Purdue University is partnering with the Indiana State Museum to support the Rad Science: Skatepark Physics exhibit to encourage more Indiana youths to enjoy learning about science. The exhibit, which opened in September, has more than 25 interactive experiences including Bodacious Board Balance, Friction Hill, Newton’s Pool, History Bowl, Vert Theatre and Wipeout Ambulance.
GREETINGS,

From historic Wetherill and Brown laboratories to the newer facilities in the Center for Drug Discovery and the Lawson Computer Science Building, the College of Science offers its faculty and students state of the art places to work, learn and discover. Within these labs and classrooms, impressive technology drives learning and fuels world changing research. Much of this equipment is customized or built from scratch by our faculty members or by the talented staff in the Jonathan Amy Facility for Chemical Instrumentation, a unique place where lab equipment is repaired, built and designed every day.

In this issue, you will explore several of the College of Science’s most amazing machines. From supercomputers to small sensors used to detect the tiniest particles of matter, you will learn the ins and outs of this equipment along with the integral research for which it is used.

Cutting edge technology is also in the capable hands of our computer science students. Drones in the civilian marketplace are at an all time high in terms of sales and debate. Two undergraduates — first year student Christian Stewart and sophomore Harris Christiansen — are experts with the machines. Stewart works for NASA’s Jet Propulsion Lab with drone plane technology that is being marked for eventual Mars exploration, while Christiansen works for Apple thanks to his previous work with a startup called iDrone. We expect the Department of Computer Science to jump on this technology as a possible career for programmers. Another CS student used hackathons like BoilerMake to develop perhaps the world’s first smart mirror.

As the temperature drops, a nice game of golf would be a bit cold for most of America but in a few short months, August Kim and her fellow duffers for the Purdue women’s golf team will be looking to repeat a strong showing in the NCAA tournament. Kim has become a team leader at the same time she has been an eagle in the lab as a biochemistry major.

We in Science are thrilled with the recently announced Ever True fundraising campaign. This bold initiative looks to bring in $2.019 billion into the University by 2019, the 150th anniversary of Purdue’s founding. Of course, the College of Science will benefit from this action. Dollars will be funneled to professorships, facilities and programs designed for student success. We know with your help that the College of Science will continue its leadership in graduating tomorrow’s scientific leaders.

As always, my sincere thanks for your support and interest in the Purdue College of Science. I wish you a happy, safe and warm holiday season.

JEFFREY T. ROBERTS
Frederick L. Hovde Dean of the College of Science

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COVER STORY | 06
Secure any loose items, don your safety glasses and be prepared for amazement in this issue of Insights, which shines the spotlight on the myriad of facilities, devices and technology at work in the College of Science every day. From mass spectrometers and xenon detectors to particle accelerators and nuclear magnetic resonance probes, you’ll explore the machinery and minds behind some of the world’s most advanced research and discoveries.
Whether it’s in the lab or on the links, biochemistry junior August Kim drives for success.

The Florida resident returned to her home state in May to help the Purdue women’s golf team finish 12th in the NCAA tournament. A young team that gelled in the regular season earned a national spotlight in the postseason.

Kim’s academic side is as strong as her golf. She has excelled in classes and has shown an early knack for lab work and research in Professor Angeline Lyon’s lab. Kim’s DNA and protein analysis added to her professor’s research on heart disease, while she and her teammates helped the women’s team earn one of the highest grade point averages in Intercollegiate Athletics at Purdue in the spring 2015 semester.

“We killed it. Like anything, you have to work at it. It’s just diligence,” she says.

After a tough 2014 season, Kim and her team rebounded and finished beyond expectations. The women were ranked No. 3 in the Big Ten and finished in that position in the 2015 tournament in Indianapolis.

At the NCAA regionals at University of Notre Dame, the team defied expectations again and dominated against 17 opposing schools vying for a slot in the national tournament. Kim finished in the top 10 for individual play.

“It’s high pressure, high stakes, but my team did awesome,” Kim says. “The second day we cleared the field by 10 shots. That was huge.”

Kim enters next season as one of the team’s strongest drivers, averaging about 250 to 260 yards per drive. Then her even stronger fairway game comes into hand.

“I’ve always liked my iron play,” Kim says. “The irons are my best friends. I’m pretty good at putting, too. ‘Drive for show, putt for dough.’ That helps.”

Kim also is a team leader.

Marta Martin, a sophomore studying movement and sports science, has looked up to Kim since their first practice together. The Madrid, Spain, native says Kim’s constant good mood is infectious and her ability to pump up her teammates is valuable for a better performance in practice and in matches.

Kim is the only College of Science student on the team, but biology and anatomy classes have further bonded the teammates.

“We’ve had a lot to talk about with our science courses over these years,” Martin says. “She leads by example. I am proud of having her as a teammate and friend.”

Kim first started golfing at the age of 9 thanks to her dad, Mike Kim, who took her to area courses. The family lived in Phoenix, Arizona, a hotbed for golf, before moving to Florida, another golf-friendly state. Kim says that besides adjusting for stronger winds, golf in Indiana is a great play year-round.

Demands are high for Kim on the golf course in 2015-16, just as they are for her chemistry studies. “Junior year, senior year — more will be expected of me on the golf course and more will be expected of me in the classroom,” she says. “It’s going to be a matter of how well I manage my time. It will be a challenge, but fun.”

“We killed it. Like anything, you have to work at it. It’s just diligence,”

— AUGUST KIM

“MORE WILL BE EXPECTED OF ME ON THE GOLF COURSE AND MORE WILL BE EXPECTED OF ME IN THE CLASSROOM.”

— AUGUST KIM

“More will be expected of me on the golf course and more will be expected of me in the classroom.”

— August Kim

COURSE OF ACTION

BY TIM BROOK

Photo by / Paul Sadler
WHAT MAKES IT UNIQUE: Most of this spectrometer was designed and constructed with the help of Purdue’s Jonathan Amy Facility for Chemical Instrumentation. The custom chamber is essential for creating the ions of interest, mass-selecting particular ions to study, and cooling them to about 5 Kelvin. The cryocooled ions are interrogated with lasers to record their infrared and ultraviolet spectra. The data provides unique structural information on gas-phase ions.

WHO USES IT: Chemistry Professor Scott McLuckey (left) and Tim Zwier (right), Distinguished Professor of Chemistry and department head, lead the project. Graduate students and postdoctoral research associates in their groups carry out the experiments using the spectrometer. Zwier’s expertise in laser spectrometry of isolated molecules pairs well with McLuckey’s mastery of ion trap instrumentation and mass spectrometry. With the customized spectrometer in full operation and the Amy Facility staff at the ready to make adjustments or improvements, the researchers are now deep into projects involving peptide ions, lignin oligomers, nanohoops, and other exotic ion samples.

ZWER ON AMY: “We have an exceptional circumstance at Purdue with Amy Facility staff who have expertise in electronics, vacuum technology and handling low temperatures, which are all critical components of this instrument. We’re getting superb, one-of-a-kind data from it. We have some unique twists in how we do things that open up different kinds of experiments compared to other groups. The instrument also has helped cross-fertilize ideas between my research group and the McLuckey group, which has been extremely valuable to both.”

ZWER ON HIS RESEARCH: “We’re studying peptides that make up proteins that have complicated structures. Since mass spectrometry as it is traditionally used makes mass measurements alone, there can be circumstances where these mass measurements don’t tell us enough about the ion, particularly about its three-dimensional structure. That’s what we hope to learn about from our laser spectroscopy measurements. We’re now studying short peptides that start to answer some of those questions. We also study lignin oligomer ions. Lignin is an important biopolymer that adds structural integrity to plant cell walls. Plant biologists wish to know more about the structure of lignin, and we hope that laser excitation will give us a unique and selective means of fragmenting the lignin chains in order to characterize them better.”

5 Kelvin is equivalent to -450.6 degrees Fahrenheit.
**Purdue Rare Isotope Measurement Laboratory**

**BACKGROUND:** A dedicated research and user facility for Accelerator Mass Spectrometry (AMS), PRIME Lab, directed by Marc Caffee, professor of physics and astronomy and department head, is dominated by the 44-foot-long tandem electrostatic accelerator whose beamline stretches 185 feet, starting from the ion source, through the accelerator and ending at the detector in the 31,070-square-foot facility. The process starts with the creation of the radionuclide ion beam in the ion source that shoots the beam through the injector magnet, low energy beamline, analyzing magnet, transmission beamline with a velocity filter, switching magnet and down one of two beamlines that contain either an electrostatic analyzer or two more velocity filters before ending at a gas ionization detector. Most experiments measure long-lived radionuclides like beryllium-10, carbon-14 and aluminum-26.

**HISTORY:** Dedicated in 1989, the first accelerator mass spectrometry measurements started in 1991. Numerous improvements and upgrades have occurred over the decades, including the new gas filled magnet.

**QUOTABLE:** "These radionuclides have half-lives of a half a million years to about 1 million years. What makes them unique in the environment is that any radionuclides made with the Earth 4.5 billion years ago have long since decayed. They’re essentially all gone. But there is a way of making them and the primary way is with cosmic ray interactions. When we measure a beryllium-10 atom in a rock or water sample or some sort of geologic material, we know that material has been exposed to cosmic rays. If we can figure out production rates, then we can date things. That is a way of dating things to see how long they have been exposed to cosmic rays. The technique we have here can tell us how long the material has been around." – Marc Caffee

**Xenon Detector**

**BACKGROUND:** Rafael Lang, assistant professor of physics and astronomy, is among many astrophysicists worldwide searching for dark matter. A member of XENON100 and XENON1T experiments at the Gran Sasso National Laboratory in Italy, Lang brought his work to Purdue and uses a smaller xenon detector in his lab. The liquid xenon is a target to search for rare dark matter particle reactions. At Purdue, radioactive isotopes are introduced to understand the properties of xenon as well as the peculiarities of the experiment.

**HOW IT WORKS:** A pulse tube refrigerator liquefies xenon gas, which is controlled by a temperature regulator. Too warm and it will evaporate, too cold and it will freeze. The liquid xenon flows down to the detector. Photomultiplier tubes act like a seven-pixel camera that records any particle reactions within the liquid xenon. The light is recorded, digitized and later analyzed offline. A turbo pump is used to evacuate the detector before it is being filled to ensure pure xenon. The detector is flanked by a gas system that is used to store xenon, purify it and introduce radioactive isotopes. The data acquisition center is composed of amplifiers from the 1960s to cutting edge digitizers that allow detailed offline data analysis. This area is integral in keeping the xenon liquid and the temperature under control. Numerous cables carry high voltage in and out of the detector, crucial for the electric drift field and for the photomultipliers, signals from the photomultipliers, temperature and pressure sensors.

**QUOTABLE:** "This is a small version of the same detector that we have in Italy, which helps us develop the technology further, make better detectors and perhaps one day find dark matter." – Rafael Lang
Since June, the LHC has been running at a record energy of 13 TeV, about twice as powerful as the collider’s first run (2010-13). December 2016. The upgraded experiment will fully utilize the increased energy and beam intensities of the Large Hadron Collider (LHC).

QUOTABLE:“We’re using commercially available semiconductor assembly technology, but sometimes the technology is pushed to the limits because we need to operate in areas of very high radiation.”

– Matthew Jones

BACKGROUND:A classic yet integral piece of laboratory equipment, the glovebox’s purpose is to protect chemical compounds from air and water by providing an inert atmosphere in which to work, says Suzanne C. Bart, associate professor of inorganic chemistry. The strong rubber gloves allow scientists to move, mix and crystallize compounds with ease. Solvents can be added and removed without compromising the compounds from the outside.

UNIQUE FEATURES:Inert di-nitrogen atmosphere protects compounds and keeps them from oxidizing, two antechambers can be under vacuum or inert atmosphere; freezer at -35 degrees Celsius for sensitive compounds; trap to collect solvents; sole noid attached to glove box adds or removes gas when the scientist puts his or her hands in or out of the gloves.

MB 2008 MBRAUN GLOVEBOX WITH SIEMENS SIMATIC TOUCH PANEL

BACKGROUND:Physics and Astronomy Professor Matthew Jones assembles sensor modules that will be used to build a tracking detector at the Fermi National Accelerator Laboratory (Fermilab) before being sent to the European Organization for Nuclear Research, known as CERN, as part of an upgrade of the Compact Muon Solenoid (CMS) experiment, slated for December 2016. The upgraded experiment will fully utilize the increased energy and beam intensities of the Large Hadron Collider (LHC).

HISTORY:Jones has worked on experiments at some of the world’s largest particle colliders, including the SLAC National Accelerator Laboratory, CERN and Fermilab.

COMPONENTS:These custom modules consist of silicon chips and sensor elements. Electrical connections on each module are made by 600 wire bonds, which are placed using a robotic wire bonder.

QUOTABLE:“We’re using commercially available semiconductor assembly technology, but sometimes the technology is pushed to the limits because we need to operate in areas of very high radiation.”

– Matthew Jones

PHYS /// Physics Building

MBR /// Brown Laboratory of Chemistry
RICE SUPER COMPUTER

MATH /// Mathematical Sciences Building

NAMESAKE: Rice is named in honor of John R. Rice, the W. Brooks Fortune Distinguished Professor Emeritus of Computer Science, who began teaching in 1964 just two years after the program — the first in the nation — was founded.

HISTORY: Rice was built in partnership with Hewlett Packard and Intel in May 2015.

FEATURES: Rice consists of HP compute nodes with two 10-core Intel Xeon-E5 processors and 64 GB of memory. All nodes have 56 Gb FDR Infiniband interconnect, making it one of the world’s most powerful university supercomputers. For perspective, Rice is 7,000 times more powerful than an average laptop. The machine is managed and maintained by Information Technology at Purdue and available to any Purdue researcher.

WHO’S USING IT: A variety of Science faculty are using Rice to process and analyze huge data sets and to model and simulate complex processes, ranging from interactions among millions of atoms to global climate change. Among them are Michael Baldwin (above left) and David Minton of Earth, Atmospheric, and Planetary Sciences, Wen Jiang of Biological Sciences, and Lyudmila Slipchenko (above right) of Chemistry.

QUOTABLE: “We use supercomputers for our entire weather forecasting process, from collecting observational data to analyzing it. The biggest thing we use it for is to run sophisticated numerical weather prediction models. There’s also quite a bit of data processing after the forecast model is completed.” — Michael Baldwin

“Questions we try to answer in our research are related to optical properties of materials. We try to make new generation solar cells. We look at protective proteins and how to improve against genetic diseases related to the optical properties of proteins. We do a lot of very complex and expensive computations. We cannot go anywhere else besides supercomputers. We can use the same software with Rice that we’ve been using on other supercomputers. Based on specifications, it is significantly faster with more memory and more cores in each node. I hope we can add another level of complexity to our computations.” — Lyudmila Slipchenko

BRUKER AV500HD NUCLEAR MAGNETIC RESONANCE (NMR) SPECTROMETER WITH CRYOPROBE

DRUG /// Center for Drug Discovery

BACKGROUND: The phenomenon of NMR is related to the absorption and emission of electromagnetic radiation by the various nuclei in molecules of a chemical sample placed in a high magnetic field. The frequencies and intensities in the resulting spectrum, as measured by the NMR spectrometer, provide a wealth of information about the molecular structure of the sample. Such information provides critical information relevant to studies in fields as diverse as synthetic chemistry, materials engineering, and biomolecular solution-state structure. The Interdepartmental NMR Facility staff, directed by John Harwood, oversees 10 NMR spectrometers, of which the AV500HD is the newest.

WHY IT’S UNIQUE: The Bruker AV500HD provides users quadruple the sensitivity compared with any other NMR spectrometer at Purdue for 1H, 13C, 15N, and 19F nucleus observation. The five millimeter liquid nitrogen cooled cryoprobe helps makes it possible to obtain spectra much more quickly than with other spectrometers. For example, the Bruker AV500HD accomplishes the same task in about one hour. This additional sensitivity also makes it possible for the spectrometer to “see” spectroscopic information, which other spectrometers cannot.

QUOTABLE: “NMR is very important in synthetic chemistry because the various spectra we get from NMR machines are like a fingerprint for the molecule.” — John Harwood
Red Hat CIO, hiker, cooking and wine enthusiast, photographer, golfer, skier. Tweeting about IT, the role of the CIO, and trends in technology.

As chief information officer, Lee Congdon (BS ’76 Computer Science, MS ’77 Computer Science) is responsible for Red Hat’s global information systems, including the technology strategy, enterprise architecture, information technology governance, solutions delivery, and systems operations supporting the company.

“I’m a freshman at Purdue and a lover of both math and drama, the first of which I’m studying.”

Smith is one of the College of Science’s 1,000 plus first-year students for the 2015-16 academic year. His first tweet as an official Purdue Mathematics freshman: “Made it to my first class early and I had breakfast!!! I’m ready for this!!!”

“A humble neurobiology grad from Purdue and EDM producer.”

By day, Michael Leathers (BS ’14, Biological Sciences) is a developmental and reproductive toxicology technician at Ceravance in Greenwood, Indiana. By night, he is an electronic dance music producer. Check out his latest tracks on Twitter.

“Host of ‘Technaction’ and ‘BioTech Nation’ on NPR Talk”

A longtime, trusted voice for tech on National Public Radio, Moira Gunn (MS ’72, Computer Science) tweets about her fascinating guests on her NPR talk shows. Her feed brings you into the studio and shows behind the scenes machinations of how to put out weekly national radio programming that stays current with every-changing tech trends.

“SVP of Engineering at Yelp”

Yelp is a battleground for restaurants. Owners, supporters and digressers wage war with star reviews. Michael Steppelman (BS ’10, Computer Science) joined his older brother and Yelp co-founder Jeremy Steppelman in 2009 as a software engineer. The younger Steppelman brother quickly climbed to senior vice president of engineering at the popular website, which has become the go-to source for quick reviews along with pertinent restaurant details like cost, location and hours. Yelp was valued at $377.5 million in 2014.

“Purdue ’17. Physicist, Triathlete, Space geek, Californian. Food enthusiast”

Elizabeth Spiers is currently interning at Boeing in the Configuration Management department. The opportunity came a year after she spent the summer of 2014 as an earth science technology intern at NASA. When she is at Purdue, Spiers builds programs to analyze decay rates in astroparticles.

“Our new stars are the best”

Mike Hoffman (BS ’81, Earth, Atmospheric, and Planetary Sciences) has been interested in the weather for as long as he can remember, but it was April 3, 1974, when he decided to pursue it as a career. That was the night of 16 major tornadoes in Indiana, which has become known as the “Super Outbreak.” The weather events claimed the lives of 51 people.


Caleb Trujillo (PhD ’14, Biological Sciences) published his first article stemming from his PhD work with the College of Science. “A Model of How Different Biology Experts Explain Molecular and Cellular Mechanisms” appeared in CBE — Life Sciences Education in summer 2015.

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The complex and amazingly dynamic inner workings of plant cells may hold keys to creating better biofuels and learning exactly how and why certain pathogens cause disease on crops. The research of Chris Staiger, Distinguished Professor of Biological Sciences, focuses on explaining those inner workings.

The goal of the Staiger Lab at Purdue is to understand how the network of plant cell filaments — the cytoskeleton — functions with their polymers as a plant grows and responds to its environment and microorganisms.

“This network of filaments is conserved in every living thing, from humans to bacteria,” Staiger says. “How it operates is essential to understanding how cells migrate in their environment — such as sperm to egg — and how they proliferate in cancer. It’s a universal phenomenon.

“Of immediate relevance to us is how plants respond to exposure to diverse microorganisms, including those that cause disease. We are now watching and quantifying how these filament networks respond to good versus bad microorganisms.”

The potential wide ranging benefits of understanding these filament networks has led the U.S. Department of Energy and the National Science Foundation to support Staiger’s work.

“For agriculture, understanding this filament system is fundamental to how cells generate biomass, which is important for how to make the best biofuels,” he says.

Staiger’s research has long been a global, collaborative effort. “My career has depended upon numerous scientific colleagues around the world — most importantly in France and the United Kingdom,” he says.

The long term nature of his work is typical of scientific inquiry aimed at answering basic, highly complex questions. “This is fundamental — blue sky — research that will take five to 10 years to pay off. Fundamental research often leads to serendipity that translates into a product. It’s very difficult to predict.”

As a teacher and mentor to many students, Staiger recalls being inspired as a Carleton College undergrad by a professor whose passion for science and for his students led him to overcome and even disregard his own disability.

“He was diabetic and blind, but he got up and lectured and drew diagrams on the chalk board, and this guy would make his stories come alive and reach out to us,” Staiger says. “This solidified in my mind his dedication to teaching, which motivated me to be a scientist, a plant person and to teach.”

Another professor fueled Staiger’s love for scientific research as he worked toward his PhD at the University of California, Berkeley. Zac Cande was a very intelligent, enthusiastic, high-energy individual who loved to talk science,” Staiger says. “He stimulated my curiosity and showed me the excitement that comes from intellectually digging into a problem. He was my main inspiration to jump into an academic research career.”

Since coming to Purdue, Staiger’s own enthusiasm and knowledge has influenced students for 22 years, while his research has advanced what is understood about plants. He is optimistic about what he will learn and eager to continue his research. “We need to keep investing in it. We always hope to have the key to the next generation of biofuels or a way to protect crops against pests, and we hope that collectively we can march the field forward.”

BY AMY RALEY

GROWING NEED TO UNDERSTAND
BILOGY PROFESSOR’S WORK EARN DISTINCTION

PHOTO BY / CHARLES JISCHKE
Purdue students seeking a way to save time getting ready in the morning while checking the latest news, email and even bus schedules have created a monitor that shows relevant information to the user and acts like a traditional mirror.

The students, Timothy Vincent and Matt Molo from Computer Science, and Nick Molo, John Lee and Joshua Berg, from the College of Engineering, say the technology is designed to serve both purposes.

“When users wake up in the morning and brush their teeth, they can view information such as weather, traffic and their emails,” Berg says. “It is not meant to replace a smartphone. It’s a noble way of providing all the information in one place.”

The team produced its prototype technology, called MirrorMirror, during惫iateMakers 2014, a 36 hour hackathon at Purdue University. The students were inspired by their needs of staying updated with the bus schedule.

“We thought it would be nice to have some sort of display in the house,” Matt Molo says. “But we didn’t think people would want another monitor on their walls, so we made it a mirror.”

The team has received positive feedback at various events, including winning first place at ExhibitYIe, a computer science fair hosted by the Undergraduate Student Board of the Purdue Department of Computer Science.

“At all the events where we showed our invention, people frequently were surprised that the mirror displayed real time information,” Vincent says. “This usually was followed by comments of, ‘I want one,’ or ‘When does it go on sale?’”

MirrorMirror employs a facial recognition feature so relevant information will be displayed when the user looks into the mirror. The team also will utilize open framework development so a variety of applications will be available.

“The mirror will display general information most of the time, but when it recognizes a user it will display their information such as emails or scores of the latest game,” Nick Molo says. “With our open development platform, anyone who has the ability to build an app can do so and share it with other users. There could be infinite possibilities of how a user could personalize the mirror.”

The team continues its work as time permits. “We are currently working on optimizations to the facial recognition process, as well as custom hardware that can detect gestures,” Lee says. “We really want to see how far we can take it.”

Nick Molo says the goal is to mass produce the product, which could help cut costs. “It’s been estimated that 1.5 million consumers have some sort of home automation device,” he says. “We would like MirrorMirror to be a hub for home automation.”

Help Purdue and the College of Science remain Ever True in field-changing research, preparing the next generation of scientific leaders and creating solutions for the world’s problems, both new and upcoming.

Ever True is the rallying cry behind a new fundraising campaign announced Oct. 9 by Purdue President Mitch Daniels. The campaign’s roots extend back to 2012 but the goal of $2.019 billion to be raised by 2019, the year of Purdue’s 150th anniversary, has been set.

Daniels said the campaign “will elevate our University’s reputation for research excellence and intellectual achievement in a new era of accountability in higher education.”

The campaign is a call to action to protect and extend Purdue’s noble, land-grant assignment.

Gifts in support of the campaign will help the College of Science keep investing in well-rounded individuals, giving them opportunities to succeed both inside and outside the classroom. We encourage our students to learn beyond the classroom through programs that enhance their potential in the job market, such as volunteer work, internships, job shadowing and study abroad programs. This fall, the College of Science welcomed the largest first-year class in years at well over 1,000. There is significant momentum.

Since the Department of Chemistry produced Purdue’s first graduate — John Bradford Harper — in 1875, the College of Science faculty and students have created a legacy that has changed — and will continue to change — the world.

Purdue has been “Ever True” for almost
150 YEARS
THE GOAL: $2.019 BILLION RAISED BY 2019

HOW YOU CAN HELP
Through Ever True, The Campaign for Purdue University, we’re expanding our reach: providing a more accessible and affordable education, increasing professorships, cultivating critical research, and transforming existing buildings into 21st century classrooms. With your help, we can equip our students and faculty to change the world.
Please check out www.purdue.edu/EverTrue for more.
**BREAKTHROUGHS**

**Animated Dynamics receives $744,066 FROM NSF**

A Purdue startup has received federal funding to further develop a microscope that detects cellular motion in 3-D tissue. Animated Dynamics Inc., which was founded by Purdue professors David Nolte and John Turek, received a two-year SBIR Phase II grant in September from the National Science Foundation worth $744,066.

Nolte, who was confirmed by the Purdue Board of Trustees as a distinguished professor of physics and astronomy in July, says Animated Dynamics’ biodynamic microscope differs from traditional microscopes in several ways.

“The biodynamic imaging microscope we are developing will study a cell’s phenotype, which is the observable traits that result from how cells in tissues interact with their environment. Studying the phenotype means scientists can see how cell samples behave, mechanistically and functionally, in the 3-D environment of living tissue.”

The NSF previously awarded a six-month SBIR Phase I grant to Animated Dynamics in 2013 to develop the biodynamic microscope. Animated Dynamics licenses technology through the Purdue Research Foundation Office of Technology Commercialization. It is a member of the Purdue Startup Class of 2014.

Nolte, who serves as president of the company, has received 35 granted patents and written four books. He is a fellow of the American Association for the Advancement of Science, the American Physical Society and the Optical Society of America. He received the Herbert Neadey Mc Coy Award of Purdue University in 2005, and the Indiana MIRA Award for Technology Innovation of the Year in 2013.

David Nolte, president of Animated Dynamics, was named a distinguished professor of physics and astronomy in July by the Purdue Board of Trustees.

**600 STUDENTS competes at hacking competition**

Six hundred student hackers from 185 different schools converged on Purdue’s campus on Oct. 16-18 to compete for prizes and the attention of top technology companies during the annual BoilerMake competition.

Teams of up to four students created products or programs entirely from scratch during the 36-hour program and innovation competition. The Purdue-BoilerMake student organization raised more than $250,000 for the 2015 competition, which included prizes of up to $10,000.

Engineers from the 23 sponsor companies also were on hand to help the students and other talented prospective employees, says Marty Kaukas, a sophomore computer science major and a member of the BoilerMake organizing committee.

“This is a competition where teams create software and hardware projects from start to finish that solve important, real world problems,” he says.

The competitions lead to a rapid prototyping of ideas and are a chance to really showcase your talent. Students frequently get job offers and some turn ideas from a competition into startup companies.

Past hackers have focused on apps, websites and new software. These trends continued this year, but more than 200 new ideas and interactive, hands-on machines also were in the mix. Highlights included a candy-shooting cannon that still fooled facial recognition technology to find a target and a bomb diffusing game complete with a business and hectic LED screen counting down from two minutes.

Even more traditional creations such as websites broke new ground, ranging from a site dedicated to analyzing crime statistics in Chicago to a “Legends of Rock” site featuring animation, original artwork and information on bands including Scorpions, Pink Floyd and Guns N’ Roses.

**Purdue-related startup develops MINIATURE DEVICE FOR BIOMEDICAL ANALYSIS**

The founder of an analytical device startup based on Purdue University innovations says his company could improve point-of-care therapy diagnosis and compliance by reducing the time it takes to analyze samples by mass spectrometry.

Zheng Ouyang, president and founder of PURSPEC Technologies Inc., says the company is developing miniature mass spectrometers, which identify the type and amount of chemicals present in blood and urine samples, to speed up the analysis time.

“Traditional mass spectrometry analysis requires sending samples to a centralized location to conduct the analysis. This process can take weeks,” says Ouyang, who also is a professor in Purdue’s Department of Chemistry. “PURSPEC is trying to make a device that can be used by physicians, pharmacists and possibly the general public to do the process in minutes.”

Ouyang said the device could have an impact on developing personalized medicine plans for prescription drugs.

“Using a miniature mass spectrometer could provide a very easy way to adjust the dosage of prescription pharmaceuticals. Currently, a physician writes a prescription for a standard dosage, which may not be effective for the patient,” he says. “With a miniature mass spectrometry system, a doctor can prescribe a drug, and then the patient can take a test dosage at the pharmacy. Within half an hour, the pharmacist can measure the concentration of the drug in the patient’s blood and adjust the dosage to more appropriate levels. And if the dosage is incorrect, it could impact a patient’s compliance.”

Ouyang and R. Graham Cooks, the Henry B. Hass Distinguished Professor of Analytical Chemistry in Purdue’s Department of Chemistry, have developed several technologies to create miniature mass spectrometers.

“TRADITIONAL MASS SPECTROMETRY ANALYSIS REQUIRES SENDING SAMPLES TO A CENTRALIZED LOCATION TO CONDUCT THE ANALYSIS. THIS PROCESS CAN TAKE WEEKS.”
Call them drones. Call them aerobots or unmanned aerial vehicles. Call them part of a new, emerging field for computer scientists to propel. Call them the future.

Department of Computer Science students are on the cutting edge of programming and improving drones of all sizes and designs. Quadcopters and tricopters are the most recognizable, but plane-shaped designs are on the horizon. Freshman Christian Stewart and sophomore Harris Christiansen (below) are among the many undergrads interested in the possibilities.

“The big consumer drone makers have developed APIs (application program interfaces) for their drones so you can write software for them,” says Christiansen, an executive board member of the student organizations Purdue Hackers. “For the general market, having programmable drones is a huge step forward.”

Most drones are about the size of a laptop but others are quite small. Christiansen’s favorite of his five drones is the Blade Nano QX. The machine fits in the palm of the hand and is surprisingly durable despite its delicate appearance.

“It is so small that you can fly it into thousands of feet below. Drones are also quadcopters have mobility but limited range. They can fly for only about three to five minutes before having to land. Quadcopters are also energy drains, while planes are more suited for long distance.

Stewart recently built a drone plane that can travel two hours. “The possibilities and opportunities are endless,” he says.
One of the biggest sports scandals of the year did not include performance-enhancing drugs, drunk driving or an illicit affair. It didn’t even involve athletes.

On June 16, the New York Times reported that analytics and computer programming employees of Major League Baseball’s St. Louis Cardinals breached a Houston Astros’ database during 2014 spring training. The Cardinals claimed very little was looked at, but the violation still called for an FBI investigation. American sports fans and media pundits were rankled.

Why was this a big deal? Money and competitive edge. Zach Hass (right), a graduate student in the Department of Statistics, sees such databases as a gold mine for professional sports teams. Huge data sets are being used to gain any competitive edge. Every pitch in baseball is scrutinized. Every down in football is dissected. Even the positioning of basketball players on the court is recorded and broken down by fractions of a second.

“Teams are very much trying to find the numbers that explain the players better than what the other teams are using,” Hass says. “Data can be expensive — collecting it, organizing it. Any time you have something someone else doesn’t have, you would like to hang onto that advantage.”

Recently, Hass co-authored an article in Chance magazine, which is published by the American Statistical Association and Taylor & Francis Group, with statistics professor Bruce Craig and then-senior Sean McCabe, who is now a graduate student at the University of North Carolina, “Easy to Criticize, Harder to Verify: Fourth and Goal” looked at overtime coaching behavior in recent seasons of National Football League games.

Before a rule change for the 2012 season, sudden death overtime games were won 64 percent of the time by the team that won the coin toss (between 2004 and 2008). Often, these victories were gained by a quick field goal. Now, a team that gains the field goal has to get back on defense. The opposing team has a chance to tie or earn the victory.

So what is a coach to do, especially in fourth and goal situations on that first overtime possession? Hass, Craig and McCabe found that coaches lucky to have teams good at converting fourth downs have a higher chance to win if they go for the touchdown at the one- or two-yard line during that first overtime possession. A field goal has a greater chance of resulting in a loss or tie.

The authors analyzed every game in the 4 years by using a Markov model, which looks at randomly changing systems where it is assumed that future states depend only on the present state and not on the sequence of events that precede it. The plays before are not as important as the plays that are going to happen.
"DATA CAN BE EXPENSIVE — COLLECTING IT, ORGA
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Second-guessing a coach's decision is a Monday morning quarterback's job. However, Hass, Drajc, and McCabe's model showed how it can be made into a tool to rewrite the rules of watching the play and writing down what happened," says Gerber. "Even to this day, if you look at a box score, there is a slight decrease in the probability of a win, and the probability of a tie is almost tripled."

Before Moneyball

Using a scientific, numbers-based system for evaluating a player's talent was brought to the mainstream audience in 2003 book Moneyball and the 2011 hit film of the same name starring Brad Pitt and Jonah Hill. Eric Gerber (below), another Purdue Statistics graduate student, says the notion goes back to the early '90s. Herzberg discovered that the statistics he uses were first integrated into a baseball team's database by the Houston Astros database was a controversy. In academics, you come up with a method or procedure or way of doing something and you share it. Maybe you'll write codes that other people can use. In sports, you want a competitive edge. You come up with a better way to evaluate talent or a way to evaluate performance or to strategize or optimize your lineup, you keep it to yourself," says Hass. "You need that advantage. You don't get to share it with anyone."

"The thing you hear about statisticians working in sports is that it can get rather lonely because you're not allowed to share what you're doing."

WAR: WHAT IS IT GOOD FOR? ABSOLUTELY EVERYTHING.

Gerber and Hass see several current trends in baseball. It tracks player positioning. Using high-definition cameras timed and stoppages are less frequent — a new data set is on the rise that deals with soccer and hockey — where the action is usually fast in contrast to the more sanitized big data for sports like basketball, where the speed is dwindling. Coaches still have a role. Numbers are becoming more important, but you still have to play the games. "Hopefully they will be doing a better job of maximizing their ability to remove a bad luck," says Hass, who compiles statistical data for Purdue football, volleyball, and men's and women's basketball. He also keys in live updates from the games for fans checking online for game updates.

Big Data, Big Money

Any sports fan with calculators could fancy themselves statisticians, but with growing data sets and more sophisticated ways to present the data, experience in a statistics program like Purdue's is helpful. Hass says having experience managing data in large sets, distributing computing, creating different models to present and organize data, and communicate it to non-technical audiences is crucial skills to have in professional sports analytics. Hass says data sets these days are known to weigh in at the terabyte level.

"The challenge is to make them more digestible and easier to understand the output," he says.

But statistical trends are not limited to professional athletes. While high school and college athletes are behind the pro in terms of big data sets, mainly due to cost and effort to make sense from it, Gerber says scouting and analytics departments are "intervened. Hass and Gerber expect more big data sets will be collected for high school and college athletes to ready them for a potential draft day.

"Scouts collect information that is not available through the high school or college." Gerber says. "Eventually, they will have mobile, high-def cameras to go with the scouts."

Gerber and Hass foresee more relevance and importance on large data sets in professional sports. There is also the statistical expansion into fantasy sports. Companies that run fantasy leagues employ statisticians and their own methods to evaluate and rank every player. In 2014, Forbes declared fantasy sports an $800 million industry. That number should continue to rise with the help of new statistical codes for player evaluations.

The importance of large data sets and the men and women who can make sense of them will increase as well. And protecting the contents of player databases will become even more important than protecting the personal ones. "I would expect if people get caught, we'll be hearing about it a lot more," Hass says. "I have doubts it's never happened before the Cardinals. People have been looking for a competitive advantage for a long time."

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By Tim Brook

It’s no surprise that courses are using online components at Purdue. What may be surprising, though, is that one of the areas leading the way at Purdue is the Department of Mathematics.

MATHEMATICS IS THE DEPARTMENT AT PURDUE ONE OF THE AREAS LEADING, THOUGH, IS THAT WHAT MAY BE SURPRISING COURSES ARE USING IT'S NO SURPRISE THAT while reducing costs Online platform personalizes learning while reducing costs. The early Internet was used for students to develop more active classroom environments by leveraging the online classroom to develop more active classroom environments by leveraging the online classroom. The latest version, for example, makes it easier for fractions to be seen as if they were handwritten in traditional pencil-and-paper form. While tweaks will be made with each semester, the system is already popular among students. “They really like the videos and the e-text is a simpler version than what other e-textbooks offer,” Delgado says. “One student said it was the best online course he has taken and it was his fourth time taking a calculus class.”

“With LON-CAPA, we now can build a system that serves as the textbook, the online course and a framework under which to develop more active classroom environments by leveraging the online materials instead of lecturing,” Wiles says.

“We have already met with Purdue Student Government leaders about the use of LON-CAPA in other courses, as well as with faculty in statistics, industrial engineering and mechanical engineering. I think a lot of instructors — including those at other universities — look at the math courses developed at Purdue as a benchmark of what can be done in this platform.”

“Instructors like Huimei Delgado are able to create their own math problems from scratch. Faculty also can upload graphs and videos, which students find especially useful. “Everything is in one place,” she says. “It has a very powerful course management capacity. We were able to do online testing for students away from class.” Delgado and other faculty who teach algebra, calculus and other introductory math courses say textbook publishers seem to produce expensive new editions every year, often with minimal changes. That added up to greater costs for students and more prep time for instructors to revive their syllabi, lectures and homework problems. It was time to go digital.

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The project I took part in last summer is part of a larger water resources and purification project within Purdue’s U.S.-China Ecopartnership for Environmental Sustainability (USCEES) that began in 2014. I learned about this opportunity from Professor Timothy Filley, whom I work for during the academic year. This was my first visit to western China and the second visit by Professor Chad Jafvert, who leads the slow sand filter water purification project with collaborators at Qinghai Normal University. Together with Professor Filley, director of the USCEES, and professors Lin Yang and Jiyuan Lan from Qinghai Normal University, the project was initiated by assembling six sand filtration units in rural homes in the Huzhu city region. During our visit in 2015, we went back to the Huzhu villages to evaluate the status of the slow sand filters installed in the previous year and discuss future plans for projects.

Slow sand filters are a traditional type of municipal water filtration system that provide inexpensive water purification for rural communities. The sand filter can be built locally and easily by placing a porous media layer in the bottom of a pail and placing sand on top of the porous media. Each unit of the filter consist of two 5-gallon pails, which can be purchased locally in Xining.

As water flows downward through the sand, slow sand filters rely on natural, microbial-driven processes to break down dissolved and colloidal organics that cause water turbidity. The microbial activity requires the water to be retained in the filter for generally four to eight hours of treatment time. Each filter unit can treat up to 30 liters of water per day.

Huzhu city is located in the north of Xining. The two villages we visited were Jia Jia Ling and Lian Da. These rural villages are high in the mountains, with no tap water nor surface or groundwater. People in the villages used to collect rainwater and store it in their underground cisterns. However, the water in the cisterns often appeared to be turbid and colored due to contamination.

On July 22, Professor Jafvert and I revisited the two villages, accompanied by Qinghai Normal faculty. We found that the government agency had installed tap water for all the rural homes in Huzhu city region in February 2015, which was seven months after the filters were installed in July 2014. The government agency also provided subsidized housing for Huzhu villagers. Thus, more than half of the families relocated away from the mountain region to get access to tap water. We contacted two of the families that had installed filters in the previous year and were still living in Lian Da and Jia Jia Ling villages. By talking to the home owners, we learned that the slow sand filters largely improved the clarity and taste of their water. They were very satisfied with the filtered water quality, and they would still be using the filters if they did not have the tap water.

This research trip to China was an incredible and inspiring experience for me. I got to participate in every detail of the research process and work with faculty from both universities. During the visit, Professor Jafvert took the opportunity to discuss research with several colleagues in China. I tagged along and listened to their discussions about various kinds of research topics such as fluoride removal for drinking water and constructed wetlands research. Aside from gaining knowledge, I also experienced the unique culture of western China. We visited some of the famous local tourist sites and were amazed by the beautiful views. In future trips, we will have to find other rural villages as demonstration locations, but generally speaking, the slow sand filter project was a success.
Sweet skateboard tricks: kickflips, ollies and primo grinds. Basic physics: friction, momentum and force. To a skateboard­
ing physicist like Darryl Masson, such concepts are tattooed
in his brain.

A graduate student in Physics and Astronomy Professor Rafael Lang’s lab, Masson began skating in his childhood home
city of Calgary, Canada. He yearned to perform tricks made
famous by the likes of Tony Hawk, Rob Dyrdek and Arto Saari.
But after a few injuries, he changed to a different type of board.
While attending Walla Walla University in Walla Walla, Washington, Masson switched to longboards, a popular mode
of transportation for college students. At Purdue, dozens of
longboards can be seen cruising around campus when the
weather is good. The longboards are heavier and, yes, longer
than the more traditional, X-Games counterparts.

“The larger wheels make the cracks in the sidewalk a
little more comfortable to go over,” Masson says. “A longboard
is easier to control at higher speeds.”

These concepts and all manner of skateboards collide in
Rad Science, a traveling, Tony Hawk-approved exhibit showing
now through Jan. 3 at the Indiana State Museum, 650 W.
Washington St., Indianapolis.

When the exhibit opened in September, Masson made the
media rounds, explaining the scientific side of skating. Here
is a taste:

“Whenever you go to turn a corner, there are a couple
things in play: Momentum is trying to keep you going in a
straight line, you’re acting against friction between the wheels
and the ground, you lean on one side of the board and it warps
the board a little. It changes the orientation of the axles. How
much you lean is dependent on how fast you are going and how
sharp of a corner you want to take.”

“If you’re going too slow, friction wins the battle, if you’re
going too fast, momentum wins the battle.

“When you’re going very quickly and your board is very
light, the slightest bump can send your board in a direction
where the rest of you is not going. You will then have what I
like to call an out-of-board moment, which usually ends very
abruptly when you reach the pavement.”

Masson’s work this semester has included calibration of
a neutron generator for the XENON1T experiment at the Gran
Sasso National Laboratory in Italy. The experiment seeks the
discovery of dark matter.

Nestled within the museum, Rad Science is a sleek,
multimedia experience with several hands-on and feet-on
features. Balance on a board, control a slow motion digital
skater or check out the trucks of a 60-year-old skateboard.

According to Traci Cromwell, director of collections for
the State Museum, Friction Hill is the most popular feature
for kids in Rad Science. Inclines of different surfaces challenge
little feet to climb up fast enough to touch a button. The kids
run along a rough surface, linoleum-like surface and an
extremely slick surface. (Hint: The rough surface lane usually
wins.)

“The more you can engage them, immerse them in what
you are trying to convey, the better they pick it up, the more
they want to get involved and the more they learn,” Cromwell
says.

Thousands have seen the exhibit so far as Rad Science
hits a multigenerational demographic. Parents who grew up
fans of Tony Hawk during the skateboarding craze of the 1980s
or the X-Games of the 1990s now have children old enough to
appreciate and feel passionate about skateboards.

Cromwell says Rad Science is a good way to get a scientific
exhibit into the museum, as science is one of the museum’s
top priorities.

“We do science-based exhibits because that is a core part
of our collection and the history of Indiana,” he says. “There’s
a lot of science behind the history of our state.”
"It was a good transition for me. It prepared me for my role here and was a good bridge to refining my interests," he says.

Blair says changing to a business school from the College of Science was an interesting experience, but the attention to detail and maximum effort he picked up during his time at Purdue helped make the transition smoother. He credits classes and mentoring from Statistics professor Mark Ward and others in the transition.

In middle school and high school. "I think I even still have myTI 83 from high school calculator," Blair says.

Today, Blair has gone back to his roots. After earning his mathematics degree from Purdue in 2013, he received a graduate degree in business analytics from University of Tennessee and started his career at Texas Instruments’ Dallas office in summer 2015.

Although calculators are what generations of math students associate with the company, Texas Instruments is a multinational engineering and technology enterprise that makes microchips and processors to fuel much more powerful machinery. Yes, calculators are still made, but are merely a fraction to fuel much more powerful machinery. Yes, calculators are still made, but are merely a fraction of what the company and its 30,000 employees worldwide produce.

Blair was hired as a customer intelligence analyst and market research project manager. He made the switch from math to business in graduate school.

Blair got the TI job after meeting recruiters at the National Black Master of Business Administration Association in Atlanta, Georgia. He and some University of Tennessee colleagues were in a case competition, and his work got his resume to the right people.

For Blair’s first few months at TI, he met with engineers and learned the details of the business side of the company. His team supports multiple groups across TI by using research to help them understand the motivations and needs of the company’s engineers, customers and employees. It’s all adding up to a successful career start.

“It’s just fascinating to see how it all comes together,” Blair says. ‘There’s always lots to learn. I’ve barely scratched the surface, which is cool. There’s a lot going on here.”

Festival. Before moving to Austin in 2014 to fill his current role at the University of Texas as a course program specialist at the Charles A. Dana Center, he served as a science education specialist for a Seattle-based education startup called Exo Labs. Within the next five years, Shaver hopes to obtain his educational administration certification and be on a road to becoming a school principal or a community leader in STEM education.

Brandon E. Davick [BS ’03, Chemistry], Bellmont, MD, served as an analytical chemist for the U.S. government during a 10-month deployment in summer 2014 aboard the MV Cape Ray, which was tasked with the destruction of EOD metric tons of Syria’s chemical weapons stockpile at sea. His responsibilities included identifying declarer ed chemicals, verifying the destruction criteria were met and operating the system used for the destruction. Davick is a senior chemist with the Environmental Monitoring Lab, Directorate of Program Integration, at the Edgewood Chemical and Biological Center in Sunnyside, MD.

Clayton H. Slaughter [BS ’03, Biological Sciences], Bloomington, IN, recently became the chief operations officer and senior counsel of Platform 39, Inc., a technology company transforming lighting through innovative hardware and software applications that improve productivity and comfort, beauty and environments and conserve energy. Slaughter earned a Juris Doctor degree from the Indiana University Maurer School of Law (’05) and a PhD in higher education administration from Indiana University Bloomington (’14). Slaughter is also a managing partner of Slaughter & Slaughter Attorneys at Law PC, where he focuses on the areas of corporate, transportation and technology law.

Ryan Thomas Crytzer [BS ’06, Mathematics], Panama City, FL, earned a scientist position in the Applied Energy Environments and Conservation program in the Department of Energy. Slaughter earned a science and engineering degree from the University of Oklahoma, Norman, OK, and the National Science Foundation’s Science and Technology Center for Coastal Margin Observation & Prediction before going to the University of Oklahoma, where he has developing a one-of-a-kind position and office called Broad Impact Officers in Research. Prompted by the NSF, the development and implementation of Broad Impact offices are on the rise at institutions across the nation. Thompson’s office builds upon and is a culmination of the best practices in Broader Impacts.

Michael E. Thompson (PhD, Chemistry), Norman, OK, worked at Dragon Health and Science University, the Institute for Environmental Health, and the National Science Foundation’s Science and Technology Center for Coastal Margin Observation & Prediction before going to the University of Oklahoma, where he has developing a one-of-a-kind position and office called Broad Impact Officers in Research. Prompted by the NSF, the development and implementation of Broad Impact offices are on the rise at institutions across the nation. Thompson’s office builds upon and is a culmination of the best practices in Broader Impacts.
IN MEMORIAM

Rodney D. Steinmetz
May 4.

IN MEMORIAM

Robert N. Windsor
BS '55, Science), Bethesda, MD, Aug. 18. He is survived by his wife, Belinda (PhD '74, Biological Sciences).

Robert Bullock
MS '63, Mathematics), Venice, FL, June 5.

Peter J. Jebuoch
BS '69, Science), Rockville, MD, Jan. 25. He is survived by his wife, Carol (MS '77, Statistics).

Barry Joseph Potkin
PhD '72, Biological Sciences), Thousand Oaks, CA, Jan. 18. He is survived by his wife, Susan.

Robert H. Windsor
BS '55, Science), Renzo Santa Margarita, CA, Jan. 15.

Joseph E. Bekins
BS '57, Natural Science Teaching), Salem, OR, March 4.

Robert Bullock
MS '63, Mathematics), Nipomo, CA, Feb. 19.

Horton G. Kimmel II
BS '84, Biological Sciences), Shelbyville, KY, Feb. 25. He is survived by his wife, Sharon.

Dale E. McCauley
BS '53, Mathematics), Venice, FL, June 5.

Peter J. Jebuoch
BS '69, Science), Rockville, MD, Jan. 25. He is survived by his wife, Carol (MS '77, Statistics).

Barry Joseph Potkin
PhD '72, Biological Sciences), Thousand Oaks, CA, Jan. 18. He is survived by his wife, Susan.

William G. Coleman Jr.
PhD '73, Biological Sciences), Bethesda, MD, Aug. 18. He is survived by his wife, Belinda (PhD '74, Biological Sciences).

Robert C. Lindemann
BS '73, Biological Sciences), Rock Hill, SC, Feb. 18. He is survived by his wife, Deloris.

Curtis J. Montgomery
BS '82, Biological Sciences), Nappanee, IN, Nov. 26.

Gerardo J. Huirre
BS '85, MS '89, Earth Sciences), New York, NY, March 12.

Peter Michael Saya
BS '74, Biological Sciences), Fort Wayne, IN, Jan. 10.

IN MEMORIAM

C. Austin Sprang
PhD '41, Chemistry), Hamilton, OH, Sept. 27, 2014.

Anna D. (Ramsey) Wolf
BS '42, Science), Walnut Creek, CA, Dec. 26.

John R. Bessa
BS '47, Physics), Columbus, NC, May 4.

Walnut Anna D. (Ramsey) Wolf
Sept. 27, 2014.

IN MEMORIAM

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The Big Picture

Professor Alton A. Lindsey, a Department of Biological Sciences legend and part of Admiral Richard E. Byrd's second expedition to Antarctica, was a driving force for the Purdue ecology program. He passed away in 1999, but his legacy will be forever remembered in a new painting by Gabriela Sincich, wife of biological sciences professor Esteban Fernandez Juricic. This portrait of Alton and his wife, Elizabeth, will hang in a new education center at Ross Biological Reserve, founded by Lindsey and home to his research.

[Photo by Tim Brouk]