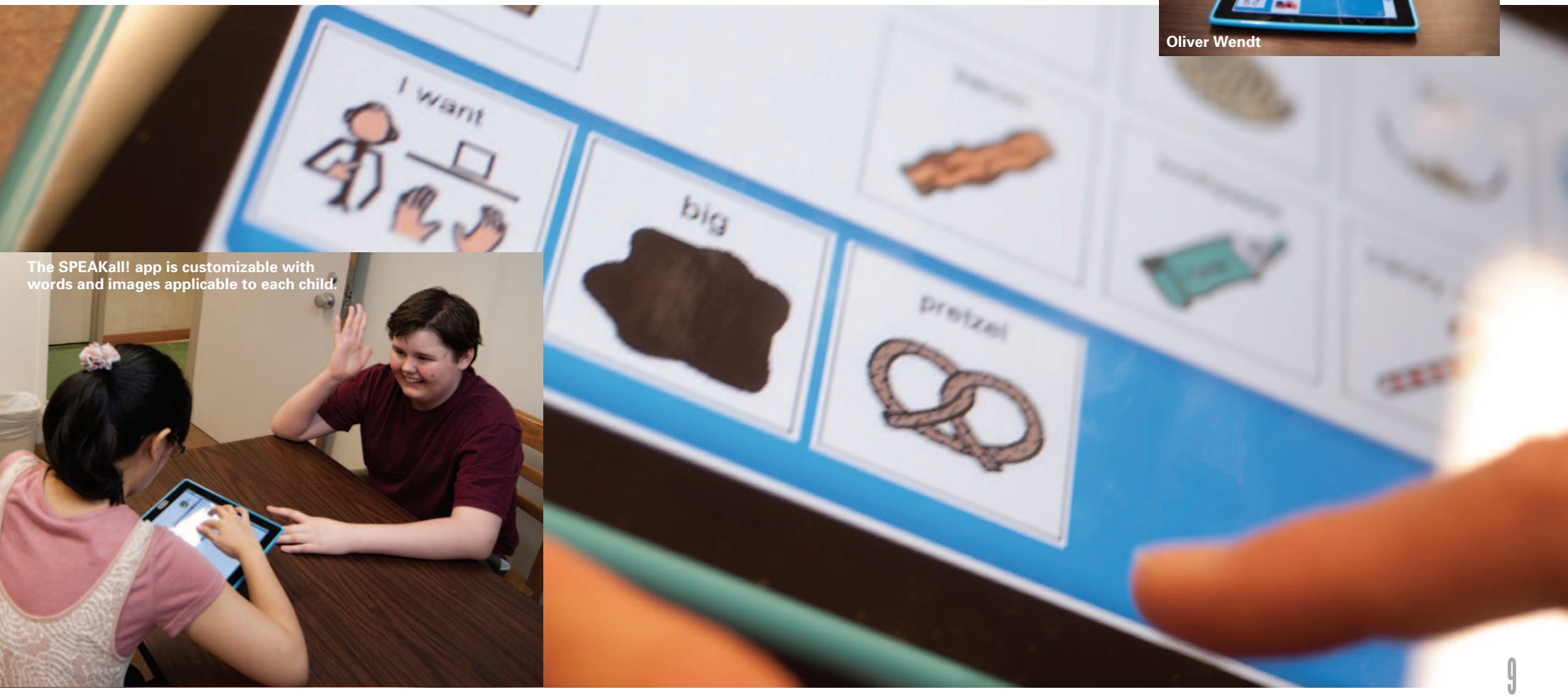
"We used the prototype with real participants while the EPICS students observed," Wendt says. They then adapted it for children's individual behavioral and learning characteristics, and it has been effective in practical, everyday interactions for children with autism.

The autism community adopted it very quickly, and the app has been presented at various conferences.■



Oliver Wendt

photos by Vince Walter



The SPEAKall! app is customizable with words and images applicable to each child.


"When one tugs at a single thing in nature,
he finds it attached to the rest of the world."
— John Muir
PLANET

Jeff Volenec and Sylvie Brouder

photos by Vince Walter

FOOD VS. FUEL VS. CLIMATE

Jeff Volenec and Sylvie Brouder stand waist-deep in a grassy prairie, their yellow plaid and floral shirts standing out against a sea of green. From their vantage point in Tippecanoe County, Ind., the researchers are seeking to inform the food versus fuel dilemma, an international debate over how to divert farmland for biofuels production without harming the world's food supply.

"The question is, how can we continue to meet the world's feed and food needs while growing a bioenergy industry in a systematic, logical way?" says Volenec, a Purdue professor of agronomy and principal investigator on a $3.8 million grant that Purdue has received from the U.S. Department of Agriculture. "We need data to inform the debate. In addition, we need to improve our understanding of the potential environmental impacts of growing new bioenergy crops."

As partners in a $25 million grant led by Iowa State University, Volenec and co-investigator Sylvie Brouder, Purdue's Wickersham Chair of Excellence in Agricultural Research, and other Purdue faculty are studying the potential of grasses as environmentally responsible bioenergy crops. They've set their sights on marginal or unused farmland that isn't optimal for other crops.

Often, marginal land is not farmed because it could be prone to flooding or soil could have insufficient nutrients to produce traditional corn and soybean crops. Farmers may receive payments from the Federal government to take these lands out of row-crop production because of low yields and higher-than-acceptable environmental risks. That could make the land ideal for grass production, if financial and environmental costs aren't too high.

"How much nitrogen does it take? How much water? If you irrigate, it adds incredibly to the cost of growing these energy crops, so in all likelihood, biomass production will be a rainfed system," Volenec says. Brouder adds, "Farming is an energy-intensive activity, so you have to really carefully consider energy input versus energy output—the net energy balance of the system. This will give us critical information to understand the potential to produce sufficient energy with these crops that won't be competing with food."

BUILDING A FOUNDATION OF KNOWLEDGE

A few miles from the prairie grasses, Linda Prokopy kneels down to examine corn stalks emerging from parched earth. Planted early during an unseasonably warm spring, then ravaged by a long drought, the corn was once again subject to nature's whims, seemingly made more capricious in recent years due to increased climate variability.

Prokopy believes that by studying how crop viability is affected by events such as rainfall and drought, scientists can give farmers better information for decision-making in the future. Funded with a $5 million grant from the United States Department of Agriculture, she's leading a team of Corn Belt climatologists, crop modelers, agronomists, economists and social scientists in developing sophisticated support tools.

"We're trying to make climate information more useful and usable to producers so that they can make longer-term planning decisions—when to plant crops, how to grow them and what kind to plant for maximum efficiency," says Prokopy of the study, which encompasses a 12-state region stretching from the Dakotas to Ohio.

Agricultural crops contribute about $150 billion annually to the U.S. economy, most of which comes from the intensely cultivated Midwest. Their viability relies in part on increasingly variable climate patterns.

The new project, Useful to Usable (U2U): Transforming Climate Variability and Change Information for Cereal Crop Producers, is studying biophysical and economic impacts of different climate scenarios on corn yields in the North Central region. Researchers also will study how producers and advisors are likely to use the information.

"Currently, climate information isn't very usable—it's scattered in a lot of different places, and the models

don't fully explain crop yields. Farmers don't have time to troll the Internet looking at different sites, so they're not using the information, which is having deleterious effects on the environment," says Prokopy, an associate professor of natural resources.

Now one year into the five-year project, team members have begun building models that predict yields based on climate variables. They've also surveyed corn producers in the 12-state region, and have polled advisors who work with farmers in four states to examine attitudes about climate change and weather information. Once the technology is perfected, Prokopy hopes it will help farmers maximize crop yields even in the face of disaster.

"If they don't know what's likely to happen, they won't change what they're doing. That's the rational thing to do—to not change if you don't know what else is needed," Prokopy says. "But this is such a critical region of the world's food supply, and we want to ensure we can grow crops in a sustainable manner." ■

Linda Prokopy

photo by Vince Walter

Val Watts and Catherine Hill

photo courtesy of Purdue Research Foundation

BRIEF // IMPROVING INSECT-CONTROL METHODS Purdue researchers seeking environmentally friendly ways of controlling disease-carrying insects have reached a eureka moment in their drug discovery efforts.

As vector insects develop resistance to current insecticides, they hope to use a novel strategy to discover new methods of insect control.

"Our goal is to identify next-generation insecticides that are safer for the environment and have less impact on non-target organisms, such as humans, animals and honey bees," says Catherine Hill, associate professor of entomology, College of Agriculture, who is working with Val Watts, professor of medicinal chemistry and molecular pharmacology, College of Pharmacy.

"We have used genomic approaches to identify key receptors, or molecules, found on a cell's surface, on these insects' central nervous systems," Watts says. Using these receptors, they have identified several compounds that selectively target mosquito receptors over human receptors.

"What's important is that these compounds also have toxicity against the insects themselves," Hill says. "That was a hallelujah moment that gives us a lot of hope."

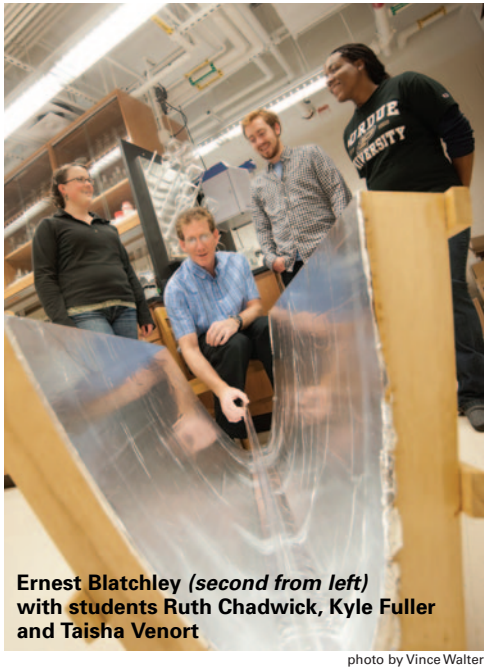
Their work is supported by nearly $1 million in grants from several sources. ■

photo courtesy of Tyler Anselm

Tyler Anselm, Dalan Talsma *(seated)* and David Buck *(center, standing)* with Papachacra Water Committee members

Christian Krupke and Greg Hunt

photos by Vince Walter



Ernest Blatchley *(second from left)* with students Ruth Chadwick, Kyle Fuller and Taisha Venort

photo by Vince Walter

BRIEF // SUN SHINES ON TWO DRINKING WATER PROJECTS

Two Purdue projects expected to improve drinking water supplies are counting on the sun for their success. The first is site-specific, a solar-powered submersible pump in Papachacra, Bolivia; the second, a wooden parabolic reflector that uses the sun's ultraviolet radiation to inactivate waterborne pathogens.

The Purdue Chapter of Engineers without Borders USA received $10,000 for the pump and panels in Papachacra from The Boeing Co. for its hands-on project. Their work will boost the water supply by 50 percent in the village of 120 families when they open a new spring.

"Our chapter was founded in 2008, and this is the first project we've worked on," says student Tyler Anselm. Five students and a professor spent two weeks onsite in July 2012 to finalize construction details and discuss the new systems with the community.

The second project, the reflector designed by Ernest Blatchley, civil engineering professor, has been effective in inactivating *E. coli* bacteria and is being tested for its ability against other pathogens. His team's work has been published by the journal, *Water Research*. ■

BRIEF // NEWS FROM THE BEEHIVE

In farmlands across the Corn Belt, the annual ritual of seed planting heralds the arrival of spring. But the very presence of corn growing near beehives is increasingly being linked to bee kills during planting time, and Christian Krupke and Greg Hunt have new evidence to that effect.

In 2010 and 2011, Krupke and Hunt analyzed honeybees found dead outside of hives at the time corn was being planted nearby. Many of the dead bees had high concentrations of neonicotinoid insecticides, commonly used to coat corn and soybean seeds before planting. The insecticides also were found at high concentrations in waste talc exhausted from farm machinery at the same time.

The researchers believe that no single culprit has killed off millions of honeybees in recent years in the United States. But they are advising beekeepers and field crop producers to temporarily relocate bees or screen them off while fields are being planted.

"Most people think of it as a honey thing, but the main pollinators of fruits, vegetables and nuts are honeybees," says Krupke, associate professor of entomology. "And we don't have other ways to pollinate massive acres," adds Hunt, professor of behavioral genetics. ■

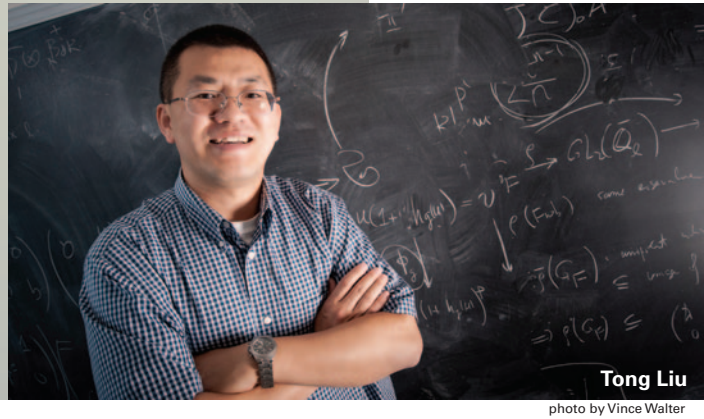
INTEGERS FOR INTERNET SECURITY

Most consumers filling their Internet shopping carts today probably have no idea that their credit card information is kept secure in part through the ancient discipline of number theory. But in recent years, modern-day cryptography —which relies heavily on understanding the relationship between integers—has moved beyond its traditional domain in military and Secret Service operations to e-commerce activities.

Enter Tong Liu, an associate professor of mathematics, who is the 11th faculty member in his department to receive a Sloan Research Fellowship since they were established in 1955. The fellowships, which provide $50,000 over a two-year period, seek to stimulate fundamental research by early-career scientists and scholars of outstanding promise. They're awarded yearly to 126 researchers in recognition of distinguished performance and a unique potential to make substantial contributions to their field.

Thanks to the fellowship, Liu will have more time to ponder the work that Euclid began in 300 B.C.

"So far, my work is pretty much theoretical," says Liu of his research into integral p-adic Hodge theory. "But eventually it could be used to improve Internet security." ■



Tong Liu

photo by Vince Walter

Natalia Doudareva

photo by Vince Walter

BRIEF // MOLECULAR TAXONOMY OF MEDICINAL PLANTS Foxglove, periwinkle and other plants have long been used in drug development for medical conditions such as heart disease and cancer. But because large quantities are often needed even for small yields of clinical compounds, researchers continue to seek ways to synthesize their life-saving properties in the laboratory.

Natalia Doudareva and some of her colleagues are aiding that cause with a new digital catalogue of 14 plant species. The goal of the multi-institutional Medicinal Plant Genomics Resource: to understand the complete formation, storage and regulation of plant-derived medicinal compounds at the enzyme and gene level and to provide that information in a publicly accessible database.

Researchers from seven different institutions analyzed specimens of plants including belladonna, echinacea, cannabis and valerian. Now that the molecular taxonomy is complete, users can conduct blast searches to compare and contrast properties of the plants.

"For each plant, we have tissue-specific expression, different developmental profiles and metabolic profiles," says Doudareva, a Distinguished Professor of Horticulture who studied the medicinal properties of rosemary. "This is creating a platform for discovery." ■

BRIEF // VIRTUAL INNOVATION Imagine traveling through a blast furnace, watching as iron ore and coke descend through its chambers toward the bottom where pure molten iron collects. The 1600-degree temperatures obviously make that impossible, but it is possible to take a virtual tour, thanks to Chenn Zhou and her colleagues.

Zhou heads up Purdue Calumet's Center for Innovation through Visualization and Simulation, where students and faculty members combine advanced simulation techniques, 3-D visualization and virtual reality technologies to solve many different university research problems, industry issues and community problems, as well as offering new possibilities for education and training.

The 3-D immersive virtual blast furnace model, for example—which was created using computational fluid dynamics principles with support from the American Iron and Steel Institute and a Department of Energy research grant—has been used by steel companies for not only training but also energy savings and efficiencies. By visualizing how conditions and settings affect output, engineers can test out new ideas before making operational changes that help to save time and capital.

Since its inception, in fact, the center has helped more than 50 organizations save tens of millions of dollars collectively. Corporations like ArcelorMittal, BP, NiSource and U.S. Steel are taking advantage of this new technology. "We have facilities, software and talented faculty and students dedicated to improving the environment, energy efficiency, product quality and productivity," says Zhou. "Our close partnerships with industries and community have enabled us to provide cost-effective solutions for real-world problems."■

Chenn Zhou

photo courtesy of Chenn Zhou

photo by Mark Simons

Daniela Bortoletto

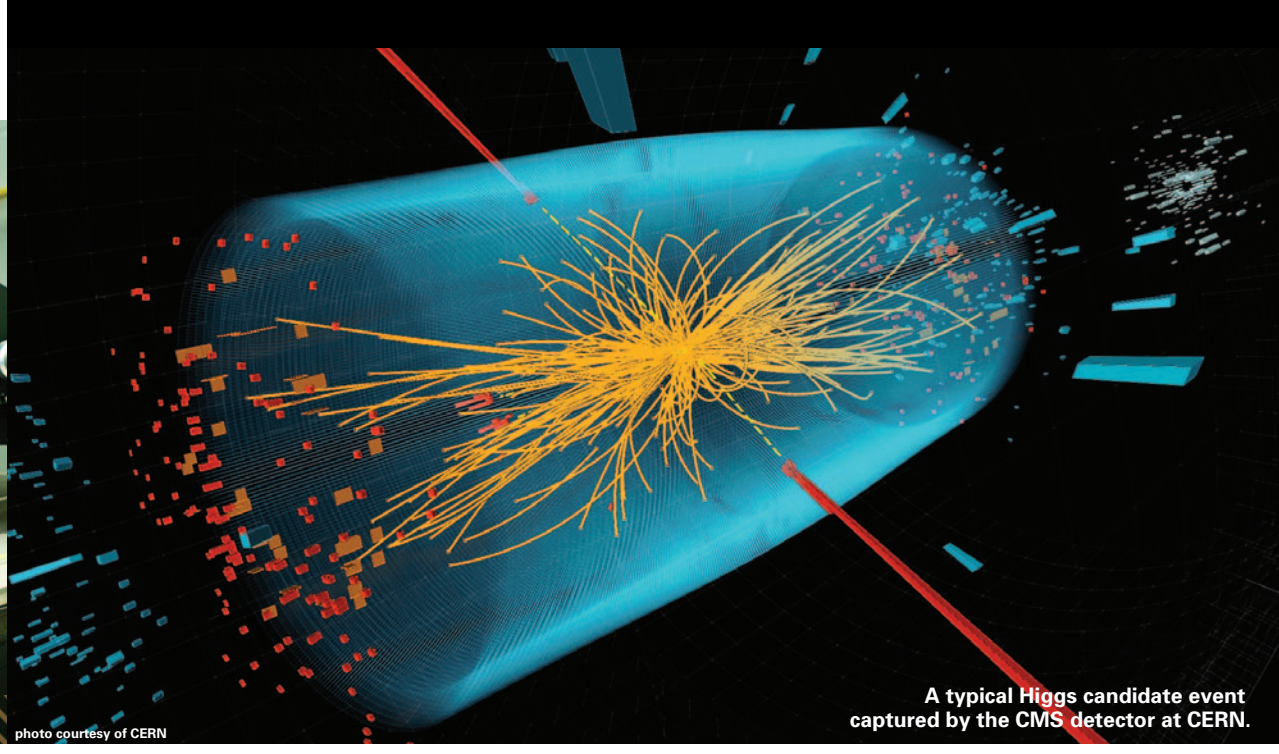


photo courtesy of CERN

A typical Higgs candidate event captured by the CMS detector at CERN.

BRIEF // A BIG BANG FOR PHYSICS Purdue University scientists were part of a historical event this 4th of July as scientists working on the biggest international experiment in particle physics history announced the discovery of a new particle that may be the long-sought Higgs boson.

Ian Shipsey

"On a day where fireworks lit up skies across America, the world of science unveiled explosive news concerning the longtime elusive Higgs boson particle," says Ian Shipsey, the Julian Schwinger Distinguished Professor of Physics. He also is the co-coordinator of the Large Hadron Collider Physics Center at Fermilab near Chicago, and was recently elected chair of the Compact Muon Solenoid Collaboration Board at CERN, the European Laboratory for Particle Physics, where the discovery was made.

"More data are needed to establish whether this new particle has all the properties of the Standard Model Higgs boson or whether some do not match, which would imply new physics beyond the Standard Model. Either way, we've discovered one more key to unlock the mysteries of the universe."

Results came from experiments using the largest machine ever built, the 27 kilometer-long Large Hadron Collider. Traces of the tiny particles are captured on three detectors, including the Compact Muon Solenoid, a 14,000-ton camera. Purdue scientists and students contributed to the design and construction of several key parts of the CMS camera, the software used to operate the camera and analyze the collisions, and have contributed to a variety of key measurements with the data.

Daniela Bortoletto, the Edward Purcell Distinguished Professor of Physics, led a team looking for evidence of specific subatomic particles that would result from one possible decay of a Higgs boson. To avoid any possible bias while analyzing new data and ensure objectivity when looking for much sought-after signs of new physics, team members drew blinds over the region where they expected to see an excess of decay events. The region was only unblinded when they were satisfied enough with their procedures to give confidence in the ultimate result.

"The moment the analysis was unblinded was amazing," Bortoletto said. "The excess at 125.3 GeV was easy to see, and we felt as though a major discovery was appearing in front of us. The statistical significance achieved was enough to be classified as a discovery. The probability of the background alone fluctuating by this amount is one in three million."■

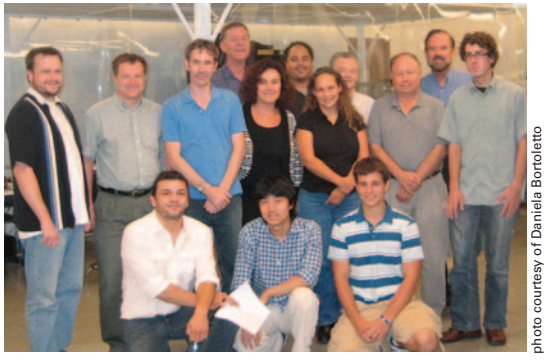


photo courtesy of Daniela Bortoletto

Part of the Purdue CMS group during construction of the CMS pixel detector:

***(standing, from left)* Adam Everett, Norbert Neumeister, Ian Shipsey, Kirk Arndt, Daniela Bortoletto, Durand Graves, Petra Merkel, Laszlo Gutay, Alvin Laasanen, Virgil Barnes and Isaac Childress.**

***(front row, from left)* Gino Bolla, Chang Liu and Jason Ortiz.**

PHARMACY RESEARCHER RECEIVES NEW INVESTIGATOR AWARD

photo courtesy Noll Campbell

For his work in aging research, including exploring the link between cognitive impairment and use of anticholinergic medications, Noll Campbell received one of 11 Merck/American Geriatrics Society (AGS) New Investigator Awards at the 2012 AGS Annual Scientific Meeting in Seattle in May.

He is the first doctor of pharmacy to receive the award, which recognizes original research on new, relevant work in geriatrics. Anticholinergic drugs are prescribed for many indications, including depression, urinary incontinence and allergies. Their long-term effects on cognition have previously been inadequately studied, Campbell says.

"Few graduates of pharmacy schools progress to the clinical proficiency that Dr. Campbell possesses, and even fewer develop that interest to pursue clinical research," says Michael Murray, Distinguished Professor and Endowed Chair of Medication Safety, College of Pharmacy.

Campbell is a research assistant professor in the College of Pharmacy, investigator at the Regenstrief Institute and clinical pharmacy specialist in geriatrics at Wishard Health Services.

BRIEF // LOOKING BACK 1,000 YEARS One thing leads to the next, and that's been true of Frederi Viens' interest in Africa that began years ago with volunteer education consulting there and today finds him establishing a pan-African center for research and graduate training in mathematics in Tanzania.

In between, the professor of statistics and math served a 10-month stint as a Franklin Fellow with the U.S. State Department in 2010, helping inform policy on climate change, energy and environmental diplomacy.

He next worked with Bo Li, assistant professor of statistics, and doctoral student Luis Barboza on climatology and environmental statistics research. That work involves models that quantify global temperature changes over the last 1,000 years.

"By using a hierarchical Bayesian model, which incorporated information from external forcings from greenhouse gases, solar irradiance and volcanism and which used long-memory uncertainty, we exploited the last 1,000 years of proxy data from tree rings, ice cores and other sources," he says.

Li and Viens are now exploring other directions, including hydrology questions in the Lake Chad basin and renewable energy potential in Morocco.

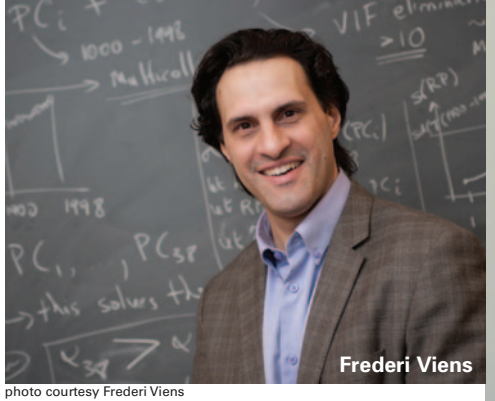


photo courtesy Frederi Viens

PROMISES FOR A DIGITAL FUTURE

Today's smartphones have more computational power than many desktop computers did just five years ago. But how do schools harness that technology to transform education?

"Everything centers on the teachers," says Arden Bement, director of the Purdue Global Policy Research Institute. "You can empower them to innovate by giving them some freedom in developing courses, lesson plans, and curriculum and also in determining how best to bring technology into the classroom."

Former director of the National Science Foundation, Bement was tapped last year to co-chair a special commission for Digital Promise, a new national center designed to identify information and technological needs that will improve learning and education. Their recommendations: to focus on individualized learning while prioritizing achievement, affordability and access.

"The big challenge is going to be with the poor school districts and some rural schools, which don't have as much access to skilled teachers in math and science, the Internet and wifi. But the cost is coming within reach of many school districts," Bement says.

"The key to community is the acceptance, in fact, the celebration of our individual and cultural differences."

— M. Scott Peck

PRESERVATION

POLES APART

Paul Shepson

photo courtesy Paul Shepson

Two Purdue research teams focusing on the earth's ice cover—and the causes and impacts of the ice melting—are working at opposite ends of the earth.

Paul Shepson, professor and department head of chemistry, and his team are looking to the north to study the effects of melting ice in the Arctic.

Matthew Huber, professor of earth, atmospheric and planetary sciences and associate director of the Purdue Climate Change Research Center, is advancing the understanding of carbon dioxide's role in creation or destruction of ice sheets in the Antarctic.

ARCTIC: WHAT ROLE DOES BROMINE PLAY? Four from Purdue and the Purdue Airborne Laboratory for Atmospheric Research spent a month in early 2012 in Barrow, Alaska, the northernmost United States city.

The group included Shepson, postdoctoral researcher Kerri Pratt, doctoral student Kyle Custard and aviation maintenance technician Brian Stirm. They were part of the Bromine, Ozone and Mercury Experiment (BROMEX) funded by the National Science Foundation and NASA, which involves 10 universities from four countries.

The Purdue researchers' goal was to gain information on the spatial characteristics of bromine in the atmosphere.

They measured atmospheric trace gases and particles from an airplane and at ground base, and investigated chemical reactions of gases at the earth's snow-covered surface. These reactions impact greenhouse gases as well as toxic pollutants that accumulate in the snowpack, tundra and Arctic animals.

Their work will help predict what will happen to the atmosphere when the Arctic sea ice is gone, Shepson says.

His overall focus is how sea ice affects the atmosphere, how gases that come from sea salt chlorine and bromine impact the atmosphere—and what the impact would be without those gases, should the ice melt.

Because the Arctic warms two to three times faster than other areas of the earth, "It's the canary in the coal mine for climate change," Shepson says.

This project is one of many since the mid-1980s that Shepson has tackled on the Arctic.

ANTARCTIC: CARBON DIOXIDE A FACTOR Huber is one of eight researchers from eight universities around the world funded by the National Science Foundation (NSF) and other groups to study geochemical remnants of ancient algae from seabed cores. The algae were collected by drilling in deep-ocean sediments and crusts as part of the NSF Ocean Drilling program.

The team recently concluded that a 40 percent drop in carbon dioxide about 34 million years ago led to formation of the mile-thick Antarctic ice sheet. Ice sheets form when carbon dioxide levels are about 600 parts per million, the scientists say.

Matthew Huber

photo by Vince Walter

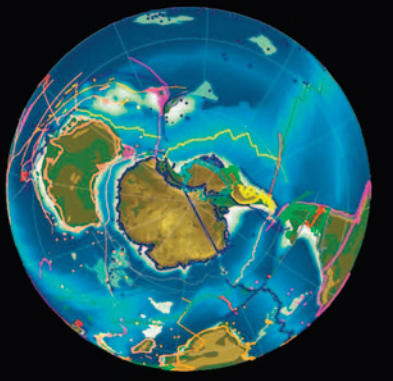
While they have not determined how much greenhouse gas would have to increase to melt the ice, "The evidence falls in line with what we would expect if carbon dioxide is the main dial that governs global climate," Huber says.

"If we crank it up or down, there are dramatic changes. The system is not linear, and there may be a different threshold for melting the ice sheet, but if we continue on our current path of warming, we will eventually reach a tipping point."

Since these results were released, Huber has been studying the impacts of ice sheet distributions on climate.

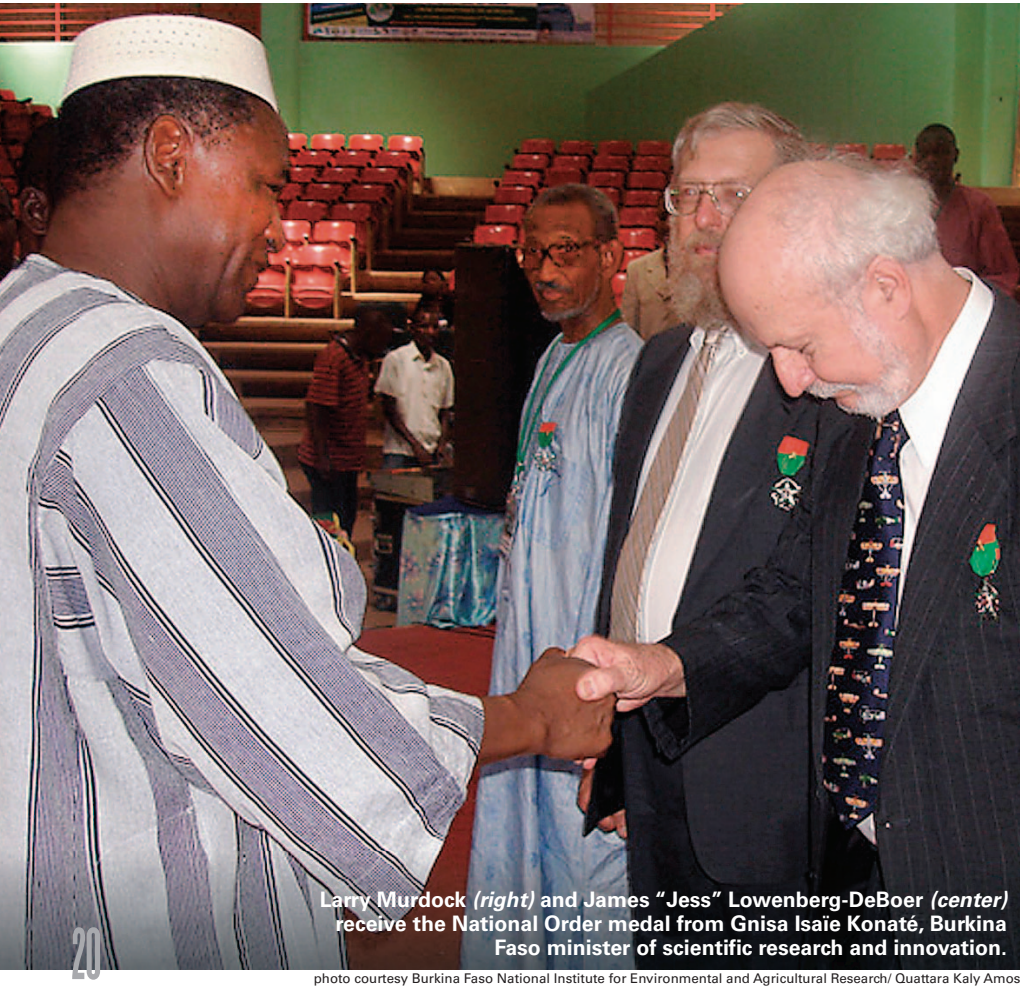
"We find that past changes in the ice sheet—the Eocene-Oligocene transition time—are small compared to what the impacts of losing an ice sheet in the future would be," he says.

"The polar ice sheet shaped today's climate, but we don't have much hard data on how that was done. We want to know by how much does it cool the planet, and how much warmer the earth would be without the ice sheet." ■



The lines in the map are the boundaries of plates and modern coastlines as they were in the past (55 million years ago). The dots are locations of deep sea cores as recovered by scientific drilling operations such as the Integrated Ocean Drilling Program.

courtesy of Matt Huber



Larry Murdock *(right)* and James "Jess" Lowenberg-DeBoer *(center)* receive the National Order medal from Gnisa Isaie Konaté, Burkina Faso minister of scientific research and innovation.

photo courtesy Burkina Faso National Institute for Environmental and Agricultural Research/ Quattara Kaly Amos

BRIEF // RESEARCHERS HONORED IN AFRICA FOR GRAIN STORAGE PROJECT

Larry Murdock and James "Jess" Lowenberg-DeBoer have been honored by the West African nation of Burkina Faso for their work in improving storage of cowpea crops. The two were honored this fall with the Chevalier de l'Ordre National du Burkina Faso, the equivalent of the U.S. Presidential Medal of Freedom.

"Jess and I are overwhelmed by the honor," says Murdock, a professor of entomology who developed the technology that led to the Purdue Improved Cowpea Storage (PICS) project. "To be thought of in such high regard by the Burkinabé people is truly humbling."

Through the PICS system, farmers can store cowpeas in hermetically sealed bags, which deprive insects of oxygen and the water insects make with that oxygen, ultimately killing them off. Nearly 2 million bags are in use in West and Central Africa.

"Farmers in these West African nations are eager to buy these bags because they conserve more food for family consumption and help increase farm income," say Lowenberg-DeBoer, an associate dean of the College of Agriculture and director of international programs in agriculture. "The bags have enabled the Burkinabé to increase their own food security in a nation that has a history of famine and malnutrition." ■

photo courtesy Beksoubo Damienne

Purdue Improved Cowpea Storage bags are opened during a May 2011 ceremony in Pala, Chad. The hermetic grain storage bags have allowed farmers in Africa to safely store their cowpea grain so they can sell their crop well beyond harvest.

© istockphoto.com

photo by Andrew Hancock

A group of students and researchers watch EarthScope Field Engineer Kenneth Oliver install a seismic station near Kentland, Ind.: *(left to right)* Austin McGlannan, Roby Douilly, Elifuraha Saria, Peter Robertson, Sarah Bischoff, Andrea Stevens, Jane Block, Katelyn Verner and Steeve Symithe

"YOU CAN ALERT PEOPLE TO AVOID THE ENTIRE AFFECTED AREA AND TAKE AN ALTERNATE ROUTE."

Srinivas Peeta

BRIEF // OFF THE BEATEN PATH Traffic jams are considered a necessary evil of modern life, but what if construction- or accident-related backups could be minimized with the help of technology?

That's one question being asked by the NEXTRANS Center, a U.S. Department of Transportation Regional University Transportation Center headquartered at Purdue. Established in 2007, the center received a $3.5 million funding renewal earlier this year to support such research as the use of real-time information for advanced navigation systems.

"Let's says there's a big accident somewhere," says Srinivas Peeta, NEXTRANS director and a professor of civil engineering. "You can alert people to avoid the entire affected area and take an alternate route."

Whether people are willing to travel off their beaten path is dependent somewhat on factors such as driver age, familiarity with the area and the amount of information being provided. A driving simulator recently installed at NEXTRANS headquarters will help researchers determine how visual maps, directional aides and two-way communication with a real control center person influence divergent behavior.■

BRIEF // RECORDING GROUND SHAKES IN INDIANA To learn more about earthquakes and earth structures, students and professors in earth and atmospheric sciences are participating in EarthScope USArray, a National Science Foundation program that uses seismometers to record earthquakes around the world.

Undergraduate students Dane Dudley and Austin McGlannan identified suitable sites in Indiana and Kentucky, then obtained landowners' permission for a seismometer to be installed on 20 properties. The stations are part of a network of 400 instruments first installed on the west coast. The stations operate two years, then are moved to new locations to the east.

"The sites currently span from southern Florida to Minnesota," says geophysics professor Hersh Gilbert, who worked on the project with geophysics professor Robert Nowack.

This is the first such investigation of Indiana, Gilbert says. "Because the eastern half of the continent is less tectonically active than the western, its structure has received less attention," he says.

"The project provides observations needed to learn about the earth—from shallow structures that could potentially produce earthquakes to deeper structures relating to formation of the North American continent."■

NATIONAL ACADEMY OF ENGINEERING ELECTS DATTA

For his work on quantum transport modeling in nanoscale electronic devices, Supriyo Datta has been elected to the National Academy of Engineering.

The 22nd Purdue faculty member to be elected, Supriyo was among 66 new members and 10 foreign associates.

Supriyo, who is now the Thomas Duncan Distinguished Professor of Electrical and Computer Engineering, joined Purdue in 1981. Since 1985, he has focused on current flow in nanoscale devices and is well-known for contributions to spintronics and molecular electronics.

A fellow of the Institute for Electrical and Electronics Engineers and the American Physical Society, Datta has won IEEE Technical Field awards for both research and graduate teaching. At Purdue, he has received the McCoy Award for his contributions to science and was named to the Book of Great Teachers.

Datta graduated from the Indian Institute of Technology and earned a University of Illinois doctorate.■

Supriyo Datta

photo by Vincent Walter

(center) Kenneth Ridgway

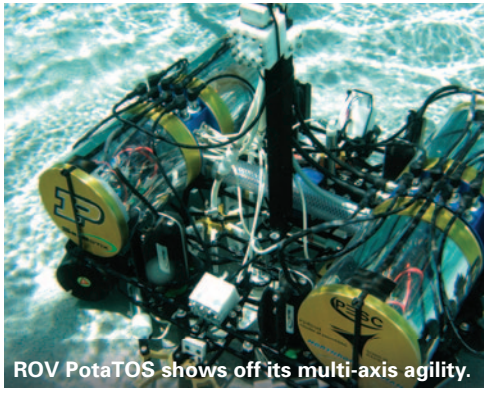
photo courtesy of Kenneth Ridgeway

BRIEF // RESEARCH ON THE HOMELANDS

Persistent drought is increasing sand dune migration on Navajo lands, and invasive species in North Carolina forests are killing hemlock trees and plants important in Cherokee traditions. These are two of the challenges being examined by Native American graduate students supported by Purdue's Sloan Indigenous Graduate Program. Funded by the Alfred P. Sloan Foundation and co-directed by Kenneth Ridgway, earth and atmospheric sciences professor, the program aims to address community issues while attracting more Native American graduate students to STEM (science, technology, engineering and math) studies at Purdue.

"We need everyone to participate in moving our society forward," Ridgway says. "Bringing Native Americans to campus also gives Purdue a greater understanding of other cultures."

Besides Ridgway, co-principal investigators are Kevin Gibson, associate professor, botany and plant pathology; Dwight Lewis, director, graduate school minority programs; Kerry Rabenold, biological sciences professor; M.J.T. Smith, Birck Professor of electrical and computer engineering and graduate school dean; Patrick Zollner, associate professor, forestry and natural resources; and Suzanne Zurn-Birkhimer, assistant head of the Department of Earth, Atmospheric and Planetary Sciences.■



ROV PotaTOS shows off its multi-axis agility.

BRIEF // NEW TECHNOLOGY FOR OLD SHIPWRECKS Inching its way across the water, a remote operated vehicle commanded by Purdue University students heads toward a sunken World War II shipwreck, taking measurements and drawing samples of the fuel inside. While the experiment was conducted in a YMCA aquatic center, and the shipwreck was a PVC pipe simulation, the threat of leaching toxins from sunken ships is real, and one that Purdue senior Seth Baklor and his teammates from the student chapter of IEEE (Institute of Electrical and Electronics Engineers) tackled with an aluminum-framed prototype they crafted for an underwater robotics contest last spring.

Held in Orlando, Florida, the MATE (Marine Advanced Technology Education) International Remote Operating Vehicles Competition pitted Purdue against universities from around the world, helping hone students' critical thinking and problem-solving skills while exposing them to potential career paths.

"There were over 7,800 shipwrecks caused by World War II, and they're usually very poor for the environment," says Baklor, whose team captured second place in the international competition. "This kind of device could help identify shipwrecks in real life, and it's similar to what the U.S. Navy uses all the time." ■

photos courtesy of Seth Baklor

FROM WEST LAFAYETTE TO WASHINGTON, D.C.

Nanoelectronics beyond the limits of Moore's Law, failure-resistant systems and foundational research exploiting parallelism are some of the advances being made by researchers in the United States today, and ones that Susanne Hambrusch is witnessing from her temporary vantage point near Washington, D.C.

As division director of the National Science Foundation's Computing and Communication Foundations (CCF) Division in the Computer Information Science & Engineering (CISE) Directorate, Hambrusch oversees research and education projects that explore areas ranging from algorithms to software and hardware foundations.

"Computer science is very pervasive, of course, and is an integral part of many interdisciplinary activities," says Hambrusch, a computer science professor who is on leave from Purdue. "It will probably be 20 years before you can buy a quantum computer, but some things are right in front of us, like big data collection."

When her three-year leave as a rotator ends in 2013, Hambrusch hopes to share her knowledge about research priorities and NSF operations with her Purdue colleagues. "It's really important for institutions to have people come to NSF and other agencies to understand how things work. There's a lot of benefit you can bring back," she says.■

Susanne Hambrusch

Amit Varma

photo by Andy Hancock

BRIEF // SAFER STEEL STRUCTURES ON THE HORIZON

It takes a 66,000-square-foot laboratory, hydraulic equipment and overhead cranes for Amit Varma and his crew to research how to make nuclear power plants safer and steel structures fire-resistant.

Their latest finding: Use a sandwich of steel plates filled with concrete to construct nuclear power plants' outer radiation shields. "That would hold up against aircraft impact or extreme earthquakes," Varma says.

The team also tests materials and creates models that could help redefine steel building and bridge design codes.

Papers published in the American Society of Civil Engineers' *Journal of Structural Engineering* describe their testing, where heating panels simulate fire and hydraulic equipment mimics loads experienced in structures.

"Conventional wisdom says concrete floors improve fire resistance. We found this isn't necessarily true for thin floors, without additional reinforcement," he says.

"Most previous work has been done in fire laboratories, which don't have the resources of a structures lab," Varma says. "We subject the structures to failure and make more fundamental observations to build models." Those are then used to evaluate designs before construction.■

BRIEF // THE TRUE COST OF GLOBAL TRADE

Buying organic apples from the back of a pickup truck at a local farmers market is an easy way to promote sustainability. But when it comes to large-scale production—the backbone of a modern economy—the solutions are far more complicated.

"Is it better for northern Europeans to grow their own flowers in hothouses, which use a ton of energy, or grow flowers in Tunisia and put them on a plane to northern Europe? Which is better in terms of emissions?" asks David Hummels, a professor of economics. Those life cycle analyses are part of Hummels' job as a research associate with the National Bureau of Economic Research (NBER), one of the nation's most influential think tanks.

As Hummels and his counterparts quantify some of these answers, policy makers will face tough decisions on how to promote emissions reductions through technology, taxation and other means. That may be harder than the economics analysis itself. "It's very difficult to do things that are costly in the short run but benefit society only in the long run," he says.■

David Hummels

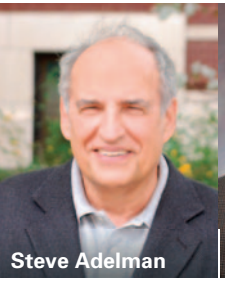
NEW AAAS FELLOWS

Five Purdue University professors have been awarded the distinction of fellow from the American Association for the Advancement of Science, the world's largest general scientific society. They are:

» **Steven Adelman,** a professor of chemistry, for developing the theoretical foundation for studying chemical reaction dynamics on solid surfaces and in liquid solutions.

» **Muhammad Ashraful Alam,** a professor of electrical and computer engineering, for distinguished contributions to the reliability of electronic devices, "carrier transport" in technology-relevant complex materials, and for lucid and broad communication of these ideas.

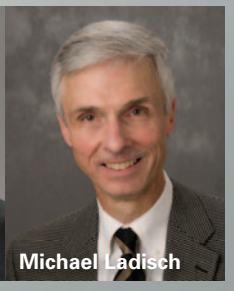
» **Srinivasan Chandrasekar,** a professor of industrial engineering and materials engineering by courtesy, for outstanding contributions to the technology of manufacturing through the integration of fundamental material properties into mathematical descriptions of machining processes and machined products.


Steve Adelman


Muhammad Ashraful Alam


Srinivasan Chandrasekar


Suresh Garimella


Michael Ladisch

» **Suresh Garimella,** associate vice president for engagement and the R. Eugene and Susie E. Goodson Distinguished Professor of Mechanical Engineering, for distinguished and pioneering contributions to the field of thermal transport and energy efficiency with significant and sustained impact on industry.

» **Michael Ladisch,** distinguished professor of agricultural and biological engineering, biomedical engineering and director of Purdue's Laboratory of Renewable Resources Engineering, for his contributions to the science of bioprocessing of renewable resources in biofuels and of bioseparations for rapid detection of food pathogens.

These professors join 43 Purdue colleagues as AAAS fellows.

PRESIDENTIAL EARLY CAREER AWARDS

Two Purdue University researchers have received Presidential Early Career awards for Scientists and Engineers from President Barack Obama. Ian Kaplan, assistant entomology professor, and Alice Pawley, an assistant professor in the School of Engineering Education, were among 96 recipients honored in July by the White House. The award—also known as PECASE—is the highest honor bestowed by the U.S. government on science and engineering professionals in the early stages of their independent research careers.

Awardees are selected for their pursuit of innovative research at the frontiers of science and technology and their commitment to community service as demonstrated through scientific leadership, public education or community outreach. Kaplan researches ecological approaches to pest management for vegetable crops, seeking to understand plant-insect interactions, the chemical ecology of insects and sustainable biological control of pests through natural predators. Pawley studies why some groups, including white women and people of color, have remained chronically under-represented in engineering degree programs.


Official White House photo by Pete Souza


Alice Pawley


Ian Kaplan

CALCIUM EXPERT RECEIVES McCOY AWARD

photos by Vince Walter

Connie Weaver

For years, kids sporting colorful T-shirts and shorts have run, jumped, undergone bone scans and drunk lots of milk in the name of science. Now the results of Camp Calcium and countless other studies have yielded the camp's founder, Connie Weaver, the most prestigious research honor given by Purdue University.

Weaver, who is a Distinguished Professor and Head of the Department of Nutrition Science, is the 2012 recipient of the Herbert Newby McCoy Award. She was recognized for her work on calcium metabolism in adolescents and the impact of diet, gender, race and sexual maturity on calcium utilization. She also is a member of the Institute of Medicine, which is the health arm of the National Academy of Sciences.

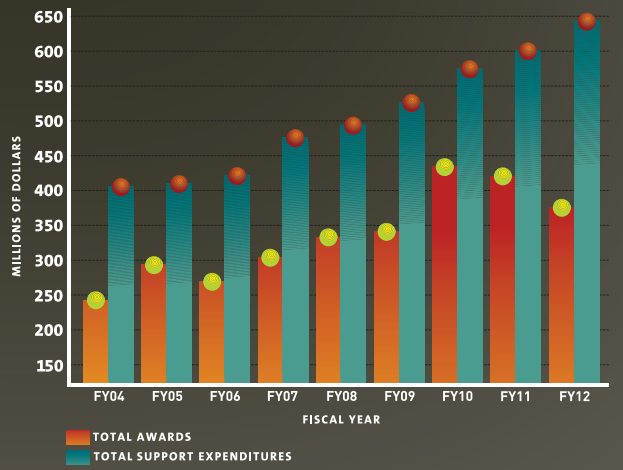
"Professor Weaver's findings have transformed the way the nation thinks about the value of calcium consumption, and especially its importance in establishing bone health in young girls that will last their lifetime," says Richard Buckius, Purdue's vice president for research.

METRICS

During the 2011-12 fiscal year, Purdue University received $354 million in sponsored programs funding. Sources included private industries, the National Science Foundation, several federal government departments and state and local grants.

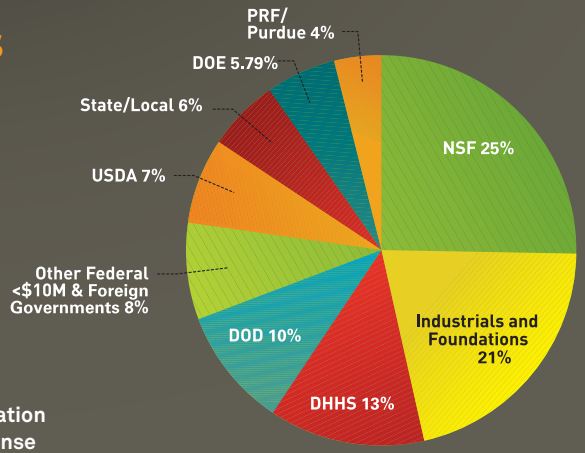
SPONSORED PROGRAM AWARDS

Purdue University sponsored programs continue to land significant funding.



MULTIPLE SOURCES

Awards for Purdue research activities can be found in industry and government.



Key:

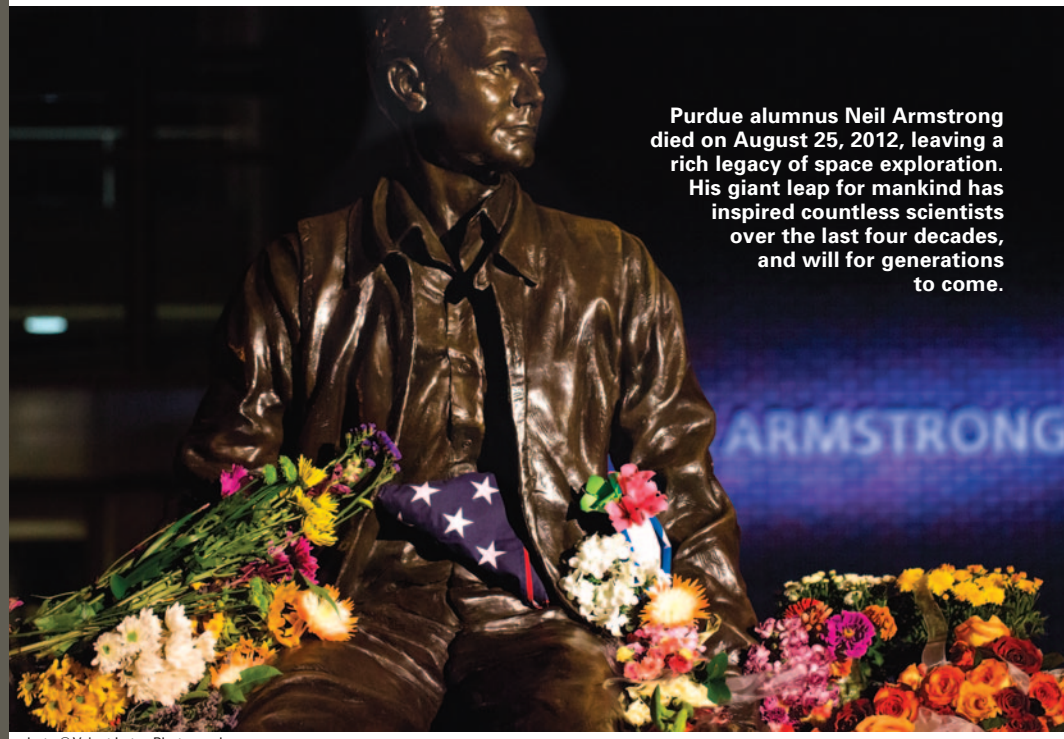
NSF ›› National Science Foundation
DOD ›› U.S. Department of Defense
DOE ›› U.S. Department of Energy
USDA ›› U.S. Department of Agriculture
DHHS ›› U.S. Department of Health and Human Services

FROM THE ACTING PRESIDENT // As a land-grant university of the 21st century, Purdue University is committed to making the world a better place. With an emphasis on sustainability, well-being and cultural preservation, our faculty, staff and students are collaborating on discoveries that inform policy makers and bring innovations to the far corners of the globe. —*Tim Sands, Acting President*

FROM THE ACTING PROVOST // Diversity of thought is essential to world-class research. At Purdue University, our faculty, staff and students represent more than 120 countries, bringing a rich perspective to their work. Collaborating here in the United States and internationally, they improve prosperity and quality of life around the world. —*Vic Lechtenberg, Acting Provost*

FROM THE VICE PRESIDENT FOR RESEARCH // Purdue University faculty members are increasingly mindful of how discoveries can fulfill broader societal goals. Working in world-class facilities, our researchers bring insight and solutions for many of the world's most pressing problems. By focusing on transformative potential, we are changing lives and impacting the future.

—*Richard Buckius, Vice President for Research*



Purdue alumnus Neil Armstrong died on August 25, 2012, leaving a rich legacy of space exploration. His giant leap for mankind has inspired countless scientists over the last four decades, and will for generations to come.

photo © Velvet Lotus Photography

Hundreds gathered around the Neil Armstrong statue at Purdue at a memorial service two days after his death.

photo by Mark Simons

Neil Armstrong

photo courtesy of N.A.S.A.

"Mystery creates wonder,
and wonder is the basis of man's desire to understand."
— Neil Armstrong

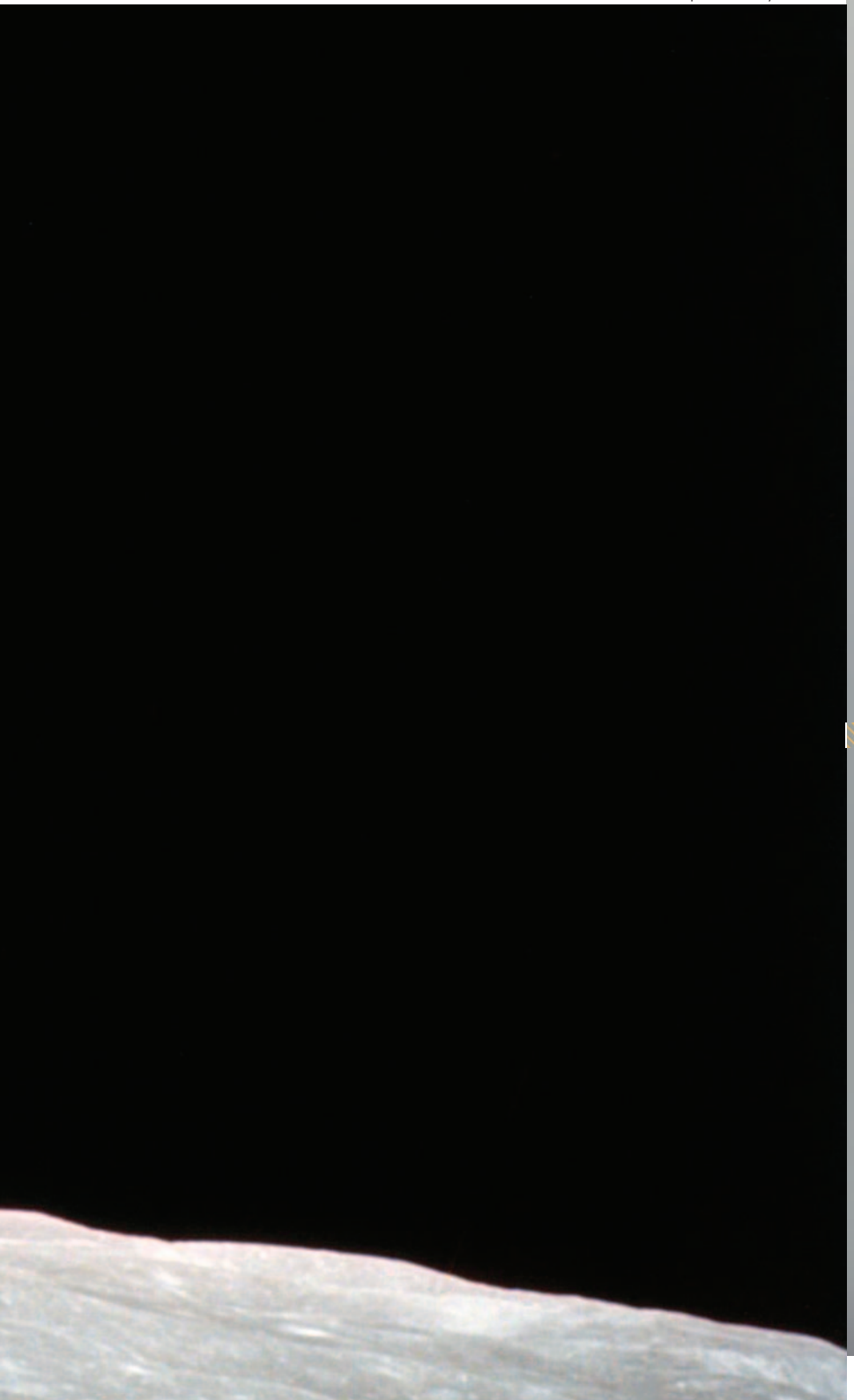


photo courtesy of N.A.S.A.

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EDITOR ›› *Pamela Burroff-Murr; director, research communications; Office of the Vice President for Research*
WRITERS ›› *Kathy Mayer, Angie Roberts, with contributions from Purdue News Service*
DESIGNER ›› *Cathy Swick, Cathy Swick Design*
PRODUCTION ASSISTANT ›› *Cindy Larson*

Send correspondence to ››
Office of the Vice President for Research
Purdue University
Hovde Hall of Administration
610 Purdue Mall
West Lafayette, IN 47907-2040

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Office of the Vice President for Research
Purdue University
Hovde Hall of Administration
610 Purdue Mall
West Lafayette, IN 47907-2040
(765) 494-6209
(765) 496-2589, Fax
orc@purdue.edu, Email

WWW.PURDUE.EDU/RESEARCH/VPR

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