The Purdue College of Science K-12 Outreach Program added an Augmented Reality (AR) Sandbox to its toolkit. A high resolution projector shines topographical imagery onto the sandbox, and the colors and textures change as a student or teacher moves the sand. The movements can create lakes, mountains, volcanoes, rainstorms and other features (see “Child’s Play” on page 24).
GREETINGS FROM WEST LAFAYETTE,

The core or heart of any institution or organization is its people. They are the ones who fulfill the mission and affect life changing impact. It has been a great privilege for me in my short term as interim dean to get to know more fully the great people in our College of Science. They are the college. It is our faculty and staff who equip and assist our students from across the campus to achieve the bright promise of their youth. And of course students are our raison d’être as an educational institution. Collectively, it is our people that make your College of Science such a special place. This is why we are so pleased that this issue is focused on providing you with greater insight into the lives of our people.

In this issue of Insights, we explore and document how packed and hectic a “day in the life” is for College of Science faculty members and students. From the moment they devour breakfast or finish walking the dogs, they are thinking, researching, learning and teaching cutting edge science and mathematics. We follow these men and women into the classroom, the lab, the meeting room and the much needed coffee break.

This summer, we were glued to our televisions and mobile devices watching the Olympics. I am proud to report that alumna Amanda Elmore was a member of the gold medal winning U.S. women’s rowing team. Her performance was amazing and she has come a long way from a走 on freshman for Purdue Crew. Elmore balanced her Biological Sciences studies with rowing and achieved tremendous success in both fields. Elmore is currently a biomedical sciences graduate student at University of Michigan.

The resurrection of virtual reality as well as smartphone apps like Pokémon Go’s amazing popularity has made the Computer Graphics and Visualization track a popular choice for students. Professor Daniel Aliaga helps lead a program that expertly teaches the back end, or how the graphics work, as well as methods to make those algorithms look so good.

We also take you to CERN — always the hub of the next discovery in particle physics — and the tops of Ecuadorian volcanoes. Sheridan Ackiss, a graduate student in the Department of Earth, Atmospheric, and Planetary Sciences, is studying ancient Martian volcanoes thanks to NASA imagery. She is comparing some of Earth’s most impressive volcanoes with what she has learned from those under the ice on Mars.

These and other untold stories are the reason our College of Science has such a bright future. Though the challenges facing higher education are substantial, I am very confident that our people will effectively take on these challenges and seize the opportunities that lie before us.

CRAIG SVENSSON
Interim Dean of the College of Science

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Statistics student takes aim at Intercollegiate Rifle Club National Championship

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Yoga, laboratory research, audiobooks, lectures, coffee, community service, caring for young children and the ukulele — all find a place in the rhythms of work, learning, fun and other duties for several College of Science faculty and students. In this issue of Insights, they share the sometimes surprising details of one day of their lives.
By Tim Brouk

Yoke is a senior member of the Purdue Rifle and Pistol Club, which placed second overall in the 2016 National Rifle Association’s Intercollegiate Rifle Club National Championships. He is also a stellar statistics major who already has a job as a systems and data analyst for an agency that serves Harley Davidson and MasterCraft Boat Co.

Since Yoke joined the team, the Purdue club has finished in the top four at nationals. Of course, Yoke keeps statistics for the team and helps with statistics for the Western Intercollegiate Rifle Conference.

“Being a statistician and mathematician, I’m very analytical,” Yoke says. “That’s what I do and love, and that’s how I was drawn to the sport. I love running rifle numbers. … I am able to predict people’s scores throughout the year and get a good idea who is on the team and who’s not, because you only get to choose five team members of the 10 to shoot for the team score.”

Yoke and his teammates compete in a sport that had the media spotlight during the Summer Olympics. Virginia Thrasher, then only 19, was the first gold medalist of the games in Rio de Janeiro for her skills in the women’s 10 meter air rifle event. She shoots for the West Virginia University team during the school year.

Like Thrasher, Yoke takes aim with a smallbore rifle. Yoke’s Anschütz rifle is an expensive piece of equipment that shoots bullets that leave clean, precise holes on paper targets 50 yards away. A typical competition sees Yoke firing 60 shots, each shot being scored from 1 to 10 points.

The sport of rifle shooting includes much more equipment than the rifle and pellets. Yoke suits up in thick, heavy protective pants and jacket. A padded glove is worn on his left hand as it delicately cradles the gun. Special boots offer flat, rubber soles for maximum grip and balance. All of this is extensively checked by judges before competition, as the slightest edge could mean a slightly improved shot, which could mean big points.

“Even the thickness of our underwear is checked,” Yoke laughs. But he is serious. The sport demands preciseness in all facets.

Precision shooting, which is what the Summer Olympics sport is all about, has many different categories and classes, including rifle and pistol.

There are different positions and combinations in precision shooting. Some shooters concentrate on certain positions while others compete in “three position,” which includes shooting from standing, kneeling and prone positions.

The Winter Olympics biathlon combines cross-country skiing and three position. Being from Florida, Yoke has competed in a biathlon that combined running and shooting. “I can say that’s pretty difficult,” Yoke says.

The Purdue Armory is home to one of the largest collegiate indoor shooting ranges in the nation.

Photos by / Charles Jischke
DAY IN THE LIFE

By Tim Brouk

They wake up. They fall out of bed. They drag combs across their heads.

Then they dive into world-changing research. They educate the next generation of scientists and mathematicians, and they excel in classes designed to help them go far in industry or academia.

They are Purdue College of Science students and faculty members, and these are one day in their lives.

Their days are packed with classes, meetings and hours in a lab. Days are full of homework and face time with job recruiters on campus.

You better believe they find their way downstairs to drink a cup or three.

Exercise Leisure/ Meals Other Research/ Sleep

You better believe they find their way downstairs to drink a cup or three.

Lisa Welp
Assistant professor of Earth, Atmospheric, and Planetary Sciences

Welp spends most of her time teaching, writing grants and papers, advising students and overseeing her lab. The activities of her two young children take up most of her non-work time, but she fits in a seven-minute-workout a few days a week, often with her 4-year-old daughter.

Cedric D’Hue
Chemistry graduate student

D’Hue is a patent attorney pursuing a PhD. He sometimes listens to audiobooks or podcasts at one-and-a-half speed during spare moments of the day. He always makes time for his wife and four young children through meals, play time and preschool pickup and drop-off.

Nicole Biddingrner
Biological Sciences senior

Biddingrner is the vice president of Purdue’s Science Student Council, a tutor for the Women in Science Program, a Science Ambassador and a “Head in Success” volunteer in a first-grade classroom. In addition to her service, coursework and research, she stays sharp on the ukulele.

Brody Conner
Physics and Astronomy freshman

It didn’t take long for freshman Brody Conner to get established in the Department of Physics and Astronomy. Within the first few weeks of his Boilermaker career, he joined the Society of Physics Students, the Astronomy Club and Physics Outreach. He’s a regular at the Society of Physics Students Lounge on the second floor of the Physics Building. He’s also a representative in Purdue Science Student Council.

“I’ve wanted to do physics since my freshman or sophomore year of high school,” Conner says. “I think it’s the fact that you’re able to define what goes on in the universe around us. I want to know everything that happens.”

While taking 19 credit hours, Conner somehow manages to squeeze in games of racquetball at the Córdova Recreational Sports Center and practice his baritone singing for his next jam with a barbershop quartet he joined while at the Indiana Academy in Muncie, Indiana.

Conner is already thinking of a study abroad opportunity in Tanzania, and he has his first show with one of Purdue’s improv troupes, Ad Liberation, all before midterm exams.

- 8:15 a.m. – Conner wakes up and gets ready for a full day of classes. He usually skips breakfast.
- 9:30 a.m. – Physics 172 Honors is first in the morning in a large lecture hall in the Physics Building. A PowerPoint slide displaying “Modern Mechanics” is already on the huge pull-down screen.
- 10:30 a.m. – Conner hoofs it over to the Herbert C. Brown Laboratory of Chemistry for a chemistry recitation, where he is greeted with a quiz. It was on nuclear chemistry.
- 1:08 p.m. – Conner takes a late lunch of some chicken curry, rice and pasta at Earhart Dining Court.
- 3:42 p.m. – Although an elective, Conner finds his anthropology class in Wetherill Laboratory of Chemistry extremely interesting.
- 5:45 p.m. – Conner returns to his dorm for dinner with his roommate.
- 7:45 p.m. – Conner returns to his dorm for dinner with his roommate.
Shi Choong's story starts in her native country of Malaysia, where she grew up speaking Mandarin Chinese and Malay across from a market where the screams of chickens being plucked alive woke her up every morning.

She was raised by hardworking parents who saw no need for education. Her father is illiterate and her mother has a second-grade education. Choong enrolled in science classes and went on to earn an undergraduate degree in chemistry from San Francisco State University. After working for pharmaceutical companies, Choong decided to continue her education and is pursuing her doctoral degree in chemistry at Purdue.

- **6:15 a.m.** — Choong is a morning person. She downs a glass of water before making her lunch. On today’s menu are bell peppers stuffed with quinoa, mushrooms, cilantro, black beans, tomatoes and cheese.
- **7:24 a.m.** — At the Córdova Recreational Sports Center — the Co-Rec — Choong works up a sweat before going into the lab. She rocks the elliptical before pumping some iron. “For me, working out in the morning is very important because it gives me the energy to get started,” Choong says. “It makes me feel peaceful and happy.”
- **8:16 a.m.** — Choong goes to the fourth floor of Brown Laboratory of Chemistry to check into the lab of Shelley Claridge, an assistant professor of chemistry and biomedical engineering. Claridge and Choong are collaborating on a project that uses phospholipids, similar to those found in the cell membrane, as building blocks for new interfaces tailored to stick to or repel other surfaces. Traditionally this has meant water-repellent windshields and backpacks, but that’s just the beginning.
- **10:30 a.m.** — Choong measures her graphite samples to see how many phospholipid molecules are swimming on the surface. She needs to get a uniform number on several different surfaces. That’s a tough task, but her lab is equipped with Langmuir troughs to help. “Right now we’re at 54 square Angstroms per molecule,” she says. “That’s the best packing density to optimize the transfer.”
- **11:38 a.m.** — Choong heats her lunch and eats in her office, as there is much work to be done.
- **2:29 p.m.** — After a check-in with Claridge, Choong goes down to the third floor of Brown to the Amy Facility for Chemical Instrumentation. In the cavernous room, a suite of high-resolution microscopes awaits. Choong loads her samples into an atomic force microscope so she can examine the surface coverage. Like an atomic scale version of reading Braille, the microscope raster a sharp probe back and forth across the surface, feeling out individual rows of molecules.
- **6 p.m.** — In a conference room within the Roland G. Parrish Library of Management and Economics in the Krannert Building, Choong helps lead a meeting of the TEDxPurdueU committee as assistant director. The big event isn’t until March 25, but the organization puts on smaller talks and other events throughout the academic year.

With wild gesticulations and often jogging in place while extolling the virtues of data analysis or probability, it’s easy to see why Mark Daniel Ward, associate professor and undergraduate chair of the Department of Statistics, is a popular and busy faculty member.

He exudes enthusiasm that his students absorb, even during 7:30 a.m. classes.

Ward is a pioneer of living-learning communities within the College of Science. He received a $1.5 million, five-year grant from the National Science Foundation to form a learning community for sophomores studying statistics. Students are roommates, classmates and colleagues. Classes are full of group interaction and one-on-one discussions with Ward.

While his research focuses on probability theory and asymptotic analysis, working with an eclectic mix of undergraduates has become a passion for Ward.
As a resident assistant for Hilltop Apartments, Gunawantha “Guna” Kondapaneni has balanced residential life leadership and computer science studies for three semesters.

Walking around his building, Kondapaneni already knows most of his 39 residents, or at least knows of them. There are a reclusive six he hasn’t met yet but is sure to soon, as the outgoing young man is always out and knows someone everywhere he goes.

9:09 a.m. – After stretching and bemoaning sore muscles from carrying deflated inflatables around after the weekend’s Hillapalooza, Kondapaneni embarks on a jog around Purdue’s hilly north campus.

Noon – After catching up on some studying, Kondapaneni attends his music appreciation class inside spacious Matthews Hall, Room 210. The course is an elective that was a late addition to his semester.

Fellow CS junior Ryan Davis is in the class, too. He met Kondapaneni in a freshman learning community years ago. “Sometimes I feel like he knows more people on campus than most of the professors combined,” Davis says.

1:30 p.m. – Kondapaneni goes a floor up in Matthews Hall to attend cryptography class with Professor Samuel Wagstaff. The Department of Computer Science is a national leader in cybersecurity, and Wagstaff helps train the next generation of software engineers who will help keep credit cards and Social Security numbers safe.

3 p.m. – Kondapaneni stops in at the Lawson Commons in the Lawson Computer Science Building to meet recruiters from Salesforce, a cloud computing company headquartered in San Francisco. With a resume in hand, he has a great conversation and hopes he is planting the seed for an internship opportunity.

Meeting recruiters from industry every week has been a perk with his computer science experience at Purdue. “We have all the chances in the world to talk to companies and get to know people,” Kondapaneni says. “It’s really cool that they’re just hanging out here. It’s very informal and they like talking with you and meeting you. Just asking them questions and getting to know them, I like doing that a lot.”

4:39 p.m. – With his RA hat on, Kondapaneni helps his Hilltop colleague Kate Parsons get her parking pass situation cleared up.

5:45 p.m. – Kondapaneni returns to campus to meet up with some friends for dinner at Windsor Dining Court. Although Hilltop offers apartment-style living, he still uses several swipes a week for meals.

8:30 p.m. – Kondapaneni attends a Hilltop council meeting with some of his residents before cracking open an avoided book. “I will read up on operating systems before the end of the night. That has to happen,” he says with (mostly) confidence.

8:09 a.m. – Lyon lives in a quaint house in Lafayette near Columbian Park. Her favorite part of the morning is walking her two small dogs, Poppy and Murphy, before heading to campus. Murphy is 15 years old and has been with Lyon through many academic achievements.

“He was a graduation present when I got my bachelor’s degree (in biochemistry from the University of Texas),” she says. “He has moved across the country and witnessed all sorts of events like a PhD defense and getting a faculty position.”

8:39 a.m. – Lyon’s laboratory consists of “a little army” of five graduate students, eight undergraduates and a technician, and it is running smoothly today.

11 a.m. – Lunch is in her office while going over slides for her upcoming lecture.

Noon – In Wetherill Laboratory of Chemistry, Lyon leads a small chemistry lecture to mostly graduate students and a few high-achieving undergrads.

1:32 p.m. – Lyon makes another sweep of the lab. The student researchers are buzzing around.

2:03 p.m. – On her way to run an errand at Lilly Hall of Life Sciences, Lyon stops in at LaArza inside Marriott Hall. This coffee stop is halfway between Wetherill and Hockmeyer, the buildings where she spends the most time. An iced coffee with cream and a lemon twist pastry later, she is ready to cross State Street and tackle the biological sciences side of her work.

2:11 p.m. – Lyon swings by the Department of Biological Sciences main office in Lilly Hall to contribute to a discretionary fund set up for sick colleagues and their family members.

2:28 p.m. – Lyon runs into graduate student Jozlyn Clasman, on whose preliminary PhD committee Lyon sits. The professor shares some encouraging words for the young scientist preparing for her candidacy exam.

2:43 p.m. – Numerous biochemistry and structural biology faculty members share a sort of locker room of crystallization samples on the third floor of Hockmeyer. Each professor has three cabinets full of stacked trays and wells. A pair of high-powered microscopes allows these researchers to check on specimens regularly.

“I was just looking to see, ideally, if there were protein crystals there. That’s the Holy Grail,” Lyon says.
Microsoft’s Station Q includes an internal team of theorists, four satellite Station Q experimental groups, including Station Q at Purdue, and two satellite Station Q theory teams working in close collaboration.

Mathematician and Fields Medal winner Michael Freedman leads Microsoft Station Q, which he describes as a grand international collaboration spanning engineering, physics and computer science, with each partner bringing unique expertise to the table for a new quantum technology.

“Microsoft is in the quantum game for the long run, we are investing in the scientific and engineering foundations,” he says. “Mike Manfra comes from the world’s finest tradition in materials growth — having early training at Bell Labs — but what really makes him stand out is that he is also a transport physicist and truly understands the fact of life and try to correct for the errors Manfra says.

The collaborative nature of the Station Q teams is like a virtual Bell Labs where groups with expertise in theory, measurement and materials come together as one team to explore the potential of new scientific territory,” Manfra says.

Manfra’s team uses a molecular beam epitaxy – or MBE, built to create special, ultra-pure materials necessary to explore new physical states and phenomena. He and his research group use a molecular beam epitaxy system to grow single-atom-thick layers of different materials in a perfectly aligned crystal lattice. Different combinations of materials and variations in the order of layers yield different properties.

Manfra’s team uses a molecular beam epitaxy system to grow single-atom-thicknesses of different materials in a perfectly aligned crystal lattice. Different combinations of materials and variations in the order of layers yield different properties. The ultra-pure materials allow electrons to interact in unusual ways, providing insights into exotic electron phases and fundamental physics. (Molecular from a diagram by Pam Burroff-Murr)

Microsoft is pursuing.

Topological quantum computing protects qubits from noise because the quantum information is stored in a single spin or ion, but rather in the inter-relation of correlated electrons. This type of qubit is less sensitive to the typical sources of noise found in solid-state systems, he says.

For the Station Q at Purdue project, Manfra collaborated with research engineer and graduate student Geoff Gardner to design a new MBE system that grows hybrid semiconductor and superconductor materials.

“This is new territory, and while it will be a challenge to create these hybrid materials, it is very exciting,” Manfra says. “There exists a relationship between strong spin orbit coupling — which semiconductors produce — paired with a superconductor’s ability to create coherence between electrons will lead to the exotic electron phases we want.”

Each of the materials is grown under different conditions that are sometimes at odds, and the new MBE has a variety of components that allow for flexibility in the growth process, he says. In addition, his team is developing new processes to enhance the compatibility of the different materials.

Stations’ support and freedom to study the fundamental physics that must be understood to achieve a topological quantum computer offers a rare opportunity, Manfra says.

“With literally the entire world of individual talent and institutional partners to pick from, Microsoft chose Purdue and these brilliant researchers.”

— Purdue President Mitch Daniels
By Tim Brouk

AS THE DEPARTMENT OF COMPUTER SCIENCE CONTINUES TO EXPAND TO NEARLY 1,500 UNDERGRADUATE AND CLOSE TO 400 GRADUATE STUDENTS, ONE TRACK HAS BEEN GAINING POPULARITY.

The Computer Graphics and Visualization program courses cover topics ranging from advances in 3-D printing to creating algorithms for programs used by city planners, architects, scientists, game designers and graphic designers.

All of the subjects covered by the program touch on growing and lucrative fields, but strapping on a pair of Oculus Rifts or coming up with the next Pokémon Go is especially alluring to students like Gen Nishida. A computer science graduate student, he knows good graphics when he sees them.

“The result of how amazed people are of Pokémon Go was expected as an augmented reality application,” Nishida says. “But augmented reality can be even more popular if the graphics are more realistic.”

Virtual reality is back, and Pokémon Go, a simple yet tremendously popular smartphone application, took over the nation for much of the year. Computer science professors such as Daniel Aliaga have been busy training and inspiring students such as Nishida to learn the back end of how computer graphics are created.

“We teach students the algorithms, the methods needed to create such visuals and many others,” Aliaga says. “We teach students the computer graphics and visualization that’s needed to create things like Pokémon Go and many other things in entertainment — be it games, be it movies or applications for mobile devices.”

Although Pokémon Go contains graphics of many instantly recognizable, colorful characters such as Pikachu, Mewtwo and Dragonite, Aliaga sees the popularity of the application as stemming from the ingenuity of getting users outside and moving, as well as the ease of use. The popularity boosts application and technology makers as well as Purdue’s Department of Computer Science. This summer and fall, a person couldn’t peruse Facebook or watch TV without seeing a mention of Pokémon Go.

“When the media latches on to something that needs graphics and visualization, it does attract more students, and that’s a good thing,” Aliaga says. “The CS department is growing like crazy in general. This year, we’ve grown by hundreds of new students.”

A graphics and visualization expert for almost 30 years, Aliaga smiles when seeing his students enthuse over virtual reality via the lightweight, smartphone-driven Oculus Rift, a virtual reality headset, or Microsoft’s HoloLens, a self-contained holographic computer headset that allows the user to interact with high-definition holograms. He recalls virtual reality’s clunky debut in the early 1990s. At the time, users were whisked away to a blocky, garish, different world. But at the time, technology couldn’t keep up, and users were enamored by other technologies. The original virtual reality virtually dissolved.

“The initial head-mounted displays were such low resolution that you were legally blind,” Aliaga says. “There were so few pixels and low color quality and it was heavy on your head. You’d probably suffer from neck damage and headaches before anything else. The hype came and it disappeared.”

Today, the hardware is lightweight and fits comfortably. Most importantly, the software creates incredible visuals.

“It’s cheaper. It’s higher resolution,” Aliaga says. “It’s more lightweight but there is the question: Is it now good enough to do some new stuff with it?”

Though the technology behind the Oculus Rift and Pokémon Go has had a long shelf life, most programs and products will need constant updating. Innovations must occur quickly.

“The quality of the visuals isn’t always the bottleneck,” Aliaga says. “You can make pretty good-looking stuff now. The bottleneck is what do you do? Pokémon Go is not impressive because of the visuals it produces. That’s been around. It’s the concept — that’s what makes something good.”

Nishida’s research on improving three-dimensional modeling for creating highly detailed virtual cities by simple sketching or using photographs looks to combine visualization and machine learning. It will be perfect for the gaming industry.

“I hope, in the future, that people can have more realistic images so that we can have a more realistic virtual experience,” Nishida says.

THE CS DEPARTMENT IS GROWING LIKE CRAZY IN GENERAL. THIS YEAR, WE’VE GROWN BY HUNDREDS OF NEW STUDENTS.

VIRTUAL PRESENTS: BEST BUY IS PREDICTING THE OCULUS RIFT WILL BE A POPULAR GIFT THIS HOLIDAY SEASON.

(POLITICALLY CORRECT)
Students in the Department of Earth, Atmospheric, and Planetary Sciences are looking to follow in the space boots of Andrew Feustel, a 1991 EAPS graduate who became a NASA astronaut in 2000. Feustel is one of 23 Purdue alumni to have been named astronauts — and the only one from the College of Science.

Purdue planetary science students have had their eyes to the skies for years, studying the surfaces of Mars, the moon, and other planetary bodies. Professors Jay Melosh and Briony Horgan have helped to attract students to the West Lafayette campus and have had a marked role in shaping students’ dreams.

Melosh, Distinguished Professor of Earth, Atmospheric, and Planetary Sciences, and Physics, has been a world leader on planetary impact craters for decades. Horgan, assistant professor in EAPS, is highly involved in space exploration missions, including NASA’s Curiosity Rover on Mars and the Mars 2020 rover.

President Hamzeh Osmani has set a goal of sending astronauts to Mars by the 2030s, and NASA received a record number of applications for its latest astronaut class. Purdue graduate student Marie McBride is a member of Horgan’s team who concentrated on research of ancient lunar volcanic deposits.

“I am in the second year of my PhD program. I’m working on mapping lunar volcanic deposits using the Moon Mineralogy Mapper spacecraft instrument and determining the style of eruption that may have created them. That research will contribute to future exploration of the moon, and maybe one day I will have the opportunity to explore them in person.”

McBride says. “Some of these deposits are very glassy, which means they are great places for oxygen to be extracted during future missions. It’s really important to characterize and map these areas for possible future exploration.”

Feustel made two spaceflights in his career, 2009 and 2011. McBride is striving for a similar opportunity.

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Years of training led to the most intense — yet most glorious — six minutes and one second of Amanda Elmore’s life.

A 2014 Biological Sciences alumna and former member of the Purdue Crew team, Elmore was a key component in the U.S. women’s Eight gold medal-winning rowing team at the 2016 Summer Olympics in Rio de Janeiro. On Aug. 13, the team finished more than two seconds ahead of Great Britain to claim the gold.

“Elmore joined the national women’s rowing team in 2014 after a year at the University of Michigan studying biology at Michigan. She’s also busy handling many outlets have already interviewed Elmore. Today, “The Today Show” and many other television shows have interviewed her team and the rowing community at large.

In the immediate aftermath of her Olympic moment, live in Rio. In attendance were little brother and her teammates after the race. They had leaned forward in unison as Elmore put her arms out of the water. The entire crowd roared in unison.

“Amanda finally crossed the finish line. She did it! She did it! It is over!” The victory was confirmed in the closing seconds as Elmore crossed the finish line.

Elmore was seated in the stroke position for the big race, with her back to her fellow rowers, to set the rhythm of the strokes. “Everyone follows each other,” she says.

“Training for years. For Elmore and her teammates, the Olympics has been the ultimate goal for years. All training led up to Aug. 13 in Rio. The team would win several races but the Olympics was always in the back of our minds. “The training builds through the whole quadrennium,” Elmore says of the four-year effort. “This past whole year was harder than the previous. We had been adding to what we had done. It’s pretty intense. Once we got to Rio, we tapered off training so that we were rested for the finals. We’d done all the work we could in terms of fitness and strength. We tried to rest and be mentally prepared to race.”

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What about the moment she and her team crossed the finish line? “The best part of the experience has been the people — the teammates, friends and family supporting me, all of the other athletes competing and getting to meet them,” he says. “I wiped them away with a U.S.-flag replica bandana so I could take more photos. Although we expected and hoped for a win, we all knew something could go wrong, or we could have underestimated the strength of another team. So after the race, I kept telling myself: ‘She did it! She did it! It is over!’”

An exhausted Amanda Elmore leaned on her teammates after the race. They had leaned forward in unison as Elmore put her arms out of the water. The entire crowd roared in unison.

“BIOLOGY IN RIO

The venue for the Olympics carried its own set of challenges, especially for the Olympic athletes who were having to manage the heat and humidity of the Rio de Janeiro climate. Elmore and her teammates had to adjust their training routines to account for the warmer weather and the added stress of the Olympic experience.

“During her high school years (at Harrison High School in Tippecanoe County), Amanda pursued cross-country, track and, most of all, gymnastics. We saw her frustration in gymnastics when she grew too tall (5’11”) for that sport, so it did not require any academic research was a factor. But we were very pleased that she chose this direction in microbiology, an area that’s very relevant and important to modern society. As she looked at graduate schools, it quickly became apparent that she wanted a school that was competitive in rowing so she could continue the sport along with graduate studies. The invitation to join the U.S. rowing team came soon after that and her drive and determination to be best made her very proud of her.”
Researchers have identified a single enzyme that can turn proteins on or off, which can trigger or stop a cellular process, Luo says. “This discovery is a paradigm shift,” he says. “It’s a family of proteins that bacteria used to hijack to spread infection within a host, says Zhao Jun, a Purdue professor of biological sciences and member of the Purdue Institute for Inflammation, Immunology and Infectious Diseases, who led the research.

This signaling process is very important, and many companies are working to develop drugs to control it and use it to treat diseases, Luo says. “This discovery is a paradigm shift because we had only seen a cascade of three enzymes named E1, E2 and E3, to initiate this process. If one enzyme could accomplish the same thing, it could potentially make the therapeutic goal easier to achieve. However, much more research needs to be done.”

Ubiquitination is one way a cell is told what to process occurs in humans, perhaps an engineered ubiquitin editing protein could be developed to target and control processes critical to the development of many diseases, including infection,” Luo says. “If that is the case, this could lead to a very precise way to target and treat diseases.

A team of astronomers at Purdue and the Mayall Telescope on Kitt Peak in southern Arizona and the Keck II Telescope on Mauna Kea in Hawaii, using measurements from the Mayall telescope on Kitt Peak has been witnessing and studying the formation process of galaxy clusters. The structure, named PC 217.96+32.3A, is located 2.6 billion light-years away in the constellation of Boötes.

The structure is one of the largest and most massive structures in the universe, and the researchers have confirmed a rare discovery of the early formation of one of the most massive structures in the present-day universe, a galaxy cluster. The structure, named PC 217.96+32.3A, is located 2.6 billion light-years away in the constellation of Boötes.

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The Zika virus structure gives scientists across the globe a way to better understand the virus, which can cause debilitating birth defects. The work by Sirohi and her colleagues eventually could lead to a vaccine and possible cure.

RECRUITED IN INDIA

Born and raised in Meerut, India, Sirohi earned her bachelor’s degree in biochemistry from the University of Delhi and a master’s degree from Tata Institute of Fundamental Research (TIFR) in Mumbai. She learned a variety of disciplines spanning immunology, cell biology, molecular biology and developmental neuroscience.

It was in Mumbai where Sirohi met Kuhn, then head of Purdue’s Department of Biological Sciences, who organized a joint Indo-U.S. conference on infectious disease at TIFR. She read about Kuhn’s work with dengue virus and was quick to accept an offer to come to West Lafayette, Indiana.

“Dengue is still more prominent than Zika and is more problematic,” Sirohi says. Sirohi’s broad biochemical background helped her fit into Kuhn’s lab, even though the work with viral diseases was a new field for her.

“I did a lot of protein biochemistry- and enzymology-related work for my master’s thesis, not infectious agents,” Sirohi says. The big picture science at the interface of basic and applied biology appealed to her the most.

A FAST, CRUCIAL DECISION

Sirohi perhaps surprised her media interviewers when she said she was in on the decision to investigate Zika and that determination was made only in December. Work started in January as soon as the group could receive the virus to work on. That meant that as many as 12 to 18 months to research Zika and only two months of lab work to find the virus’ structure before Purdue’s landmark March announcement of the determination of the Zika virus structure.

“Research on Zika is a hot area with intense competition,” Sirohi says. “If you don’t do it quick, before you can blink somebody else has done it.”

Once samples arrived at the Hockmeyer Hall of Structural Biology wet lab and still photos of her working in a biosafety hood with a pipette were posted worldwide.

Sirohi, a PhD student, worked with her predecessors and postdocs Zhenguo Chen, Lei Sun and Thomas Klase. But she also had to handle late night media requests much like Kuhn and Rossmann have had to do during their illustrious careers.

“When it all started, there were so many news channels from India that called me in the middle of the night requesting an interview,” recalls Sirohi with a laugh. “It was too much, too soon. It was very humbling but also overwhelming.”

Zika is a flavivirus, a family of viruses prominent in India and many other countries. Kuhn’s lab has had recent breakthroughs in this cluster of viruses, including the landmark visualization of the dengue virus in 2002 and West Nile virus in 2003.

Kuhn and Rossmann knew that many other researchers were investigating the Zika structure so they had to work fast.

“A lot of us were working around the clock,” Sirohi says. “As a group, we were working at least 10 to 20 hours a day. There was a lot to be done and it had to be done yesterday. The day we got the samples was the day we first infected the cells.”

Sirohi’s lab duties were crucial to the discovery. She decided in which cells to grow the virus, and she experimented with different purification methods to get the best preparation for homogeneous samples for single-particle reconstruction. She also helped in data analysis and writing of the manuscript, which was published in the April 1 edition of Science.

“It took more than a month to get the cells ready, grow and purify the virus,” Sirohi remembers. Along the way, Chen took thousands of pictures with the state-of-the-art, multimillion-dollar FEI Titan Krios cryo-electron microscope to create a three-dimensional map of Zika virus.

Along the line of long days, long weeks and long months in the lab, Sirohi and team celebrated each step that brought them closer to the Zika structure: successful purification and first images of the virus, the discovery that the Zika virus looked similar to other flaviviruses, the subtle differences between the viruses, and each time the virus structure became clearer and clearer.

“Something or the other was always happening. We were making progress and there was continuous excitement,” Sirohi says.

Kuhn recognized Sirohi’s potential early and recognized her pre-Purdue accomplishments.

“She’s a very smart, articulate person,” he says. “She is passionate about science and really, really dedicated and really engaged.”

Kuhn praises Sirohi’s work in the trenches, both at the bench creating samples and at the computer deciphering data. He gives her credit for knowing that work on Zika is a sprint to the finish. Work would have to be done day and night. Yet she and her fellow researchers would have to stay sharp and not get burnt out.

“She jumped headlong into preparing the virus,” says Kuhn, noting Sirohi had been working on cryo-EM reconstruction before the Zika project. “There was so much to do and so little time. She had her hand on every aspect, Devika was up on everything on Zika. Everything we needed to know, she was aware of it. Not just bench work — it was who’s doing what, what makes sense and how we interpret the data.”

Kuhn is proud of how Sirohi has taken on the science spotlight, along with the rest of his team of postdocs and research scientists.

“She’s gained some recognition in the lay and scientific communities,” says Kuhn, adding that a recent meeting he attended of the American Society of Virology had many of his peers congratulating him and his team on the work. “She’s a senior author on the [Science article]. She’s on the front edge of that area.”

MUCH MORE TO BE DONE

Sirohi expects to receive her doctoral degree from Purdue in biological sciences in December. Until then, she will continue her work on Zika and dengue viruses.

“This is just the beginning,” Sirohi says. “Having the structure opens the door for many hypotheses-driven questions. What regions of the virus are important for receptor binding? What epitopes on the virus will bind antibodies that will help neutralize the virus?”

“We continue to work with Zika, further exploring the antigenic structure of the virus and collaborating with many groups in Purdue to develop inhibitors that block Zika infection in cells. We are also studying the impact and mechanism of infection both in cell culture and in an animal model.”

And she will continue to field media requests and lecture bookings as well as manage a full email inbox.

“T’m still getting a steady stream of email with resumes on them to see if I can hire them,” Sirohi laughs. “I’m a graduate student. I cannot hire you!”

For now, at least. The next level — and discovery — is coming soon.

“Zika Decoder Girl” Devika Sirohi is huge in India. Dubbed the “Zika Decoder Girl” by her home country’s many media outlets, Sirohi was one of the key faces of this spring’s Zika virus structure discovery by a team led by Biological Sciences professors Richard Kuhn and Michael Rossmann.

Video of her at the hood in a Hockmeyer Hall of Structural Biology wet lab and still photos of her working in a biosafety hood with a pipette were posted worldwide.

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Photo by / Mark Simons

Fall 2016 | 23
Playing in the sand has never been so educational and high tech.

The Purdue Science K-12 Outreach Program’s latest piece of educational equipment — the Augmented Reality (AR) Sandbox — combines cutting-edge technology with the childhood zeal of digging around in a large sandbox.

A short-range, high-resolution projector (1,280 pixels by 768 pixels) that is connected to a powerful computer tower and keyboard shines down onto the sand pit. Steven Smith, outreach coordinator in the Department of Earth, Atmospheric, and Planetary Sciences; Tom Ratkus, academic IT specialist in the College of Science; and Bill Bayley, outreach coordinator in the Department of Chemistry, constructed the machine. The projector shines topographical digital imagery onto the sand. Colors and digital textures change as the student or teacher moves the sand around.

Users can create lakes, rivers, mountains, deserts — even volcanoes — just by digging around. Holding a hand over the sand creates a torrential digital, blue rainstorm. Several teachers who were on the Purdue campus for the Global Learning and Observations to Benefit the Environment (GLOBE) conference July 19 were among the first to try out the new technology.

“My mind is flooded with all the ways I can use this in my classroom,” says Lora Cottam, a life and environmental science teacher at South Vermillion High School in Clinton, Indiana. She has just enjoyed her first sandbox dig. “From karst topography to the water table to volcanology and plate tectonics. He made a waterfall in there.”

Added to the Science Express arsenal of equipment lent and delivered to more than 300 Indiana K-12 science teachers, the AR sandbox is the perfect mix of classic hands-on activity with mesmerizing digital advancements. Ratkus says the software and programming originated with Peter Gold of the University of California, Davis Department of Geology. Ratkus combined the pieces with a high-end graphics card and after-market power supply to customize it for Science Outreach and EAPS. The extra power for the graphics is necessary to simulate the flowing water, a top feature for the program.

Smith and Bayley constructed the chassis to hold the projector at the precise distance from both the stand and the cart so the sandbox can be wheeled easily into classrooms.

“Hopefully, we will collaborate more in the future and continue making cool stuff,” Ratkus says, reflecting on the teamwork.

Similar software can be seen in other educational equipment and art performances across the country; however, the creation by Smith, Bayley and Ratkus offers topological lines of study and the ability to create students’ own worlds.

“I am thrilled that the teachers are so excited about using the AR sandbox in their classrooms,” Smith says. “We felt that it would be a great resource to make concepts like topographic maps more concrete and understandable for students.”

Todd Millar, an environmental science teacher at Lebanon (Indiana) High School, has been taking advantage of Science Express lesson plans, experiments and equipment for 12 years. He says the sandbox is one of the most impressive tools he has seen.

“It’s revolutionary to be able to do such things with topographic maps, volcanoes and features, and plate boundaries,” Millar explains. “This will let us do things we haven’t been able to do before.”

Smith is proud of the sandbox’s early success. It’s proof that fun in the sandbox can inspire and educate young future scientists and their teachers.

And Cottam says, “You just gave me the ability to build a volcano on a table in my classroom. I can make a model of Mount St. Helens and erupt it in my classroom. I’m going to have to recover from this.”
SHATTERING STEREOTYPES

A plaque in the Electrical Engineering Building states “In Honor and Memory of the Men of the NESEP Program.” It was created well before the graduation of Edeline ‘Tidy’ White (’74 Chemistry) and Lenzie Burgess (’75 Atmospheric Science), who were Purdue’s first female NESEPs. White recounted Purdue’s administrative staff trying to get her out of the program — suggesting she and Burgess transfer to a different school — before she even landed in Indiana. Even though they already had their orders in hand, they were told their orders could be changed — if Purdue asked the Navy’s top brass themselves.

“We told them to go jump in a lake and we were at Purdue 40 days later,” says White, noting the NESEP directors had her back and ensured she would get equal treatment at Purdue.

Once White arrived on campus, she says, the focus was on passing physics, chemistry and mathematics classes. But she still had battles to fight because of her gender. When it was time to go to Officer Candidate School as her Purdue career and that of Burgess were winding up, they were first recommended to train with naval nurses instead of their male counterparts.

“We not only said ‘No,’ we said, ‘Hell no! We are NESEPs,’” White says. “We were too salty to just accept that. There was no way! So we were allowed to train with the men.”

White eventually became a naval investigator. She was “NUSIs” before the CBS hit show of the same name. She worked cases as complex as brutal violence or as simple as the captain stealing money from their commands. After decades as a naval law enforcement, White decided to follow a spiritual calling and became a Presbyterian minister in Ozark, Missouri.

“During my stint as a special agent, my cases were all bloody crimes — rape, murder, drug deals. You name it, I did it. I saw all of the bad guys,” she says. “After that, I realized I liked helping people stay out of jail more than I liked putting them in jail.”

When I got out of the Navy, I wanted to help people.”

TURBULENT TIMES

The reunited NESEP students recounted their Purdue years, which coincided with the Vietnam War. Dave Pratt (’74 Mathematics) said Purdue was quite conservative compared with many other campuses around the nation.

Daniel G. Kooko (’74 Mathematics) says, “A few schools even had students burn the ROTC buildings. The Kent State incident happened while we were in school. Being at a more conservative campus like Purdue was definitely a blessing for us.”

As students, NESEP’s tended to be older than their classmates by a few years and were required to wear their service uniforms once a week. Besides that, they were like most undergrads.

“I was a part of the first Purdue Student Concert Committee and we brought in Jefferson Airplane,” recalls Jim Dech, a 1969 alumnus. “I met them at the Purdue Airport and the first thing Grace Slick says, ‘What are you doing in the middle of a cornfield?’”

Pratt and his classmates were called to be leaders and experts on their ships.

“Pratt dove into mathematics and early computer science classes as a 24-year-old freshman after a six-year stint working in U.S. nuclear submarines in Holy Loch, Scotland.”

“It was the height of the Cold War with ballistic missile submarines at the forefront,” Pratt says. “It was a time of nuclear protests by the Scuds, Russian apes and spy ships, the black market, and an exponential expansion of technology. Exciting times for a young sailor.”

“At the time, the Navy needed to increase the number of technically trained officers,” recalls Pratt, Florida native. “The systems and weapons were becoming as much more complex. We needed to ramp up the level of technical knowledge among the officer corps in a hurry.”

He was elated to be accepted in NESEP. He moved his wife, Isabel, and baby daughter to West Lafayette after finishing training and classes at NESEP prep school in San Diego. His son was born during his junior year.

“The Navy paid my full salary, tuition, books, fees, everything,” he says. “My job was to go to school and we all took it seriously.”

NO MORE NESEP

The last Purdue NESEP graduate was Thomas Catalano (Civil Engineering) in 1992. The final Science NESEP was William Breden (Computer Science ’79).

“But we were all family,” Bain says, “and still are.”

Bain adds, “Some science and engineering degrees held great weight in the ’70s, thanks to notoriety of the Purdue astronauts and the school’s much acclaimed science programs. That degree opened so many doors for us, even well after our service years. Purdue was innovative. We didn’t have the first Nobel laureate (Chemistry professor Herbert C. Brown), yet, but Purdue’s reputation in the science community was very useful.”

“We were NESEPs,” White says. “That was an honor to be a NESEP. We worked to get here and by goodness we worked to graduate. … I’m extremely proud of giving the men and women of the program. I had a great career. I did things I never expected I would do and have been places I never expected I would go.”

A revised plaque that includes the Purdue NESEP women and Marines is in the works. Additionally, a NESEP fund is being established at the University to help deserving Purdue NROTC students.
Several visiting mathematics students were PRiME-d and ready to dive into research over the summer. Led by professors Edray Goins and Jonathan Peterson, the group of eight visiting math majors from universities as far away as California, New York and Florida joined their Purdue counterparts for the Purdue Research in Mathematics Experience (PRiME). The research project was one of Purdue’s successful Research Experience for Undergraduates (REU) sessions.

The research was a ticket into the mathematics community — where mathematicians interact and exchange ideas worldwide. The projects were presented at a conference in July in Indianapolis, as well as showing results. The projects were presented at a conference in July in Indianapolis, as well as showing assistance of the objects at hand, Goins says. pedestrian moves along the sidewalk. Giving

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The graphs are three-dimensional and look similar to the scribbles a young child draws, but go well beyond the familiar high school ink and paper y=x^2 graphs. They look at vertices and edges. Goins’ students set out to map and explain these complex graphs.

“You’re attempting to do math that has never been done before,” says Purdue math graduate student Mark Pengitore, who assisted with Goins’ research project. Goins and Peterson started their students with intensive lectures six hours a day — Monday through Friday — for the first two weeks. Welcome to the rigors of undergraduate research. “THE ESTIMATES WERE MUCH, MUCH BETTER THAN I HAD EVER EXPECTED,” he says. “I’m PROUD OF HOW HARD THEY WORKED. I AM ESPECIALLY PROUD OF HOW MY GROUP WORKED TOGETHER. THEY CAME FROM FIVE DIFFERENT UNIVERSITIES AND NEVER SAW EACH OTHER BEFORE. THEY HAD TO BE ABLE TO WORK TOGETHER REALLY QUICKLY.”

The visiting students were divided into two groups. Goins’ group focused on graphs on elliptic curves, which can be drawn on the geometrical doughnut-like torus. Peterson’s students studied “excited random walks,” a model in probability theory of self-interacting random motion.
Satellite imaging wasn’t enough for Sheridan Ackiss, a PhD student in the Department of Earth, Atmospheric, and Planetary Sciences. Ackiss followed up her internationally recognized, NASA-backed findings on Mars’ ancient volcanic history with a trip to study the volcanoes of Earth.

By studying images retrieved from NASA’s Mars Reconnaissance Orbiter’s mineral-mapping spectrometer, Ackiss and her team found evidence for volcanoes in a southern region of the Red Planet known as Sisyphi Montes. Different types of rocks cover the volcanoes, and her research suggests the rocks tell a story of volcanic eruptions beneath a sheet of ice. For NASA, this volcanic and icy history could help reveal more about past Martian climate and the history of its potentially life-sustaining water.

But getting to see Mars’ ancient, under-ice volcanoes up close is out of the question, at least for a long time. Ackiss decided to take a trip to Ecuador to compare and contrast the Mars volcanoes she is researching from afar with some of Earth’s most active volcanoes within the majestic Andes Mountains.

“I think volcanic processes and behaviors are the same on both planets,” says Ackiss, who works in EAPS professor Briony Horgan’s laboratory and is a NASA Earth and Space Science doctoral fellow.

Ackiss, fellow EAPS graduate student Marie McBride and students from other universities joined the South Dakota School of Mines’ Volcanology Field Camp to put on their hiking boots, grab their hammers, and investigate lava flows, compositions, deposits and the surrounding rocks of Ecuadorian volcanoes from May 17 to June 3. While her South Dakotan peers concentrated on Earth stones, Ackiss was still thinking of the Martian minerals.

“I wanted to go and see the deposits firsthand to know what I’m looking at on Mars,” says Ackiss, who worked for NASA’s Goddard Space Flight Center before arriving at Purdue. “We can’t look at images from Mars and say ‘This is a layer of pumice followed by a layer of dirt’ mostly because it’s not that definitive. As planetary scientists, we have to look at all possible angles to verify what we think we are seeing. Everything has to be non-interpretive. So, we would say something like ‘This is a light-toned layer followed by a dark-toned layer.’”

Ecuador, which is about the size of Colorado, has tremendously diverse terrain—rainforest, mountains, beaches and islands. Fortunately for Ackiss, volcanoes touch all of these Ecuadorian regions. Ackiss conducted field work at the freezing Tungurahua and Cotopaxi (5,900 meters above sea level) stratovolcanoes in the Andes Mountains, and Galapagos Islands’ shield volcanoes.

“It was an amazing learning experience for me,” Ackiss says. “It’s made me really rethink things for my research. For Mars, we look at things from the 5- to 10- to 50-kilometer scales. On Earth, it’s a centimeter scale.”

Horgan and Ackiss are part of the upcoming NASA Mars 2020 rover mission. Horgan has worked on the science team for the $2.5 billion rover’s camera since 2014. Mars research likely will remain an important part of the planetary sciences program as NASA, and millions of planetary science fans consistently have one eye on the Red Planet.

Since the region of Mars that Ackiss studies is near the planet’s south pole, it’s much too cold, treacherous and remote for a rover to land. NASA is banking on researchers like Ackiss to reveal as much as they can about Earth’s neighbor. The Sisyphi Montes will be inaccessible for many years.

“We’re sending rovers. We’re trying to get samples returned and we’re trying to send humans,” Ackiss says. “I think my research is interesting because it’s not accessible to the rovers or the landing sites. We learn so much from the rovers but we learn about planetwide processes thanks to the satellites.”
A researcher who develops technology to analyze trace amounts of molecular compounds in complex samples — undetectable by all but the most sensitive equipment — has become a standout talent, distinct among a field of tens of thousands of scientists.

Scott McLuckey (CHEM ’82), the John A. Leighty Distinguished Professor of Chemistry, won two of the top awards in mass spectrometry in 2016: The International Mass Spectrometry Foundation Thomson Medal and the American Society for Mass Spectrometry’s Distinguished Contribution Award.

Timothy Zerier, head of the department and M.G. Mellon Distinguished Professor of Chemistry, says the awards are arguably the two most prestigious awards in the field of mass spectrometry worldwide.

"It is striking that he has won both these medals in the same year," he says. "There are literally tens of thousands of scientists worldwide who are using mass spectrometry to characterize chemical and biological samples, and Scott has established himself as a premier leader in this large and vibrant field of science."

Both the Thomson Medal and the Distinguished Contribution Award are the highest awards given by their respective foundation and society. The Thomson Medal recognizes "outstanding achievements in mass spectrometry and outstanding service to international mass spectrometry," while the Distinguished Contribution Award recognizes a singular achievement. The citation for McLuckey’s award reads “For pioneering contributions to the understanding of the gas-phase ion/ion reactions of polyatomic molecules and their application in analysis with mass spectrometry.”

McLuckey studies fundamental aspects of the interactions of ions, or electrically charged molecules, and develops new mass spectrometry tools and analysis methods. Mass spectrometry identifies the contents of a sample by measuring the mass of its ions. The mass spectrometry analysis method has broad applications ranging from the characterization of proteins to medical diagnostics to identification of foodborne pathogens, bacteria, pesticides and explosives residues.

He says his group’s work is driven by both the needs of particular problems and the unexpected findings that lead to fundamental discoveries.

"There is a saying posted above a door in his laboratory: ‘We accomplish in proportion to what we attempt.’ McLuckey and his team take that philosophy to heart. "We push into unexplored areas and are all the time attempting to do things no one has ever done," says McLuckey, who also is a former winner of the Herbert Newby McCoy Award, the University’s top research honor in the natural sciences. "Being in uncharted territory increases the chances of making a discovery that could catalyze new areas of research. Serendipity plays an important role in science. Perhaps the most interesting and important work performed by this group has arisen from unexpected findings and curiosity."

McLuckey has won many awards, but he is most proud of the more than 30 students who have graduated from his research group since it began in 2000. "The students are why I left the national lab," he says. "I felt I could have more of an impact in the long run if I taught talented young scientists how to do the research. Collectively, they will do far more than I possibly could."

McLuckey was a graduate student of R. Graham Cooks, Purdue’s Henry Bohn Hass Distinguished Professor of Chemistry, and earned his doctorate in analytical chemistry from Purdue in 1982. McLuckey joined the Analytical Chemistry Division of Oak Ridge National Laboratory as an Eugene P. Wigner Fellow in 1983. He became head of the analytical spectroscopy section in 1990 and in 1999 was named the laboratory’s scientist of the year. He returned to Purdue in 2000 to become a professor of chemistry.

"Scott has been a leader in the department of chemistry ever since he arrived from Oak Ridge," Zerier says. "He brings a unique perspective to our department from his time in a national lab, adding much to our discussions about the future of chemistry, the nature of the chemistry workforce and the role played by the university in society.”

McLuckey’s honors add to a tradition of excellence in the field of mass spectrometry. Cooks and former faculty members Fred McLafferty and Richard Caprioli also have received both the Thomson Medal and the ASMS Distinguished Contribution Award.
The Department of Physics and Astronomy for decades has been a presence at the European Organization for Nuclear Research, or CERN, laboratory in Geneva, Switzerland. Faculty members and graduate students were there in 2012 for the historic discovery of the Higgs boson, a long-sought subatomic particle predicted by the Standard Model of Physics. Four years later, Purdue scientists remain in the fold, pursuing the next major discovery in particle physics.

Andreas Jung, one of the department’s newest physics professors, was recently stationed at CERN’s Large Hadron Collider (LHC). He works in collaboration with fellow Purdue Department of Physics and Astronomy professors and CERN affiliates Virgil Barnes, Lumio Galay, Matthew Jones, Norbert Neumeister and David Miller. Jung reports back to West Lafayette about the brewing excitement at the world’s largest particle accelerator.

**REPORT FROM CERN:**

**THE PURSUIT OF A PARTICLE**

**A:** Purdue positions are present for a significant fraction of the time per year, as well as faculty members like me, of course, between the teaching/lectures each of us does.

My group is working on a measurement of the process where we are looking for a new particle. By looking at the invariant mass spectrum of the top anti-top quark pair, we displace mass regions where CMS and ATLAS experiments see hints for a new particle. This is a complementary way of understanding the nature of a potential new particle.

**B:** It is an extremely exciting time. The LHC restarted with better performance than ever, which will turn in much more data by the end of the year than expected.

This allows data analysis to be more sensitive to new physics and yields more precise results to challenge our best theoretical model, the Standard Model. We are looking very hard and turning every stone to find new particles — so, stay tuned!

**C:** I have been a member of Compact Muon Solenoid experiment at the LHC since 2011, and I have returned multiple times to CERN since then for various reasons: shifts at the experiment, workshops and detector development.

For this trip my primary tasks were to carry out shifts at the CMS experiment, looking at smooth data taking and detector operation as a shift leader, carrying out detector software development for CMS and presenting multiple workshops on optimizing analysis methods to squeeze out every bit of information there is.

**D:** To my and all particle physicists’ disappointment, the indications of a new elementary particle at a very high mass of about 750 gigaelectron volts (GeV) turned out to be a statistical fluke. The criteria for a discovery in particle physics, where we are dealing with very rare events in billions of proton-proton collisions, is that it must be statistically certain to 5 standard deviations. That means a 0.000004 percent certainty or a chance of less than 1 in 5 million that it is a data fluctuation that mimics a new particle.

The indications we saw earlier had a significance of about 3 standard deviations. We analyzed more data, and, unfortunately, we could not confirm a new particle.

Decades of College of Science alumni on July 17 were treated to the front-row excitement at the Indiana State Fair in Indianapolis, the historic Indianapolis Motor Speedway. While cars for the July 24 Crown Royal 400 zoomed practice laps nearby, the alumni joined together for ice cream, a classic car show and Purdue fellowship in Indianapolis. Almost 100 got the rare opportunity to see the famous racetrack up close, without thousands of other enthusiastic race fans in the way.

Biological Sciences alumna Rachael Bazzell felt at home at the Speedway. She was a featured winner for the Purdue “All-American” Marching Band and also performed multiple times in the very same plaza where Purdue Alumni Day was held.

Bazzell says, “I feel like I’m at home, even though I’m in Indy away from Purdue.”

Bazzell and others were treated to hands-on activities from the Speedway. Video racing simulators proved popular for kids of all ages. The participating Purdue colleges also brought numerous giveaways and hands-on educational activities.

The Purdue Science table had electronic motion detectors, courtesy of Science Outreach, that work on the conventional distance equals speed times time principle (d = vt). The user makes a motion plot that matches a given distance-time plot.

Adjusting the starting position, speed and direction can change the shape of the plot.

While revisiting old friends and meeting other fellow Boilermakers, old memories were conjured. Bazzell recalled sleeping in a Stewart Center bathroom as a freshman. She didn’t want to stay from a study room, so those first finals required all-nighters.

Stephanie Thorburn, another Biological Sciences alumna, recalled a rigorous, diverse course load that ended up helping her throughout her career.

“I worked in a lab for a few years doing biology work and then got to go back to school to get a master’s in public health,” says Thorburn, who travels to schools in promoting wellness through nutrition and physical activity for the Marion County Health Department.

“I got to work in a bunch of different places before the health department thanks to my biology degree. I had experience in microbiology, cell biology and genetics. I get to do a bunch of different things. It was a very well-rounded degree to have.”

Many years ago, Purdue’s Industrial Economics program was part of the College of Science. Today, it resides within the Krannert School of Management. Richard Thomas’ time in the program was in the College of Science. His career fields were in mechanical engineering and industrial economics.

At Alumni Day’s classic car show, Richard Thomas and his wife, Kyle, proudly displayed their first-off-the-line 2002 Shelby Cobra sports car, which Kyle Thomas purchased from Carroll Shelby, the car’s original designer and former race car driver. The Thomas’ black-ghost edition of the car is one of only 18 in existence.

“Shelby Cobras were originally released in 1962,” Kyle Thomas says. “There aren’t many hanging around the Midwest. This is her first show and we did it because of Purdue.”

“The high-octane afternoon was a success all the way to the checkered flag. But no matter their pole position, alumni like Mathemática’s Tim Winters think it is important to stay connected.”

“Getting to drive into the Speedway is a thrill, just seeing some of the stuff up front,” he says. “But we’re here, really, to support Purdue.”
IN MEMORIAM


Damon C. Bowerman (BS ’42, Science), Corpus Christi, TX, Dec. 13, 2015.

Elizabeth (Lawrence) Lawson (BS ’42, Science), Lawrenceburg, IN, April 23.

Nicholas Hood Jr. (BS ’45, HCS ’46, Science), Detroit, MI, April 10.

William A. Baker (BS ’49, Biological Sciences), Phoenix, AZ, Dec. 11, 2015.

Fred D. Hoeger (MS ’53, PhD ’55, Chemistry), Midland, MI, March 5.

Carl J. Slone (PhD ’54, Mathematics), Kentwood, MI, Jan. 20. He was survived by his wife, Cora.

Jeannine E. (Sam) Falck (BS ’55, Economics Management), Fort Wayne, IN, March 15.

Ted J. Logan (MS ’56, PhD ’58, Chemistry), Cincinnati, OH, April 9.

B. Richard Irwin (BS ’58, Industrial Economics), Columbus, IN, March 26.


Robert D. Doorna (BS ’62, Industrial Economics), Carmel, IN, Jan. 21.

Thomas E. Fenney (BS ’62, Industrial Economics), Caselbary r.l, Feb. 23.

Vance D. Vanderburg (MS ’63, PhD ’65, Physics), Mexico, MI, Dec. 6, 2015.

David R. Chyla (BS ’66, Sciences), Northbrook, IL, Feb. 16.

Edward M. Chair (BS ’67, Chemistry), Chapel Hill, NC, Feb. 24. He is survived by his wife, Carol.

Paul L. Robbins (BS ’68, Science), Holly, MI, Jan. 4. He is survived by his wife, Cynt (BS ’68, Science).

Michael D. Bratton (BS ’69, SP/UPS Health Technology), Indianapolis, IN, April 1.

William E. Smith (BS ’71, Chemistry), Haverford, PA, May 5.

Carole R. (Bowie) Sweeney (BS ’75, Chemistry), Elkhart, IN, Aug. 13, 2015.

Paul James Plummer (BS ’78, Chemistry), Monticello, IA, Aug. 20, 2015.

David D. Dawson (BS ’93, Computer Science), Rockville, TX, April 13. He is survived by his wife, Hua. Varan (BS ’92, Biological Sciences), son Michael, Cabak and Mark Dodson, and parents Darla and David Dodson (MS ’68, PhD ’72, Computer Science).

Jan A. Marschall (BS ’90, Computer Science), San Francisco, CA, Dec. 28, 2015.

I am 97 years old and did my third skydive for my birthday,” he states. “My first was at 95. ketch, Resolution, to St. Croix, Virgin Islands, retired from Cummins and, most recently, from PNC Bank as vice president of technology sourcing. In November 2015, he asked his 65-foot ketch, Resolution, to St. Croix, where he and his wife, Beverly, now reside.

James Clamms (BS ’75, Mathematics, MS ’77, Computer Science), Palm Bay, FL, was named the newest member of the Florida High Tech Council Board. He will lend his expertise in engineering and strategic technology partnership management to the Council. Clamms is vice president of engineering for Harris Corp.

Michael Johnson (BS ’77, IPSW = Mathematics), Fishers, IN, launched Coach for Tomorrow LLC, a career coaching practice. He focuses on career development with individuals in all life and career transition and companies seeking to increase employee retention and engagement.

Roger Quellen (MS ’77, Mathematics), Atlanta, GA, was re-elected as chairman of the management committee at Fisher Phillips. He has led the national labor and employment law firm since 1989.

Marilyn S. Abbott (PhD ’71, Biological Sciences), St. Cloud, MN, recently accepted the position of provost and vice president for academic affairs at Lindenwood University.

MY JOURNEY

My journey as dean of the College of Science lasted 2,013 days, with plenty of travel and more than enough work to keep me busy. But what a privilege it was to serve in that role!

Where did my journey take me?

To the offices and laboratories of faculty members, who—with the students who conduct research under their guidance—are working to improve human health and understand the origins of our universe and unlock the mysteries of numbers. To cities and towns across the country and around the globe, where I met thousands of Science alumni whose success—as scientists, entrepreneurs, businesspeople and businesspeople, and engaged citizens—they readily attributed in no small part to their Purdue educations. To classrooms and residence halls, where I saw the magic that occurs over the span of a Purdue education and the spectacular things that happen when great students learn together, are taught by world-class professors, and are supported by a college that nurtures and respects them.

It was such a ride, how could I ever try to tax the highlight of seven years? Was it to sit in the balcony of the Stockton Cook Center to see Distinguished Professor of Chemistry Ei-ichi Negishi receive his Nobel Prize? Or to watch Physics undergraduate Tony Danger Castro unveil his creation, a solar-powered merry-go-round? Maybe it was the trip to Sri Lanka, where I met Computer Science alumni who are working to make their native country a center of IT innovation. Then again, there were the celebrations of newly opened research buildings, Rockmeyer Hall and the Drug Discovery Research Facility, not to mention the celebrations of scientific breakthroughs, like the determination of the Zika virus structure, that were made in those very laboratories.

In thinking about it, though, two things gave me more pleasure as dean than anything else: to shake the hand of every new Purdue Science graduate who walked across the company’s balcony of the Stockholm Concert Hall to see Distinguished Professor of Chemistry Ei-ichi Negishi receive his Nobel Prize? Or to watch Physics undergraduate Tony Danger Castro unveil his creation, a solar-powered merry-go-round? Maybe it was the trip to Sri Lanka, where I met Computer Science alumni who are working to make their native country a center of IT innovation. Then again, there were the celebrations of newly opened research buildings, Rockmeyer Hall and the Drug Discovery Research Facility, not to mention the celebrations of scientific breakthroughs, like the determination of the Zika virus structure, that were made in those very laboratories.

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The Big Attraction

Two 13-ton magnets arrive at the Purdue Rare Isotope Measurement Laboratory, located underground adjacent to the Physics Building. The PRIME lab uses accelerator mass spectrometry to measure radionuclides and rare trace elements in samples. The powerful magnets will improve the precision of all measurements and may enable new capabilities. The magnets will undergo cleaning and testing next summer.

[Photo by Tim Brouk]