WONDER

MAKES US SEE THE UNSEEN

THE UNIVERSITY OF ARIZONA

Photo credit: Event Horizon Telescope Collaboration

Welcome to Wildcat Country!

Student success is integrated throughout every pillar of our new strategic plan, and the University of Arizona has been doubling down on how best to support our students on their Wildcat Journey. This support ranges from advancing our scholarship and financial aid options to redesigning the physical spaces where they learn and the curriculum our faculty use to engage them. Preparing our students for success is the most important part of our mission to serve our state.

We are developing problem-solvers capable of tackling our greatest challenges, and many of our students already have a huge impact in our region and around the world. They are a tremendous source of pride, as our students put on world-class artistic performances, compete on the world stage in our athletics programs, and work side-by-side with the world's leading experts on innovative breakthroughs like the Event Horizon Telescope project that captured the first image of a black hole.

In the pages that follow, you will find just a few stories about the incredible work that our students are doing and why everyone here at the University of Arizona is so proud of what our students accomplish. I hope you take these stories as an invitation to learn more and to join us as we create a bold future for our state.

Thank you, and Bear Down.

Robert C. Robbins
President
University of Arizona

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Engineering Wildcat Back on His Feet with Mentor's Help

Ian Jackson was riding his motorcycle from the University of Arizona campus to his apartment a few blocks away when a car ran a stop sign and plowed into him, dragging him 40 feet down the road. His left leg was trapped under the vehicle for several minutes before a group of nearby students lifted the car off him. It was Oct. 19, 2018, just four days after his 22nd birthday.

Paramedics rushed Jackson, then a biomedical engineering senior, to the Banner – University Medical Center Tucson trauma program. There, doctors uncovered one injury after another: a broken femur, tibia and fibula; unstable fractures of several vertebrae; and a mangled left foot with multiple broken bones and missing skin. Jackson was rushed to the operating room, where he underwent a spinal fusion, had rods placed in his thigh and his leg, and had pins put in place to hold his foot together. His surgery lasted 10 hours.

"When a doctor came out and started telling me all the things that were wrong, I was really shocked," said Jackson's father, Kerry. "He said if just one of these injuries had occurred, it would be very serious. And Ian has five of them, so it's very, very serious."

Kris Herning/UAHS BioCommunications

University Arizona biomedical engineering alumnus **Ian Jackson** walking down the front steps of the "Old Engineering" building on his reconstructed left foot.

Three days later, Dr. Daniel Latt, an associate professor of orthopaedic surgery and biomedical engineering at the UA and foot and ankle orthopedic surgeon at Banner – University Medicine, was wondering where his pupil was. Jackson planned to attend medical school after graduation, and he'd been shadowing Latt in his clinic for about two years. This time, Jackson didn't show up.

Finding His Footing

It didn't take long for Latt to realize Jackson was, in fact, at the hospital—but as a patient. As a foot and ankle surgery specialist, Latt reviewed Jackson's X-rays, especially of his foot, which several colleagues had mentioned may need to be amputated. When he went to visit Jackson, Latt brought along a model of a foot he could use to explain the damage.

One of Latt's specialties is operating on patients with Charcot arthropathy, a complication of diabetes that can weaken the bones in the foot, causing recurrent fractures and severe deformity. Jackson had spent the last year "observing Latt's work with Charcot patients, who were often facing amputation and traveled from all over the country to see Latt.

"It made me realize he was doing something different," Jackson said. "I just didn't realize how important it would be for my life. I told him, 'I really believe you can fix it.' Because he fixed impossible situations."

Dr. Lloyd Champagne, a plastic surgeon from the Arizona Center for Hand to Shoulder Surgery in Phoenix, used skin grafts to repair the outside of Jackson's foot first. Then, Latt used plates and screws to carefully reconstruct the inside over the course of two eight-hour surgeries.

Thanks to the efforts of these and other doctors from Banner Health, Jackson is fully on his feet today. He's walking normally and relearning how to run and squat. The metal in his foot has been removed, and Jackson reinstalled it on the foot model Latt brought on that first hospital visit.

"Our goal was to get him a foot that was square to the ground that he could walk on," Latt said. "I expected it to be very stiff and likely somewhat painful. So this is pretty amazing."

To Excel and Empathize

Jackson was back in class, in a wheelchair, three weeks after the accident. He finished his senior-year coursework over the summer, earning all A's except for one B, which drives him crazy.

But he wasn't so dedicated to academics growing up in Chandler, Arizona. In fact, his GPA out of high school was too low for admission to the University of Arizona. His father agreed to support him through college if he majored in engineering, so Jackson started taking engineering courses at Chandler-Gilbert Community College. He was surprised how much he liked it.

"I started to see the world differently," he said. "That's what was really exciting for me."

After a severe vehicle accident left **Ian Jackson** with several broken bones in his foot, doctors were considering amputation. His mentor, orthopaedic surgeon and biomedical engineering professor **Dr. Daniel Latt,** reconstructed Jackson's foot over the course of two eight-hour surgeries.

After a year of community college, Jackson decided the biomedical engineering program at the University of Arizona was a good fit. He entered the Honors College with a Phi Theta Kappa transfer tuition scholarship.

He excelled as a Wildcat and medical school was on the horizon. But since the agony of the accident, the humbling recovery process and a realization of how difficult it is to understand others' pain, he's learned there is more to life.

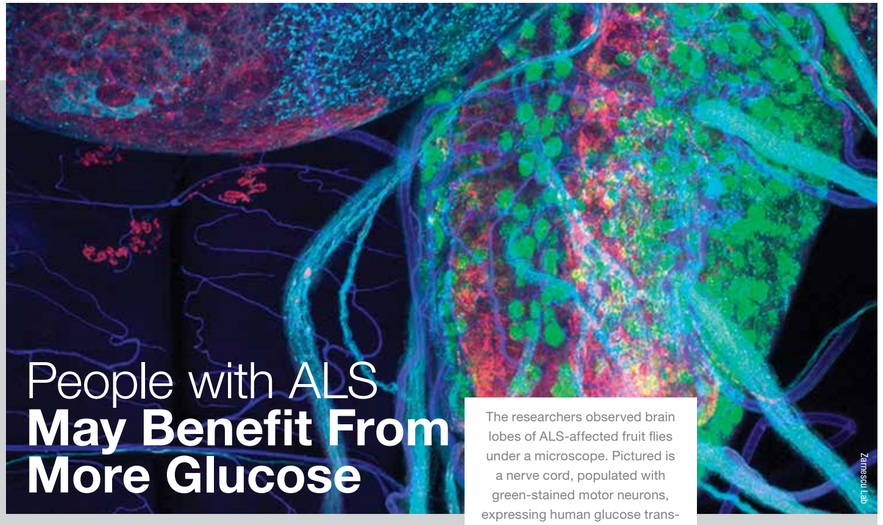
"I feel like this is the best thing that ever happened to me," he said. "The crash was an opportunity to really understand what's important in my life and the man I want to be."

Steps Toward a Better Future

Jackson has decided to hold off on going to medical school, though he hasn't eliminated it as an option. His experience gave him lots of ideas about how to make hospitals more comfortable for patients. He plans to build a specialized design laboratory where he can bring his inventions to life.

"The feeling of hopelessness when you're in the hospital every day is honestly awful," Jackson said. "If I could just produce devices that make a person's experience one degree better, that's worth it. If I wasn't a biomedical engineering major, I don't think I would have even considered that I might be able to change the industry to be patient-focused."

People with ALS May Benefit From More Glucose



Zarnescu Lab

The researchers observed brain lobes of ALS-affected fruit flies under a microscope. Pictured is a nerve cord, populated with green-stained motor neurons, expressing human glucose transporters. Areas of neurotransmitter release are shown in red, while muscles are shown in blue.

Increased glucose, transformed into energy, could give people with amyotrophic lateral sclerosis, or ALS, improved mobility and a longer life, according to new findings by a University of Arizona-led research team.

Physicians have long known that people with ALS experience changes in their metabolism that often lead to rapid weight loss in a process called hypermetabolism. According to the study's lead author Ernesto Manzo, a doctoral student in the Department of Molecular and Cellular Biology, hypermetabolism can be a relentless cycle.

People with ALS use more energy while resting than those without the disease, while simultaneously they often struggle to effectively make use of glucose, the precise ingredient a body needs to make more energy. Experts have not known exactly what happens in a patient's cells to cause this dysfunction or how to alleviate it.

"This project was a way to parse out those details," said Manzo, who described the results, published online in eLife, as "truly shocking."

The study revealed that when ALS-affected neurons are given more glucose, they turn that power source into energy. With that energy, they're able to survive longer and function better. Increasing glucose delivery to the cells, then, may be one way to meet the abnormally high energy demands of ALS patients.

"These neurons were finding some relief by breaking down glucose and getting more cellular energy," said Manzo, who graduated with his Ph.D. in August.

ALS is almost always a progressive disease, eventually taking away patients' ability to walk, speak and even breathe. The average life expectancy of an ALS patient from the time of diagnosis is two to five years.

"ALS is a devastating disease," said Daniela Zarnescu, professor of molecular and cellular biology and senior author on the study. "It renders people from functioning one day to rapidly and visibly deteriorating."

Previous studies on metabolism in ALS patients have focused primarily on what happens at the whole-body level, not the cellular level, Zarnescu explained.

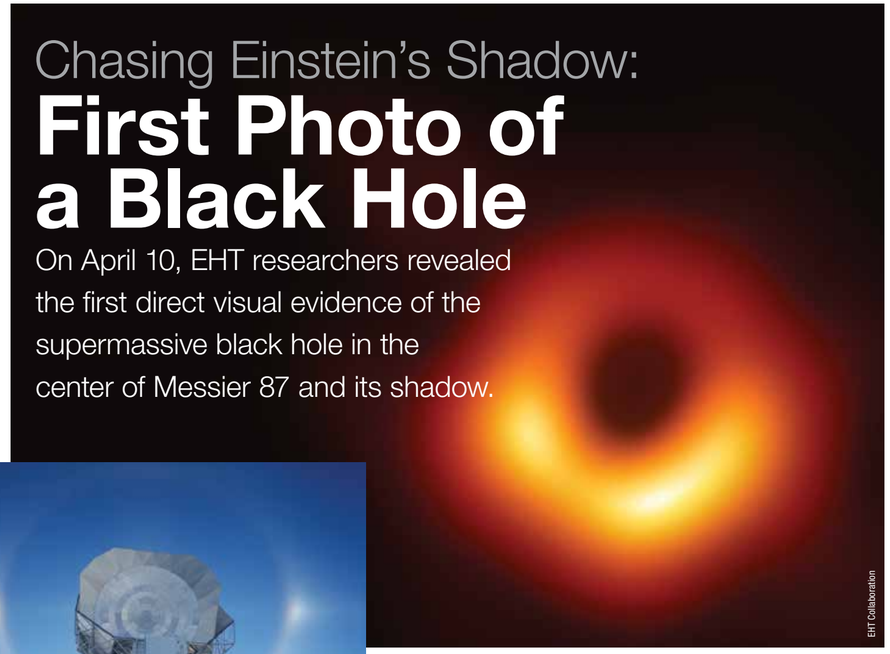
"The fact that we uncovered a compensatory mechanism surprised me," Zarnescu said. "These desperate, degenerating neurons showed incredible resilience. It is an example of how amazing cells are at dealing with stress."

Their findings were consistent with a pilot clinical trial, which found a high-carbohydrate diet was one possible intervention for ALS patients with gross metabolic dysfunction.

"Our data essentially provide an explanation for why that approach might work," Zarnescu said. "My goal is to convince clinicians to perform a larger clinical trial to test this idea."

Chasing Einstein's Shadow: First Photo of a Black Hole

On April 10, EHT researchers revealed the first direct visual evidence of the supermassive black hole in the center of Messier 87 and its shadow.


EHT Collaboration

On April 10, members of the Event Horizon Telescope collaboration, including University of Arizona faculty, post-doctoral researchers, students and telescope support staff, unveiled the first direct visual evidence of a supermassive black hole. The discovery was announced in a series of six scientific papers published in a special issue of The Astrophysical Journal Letters.

The globe-spanning Event Horizon Telescope collaboration, or EHT, offers scientists a new way to study the most extreme objects in the universe predicted by Albert Einstein's Theory of General Relativity.

Black holes have been the realm of science fiction and textbook diagrams for more than a century. By its very definition, a black hole cannot be seen. It's a mysterious object whose mere presence rips apart everything we think we know about the laws of physics, and so extreme it twists space and time into a swirling maelstrom of darkness.

Welcome to Messier 87, or M87, a massive galaxy in the Virgo galaxy cluster 55 million light-years from Earth. At its center sits a supermassive black hole, with a mass 6.5 billion times that of our sun.


Junhan Kim

The South Pole Telescope is one of two University of Arizona telescopes that contributed to the global EHT project.

M87 is about the size of our solar system, yet it is so far away that resolving its features across 55 million light-years is like "taking a picture of a doughnut placed on the surface of the moon," said Dimitrios Psaltis, a professor of astronomy and physics and former EHT project scientist.

But thanks to its enormous mass and relative proximity, M87's black hole was predicted to be one of the largest viewable from Earth, making it a perfect target for the EHT. To see the unseen, eight telescopes came together into one virtual telescope as big as Earth, offering unprecedented sensitivity and resolution.

Carefully Choreographed Telescopes

The EHT uses a technique called very-long-baseline interferometry, or VLBI, which synchronizes telescope facilities around the world and exploits the rotation of our planet to form one huge telescope, said Daniel Marrone, associate professor of astronomy. Marrone traveled to Antarctica with graduate student Junhan Kim several times to integrate the South Pole Telescope into the array.

After two weeks of observing with the global telescope, the researchers collected about 5,000 trillion bytes of data on 1,000 disks—enough to keep a playlist of high-quality mp3 files playing for 4,700 years. The data were flown to supercomputers around the world where experts distilled the raw data to a more usable volume.

Arash Roshanineshat, a doctoral student in electrical and computer engineering and minoring in astronomy, created signal-processing algorithms for taking the data, processing and recording it, before passing the data on to astronomers.

"I know both electrical engineering and astronomy, so I'm trying to connect the two," Roshanineshat said. "I've always been interested in looking at the sky, but I didn't know I could work on this subject while I was doing my studies in electrical engineering."

He continues to run simulations to find the best level of recording precision for processing the data tsunami rushing in from space. Too much precision can be a waste because it doesn't add any useful information. Not enough means you lose some of the data needed to produce an image.

Following data calibration, the EHT collaborators reconstructed the black hole images in separate groups using different methods. They all arrived at the same result.

Stars on the Menu

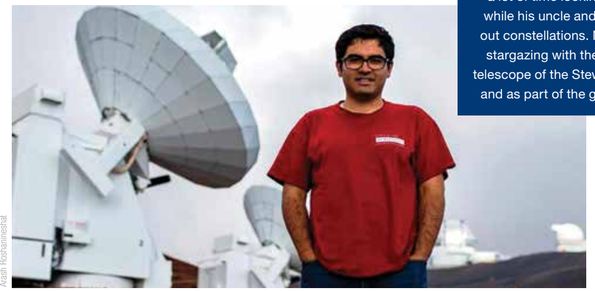
As surrounding gas and dust plunge into the abyss of space and time, and entire stars are shredded into wispy swirls, matter piles up around the black hole, forming a so-called accretion disk of plasma—charged particles heated to billions of degrees and accelerated to almost the speed of light. Due to the black hole's massive gravity, light gets bent around it, creating a tell-tale photon ring, the appearance of which is predicted by Einstein's equations. If Einstein's equations are correct, a dark region should appear in the center, caused by the absence of light captured by the black hole.

An image of the black hole's shadow is the closest thing to an image of the black hole itself. In the case of M87, the shadow appears around 2.5 times larger than the true size of the black hole's boundary—the event horizon from which the EHT takes its name—due to light bending. For M87, the horizon should be just under 25 billion miles across, the size of Pluto's orbit three times over.

Einstein nailed it; Multiple independent EHT observations and imaging methods have revealed a ring-like structure with a dark central region. The predicted size and shape of the shadow theory match observations remarkably well, Psaltis said, increasing science's confidence in Einstein's century-old Theory General Relativity.

University of Arizona team members used a total of $7.2 million in National Science Foundation funding to provide cutting-edge technologies to support the EHT collaboration. In addition to building and maintaining the EHT cloud infrastructure, the team generated high-fidelity models of EHT observations by harnessing the power of a supercomputer consisting of 140 Nvidia graphics-processing units, or GPUs, commonly used for graphics-heavy video-gaming applications. The time-dependent simulations of the black hole's shadow as predicted by general relativity are hosted in the NSF-funded CyVerse, headquartered at the University of Arizona.

"New technologies such as cloud computing are essential to support international collaborations like this," says Chi-kwan Chan, leader of the EHT Computations and Software Working Group and an assistant astronomer at the UA. "When we were working on the six papers, we had over 20 powerful virtual machines running in two Google data centers—one on the East Coast and one on the West Coast—to serve the EHT members' computation needs across the globe."


Arash Roshanineshat

When he was a kid growing up in Iran, **Arash Roshanineshat** spent a lot of time looking up at the sky while his uncle and cousin pointed out constellations. Now he does his stargazing with the high-powered telescope of the Steward Observatory and as part of the global EHT team.

In addition to integrating the South Pole Telescope into the EHT array, the University of Arizona team was responsible for bringing the Submillimeter Telescope on Mount Graham in southeastern Arizona into the network.

In early September, the internationally distributed group of researchers that make up the Event Horizon Telescope, including 21 University of Arizona faculty, post-doctoral researchers, students and telescope support staff, were awarded the 2020 Breakthrough Prize in Fundamental Physics. Known as the "Oscars of Science," the award is considered the world's most generous science prize; $3 million will be split equally among all of the EHT co-authors.

Yet, this is just beginning. The EHT collaboration will continue capturing images supermassive black holes in the center of other nearby galaxies.

Behind the Scenes: Wildcat Mentor Builds Ties to TV Career


Chris Richards

Kam Kindschi and **Suzanne Rauscher** connect via a video chat through the Wildcat Mentor Society.

Starting down any career path can be tough, and that goes double for the television business, where the competition is fierce, the hours grueling and the learning curve steep. Guidance from a seasoned pro can be priceless, and so is the satisfaction of helping a determined student learn the ropes—just ask Kam Kindschi and Suzanne Rauscher.

Kindschi is a senior majoring in film and television at the University of Arizona; Rauscher works as an ex-ecutive producer for Discovery Studios. The two were recently connected through the University of Arizona Alumni Association's Wildcat Mentor Society, and the rewards are already obvious: Kindschi is re-ceiving expert advice and critical contacts, while Rauscher loves giving the kind of guidance she never received.

Rauscher graduated from the University of Arizona in 1993 with a B.A. in media arts. Fresh out of college, worked temp jobs and sold stadium tickets before finally making her way to a career in Los Angeles. To-day, she oversees reality shows ranging from "The Little Couple" and "Seeking Sister Wife" to "Sweet Home Sextuplets."

"When I graduated, I didn't have a lot of direction and hadn't done any research," she says. "I kept telling people I was going to be a TV producer. But I really didn't know what that meant. I kind of expected a mentor to fall out of the sky and tell me. I ended up being a little bit lost."

Helping Kindschi avoid the same pitfalls, she says, is "cathartic."

"I told myself, if anyone wants to come and talk to me, there has to be something in my past that is going to help them," she says. "It has made me OK with all the mistakes I've made."

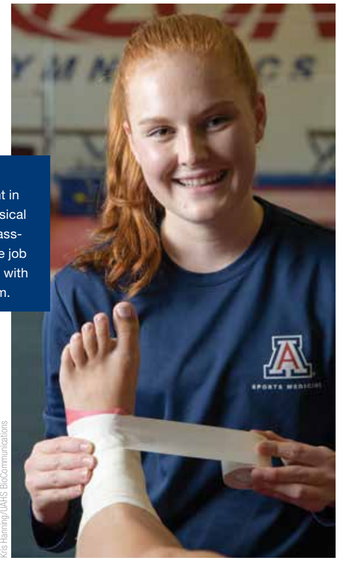
Her advice to students starts with the basics, from the way they present themselves and communicate to yourself, to being very streamlined and detail-oriented. And when it came to determination, she had lit-tle doubt about Kindschi's resolve. He was hustling temporary production assistant jobs while attending community college, and kept chasing gigs during his years at the University of Arizona.

"I wanted to work in the industry while I was still in school. I didn't want to sit around and wait," said Kindschi, who will soon be on his way to L.A. "I think Suzanne is going to be a big help, working with me on my interview skills and building a network out there. When it comes time for me to narrow down where I want to apply, she is really going to help guide me to the right places."

And that's a sweet spot for both.

"It has been really rewarding," Rauscher says. "We all get to a certain age and have life experiences that can help others."

Student Researcher Studies How Common **Antibiotics Weaken Tendons**



Liz Hennen/UAHS BioCommunications

Physiology major **Mikayla Campagne's** entire life is spent in pursuit of her desire to be a physical therapist, whether it is in the classroom, in the laboratory, or on the job as an athletic training technician with the women's gymnastics team.

Growing up, Mikayla Campagne was an avid soccer player. Multiple orthopaedic injuries forced her to retire from the sport but fostered a love of physical therapy and sports medicine, which led her to the Szivek Orthopaedic Research Lab at the University of Arizona College of Medicine – Tucson. There, as an undergraduate research assistant, she helps researchers study how a common antibiotic alters the Achilles tendon, the site of injury for countless active and athletic people.

A class of antibiotics called fluoroquinolones is among the most frequently prescribed antibiotics in the U.S., however, safety concerns about these drugs—particularly about the risk of tendinitis and Achilles tendon ruptures—have gained increased attention in recent years.

These concerns led David Margolis, M.D., assistant professor of orthopaedic surgery, biomedical engineering and physiology, and orthopaedic surgery resident David Falgout, M.D., to study the link between fluoroquinolone and tendinitis and tendon rupture. Specifically, they are trying to determine how long it takes the tendon to heal after stopping ciprofloxacin, a common antibiotic.

"Previous studies examined the associated tissue abnormalities that occur with administration of a fluoroquinolone. However, to the best of our knowledge, no one has examined how long it takes for the tendons to return to normal after discontinuation of fluoroquinolones," said Campagne, a senior physiology major who is working on her honors thesis under Margolis' mentorship.

The study will measure the biomechanical properties of Achilles tendons at different time points following a course of ciprofloxacin using ultrasound elastography, an imaging technology sensitive to tissue stiffness. If successful, ultrasound imaging may provide a cost-effective, non-invasive way of screening patients who have taken fluoroquinolones.

Campagne said the goal is to provide clinicians the ability to perform an ultrasound on a patient and identify the abnormalities and associated weak points to assess risks.

"If the abnormality can is seen before the tendon tears, patients can be advised to abstain from particular activities for a certain amount of time until the risk is gone," Campagne said. "The risk for the injuries is higher for those who live an active lifestyle. We are starting with the Achilles tendon, but hope to look at other tendons, such as patellar (kneecap) and tricep tendons, to see if similar issues arise."

Campagne also works for the women's gymnastics team as an athletic training technician, working with medical professionals to deepen her understanding of sports-related risks, injuries and treatments. She attends team practices and home meets, and assists with physicals, rehabilitation regimens, tapings and emergencies.

After graduation, Campagne plans to pursue a doctorate in physical therapy, specializing in pediatric or sports physical therapy.

"I had to attend physical therapy after each of my injuries, and I love how you build a special bond with the therapists. They always seem so happy and so passionate about their job," she said. "I also love the drive and dedication that researchers have about the work they do, and hope to integrate research into my career path."

University of Arizona Highly Ranked Around the World

#1 GLOBAL RANKING IN **WATER RESOURCES**
— ShanghaiRanking Academic Ranking of World Universities

#1 IN **ASTRONOMY RESEARCH AND DEVELOPMENT EXPENDITURES** AMONG U.S. PUBLIC INSTITUTIONS
— National Science Foundation

#20 **U.S. PUBLIC RESEARCH INSTITUTION**
— Times Higher Education World University Rankings

#11 IN **ARTS & HUMANITIES** AMONG U.S. PUBLIC INSTITUTIONS
— Times Higher Education World University Rankings

#1 IN **LIMNOLOGY**
— Center for World University Rankings

#5 IN **ASTRONOMY & ASTROPHYSICS**
— Center for World University Rankings

#2 IN **MANAGEMENT INFORMATION SYSTEMS** AMONG PUBLIC UNIVERSITIES
— U.S. News & World Report

#5 IN **INFORMATION & LIBRARY SCIENCES**
— Center for World University Rankings

Do Bigger Brains Equal Smarter Dogs?

Bigger dogs, with larger brains, perform better on certain measures of intelligence than their smaller canine counterparts, according to a study led by a University of Arizona graduate student.

Larger-brained dogs outperform smaller dogs on measures of executive functions—a set of cognitive processes that are necessary for controlling and coordinating other cognitive abilities and behaviors. In particular, bigger dogs have better short-term memory and self-control than more petite pups.

"The jury is out on why, necessarily, brain size might relate to cognition," said lead study author Daniel Horschler, an anthropology doctoral student and member of the Arizona Canine Cognition Center at the University of Arizona. "We think of it as probably a proxy for something else going on, whether it's the number of neurons that matters or differences in neuron connectivity. Nobody's really sure yet, but we're interested in figuring out what those deeper things are."

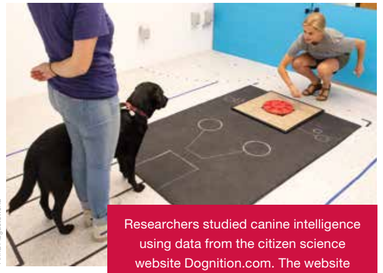
University of Arizona doctoral student **Daniel Horschler** found that larger dogs have better short-term memory and self-control than smaller breeds.

Canine brain size does not seem to be associated with all types of intelligence, however. Horschler found that brain size didn't predict a dog's performance on tests of social intelligence, which was measured by testing each dog's ability to follow human pointing gestures. It also wasn't associated with a dog's inferential and physical reasoning ability.

The study's findings mirror what scientists have previously found to be true in primates—that brain size is associated with executive functioning, but not other types of intelligence.

"Previous studies have been composed mostly or entirely of primates, so we weren't sure whether the result was an artifact of unique aspects of primate brain evolution," Horschler said. "We think dogs are a really great test case for this because there's huge variation in brain size, to a degree you don't see in pretty much any other terrestrial mammals. You have chihuahuas versus Great Danes and everything in between."

Horschler's study is based on data from more than 7,000 purebred domestic dogs from 74 different breeds. Brain size was estimated based on breed standards. The data came from the citizen science website Dognition.com, which offers instructions for dog owners to test their canines' cognitive abilities through a variety of game-based activities. The users then submit their data to the site, where it can be accessed by researchers.



Anna Augustowska

Researchers studied canine intelligence using data from the citizen science website Dognition.com. The website offers instructions for dog owners to test their pups' cognitive abilities through simple game-based activities, much like those carried out at the Arizona Canine Cognition Center.

Short-term memory was tested by dog owners hiding a treat, in view of their dog, under one of two overturned plastic cups. Owners then waited 60, 90, 120 or 150 seconds before releasing their dog to get the treat. Smaller dogs had more difficulty remembering where the treat was hidden.

To test self-control, owners placed a treat in front of their seated dog and then forbade the dog from taking it. Owners then either watched the dog, covered their own eyes or turned away from the dog. Larger-breed dogs typically waited longer to snag the forbidden treat.

Horschler and his colleagues controlled for whether or not the dogs had been trained. They found that larger-brained breeds had better short-term memory and self-control than smaller dogs, regardless of the extent of training the dogs had received.

Combating Diabetes through Food Security

Nutritional sciences and public health students Eliza Short and Jayati Sharma interviewed more than 200 Community Food Bank of Southern Arizona clients to evaluate overall diet quality

Rosemary Brandt

Nutritional sciences and public health students **Eliza Short** and **Jayati Sharma** pack food boxes at the Community Food Bank of Southern Arizona.

At least 10% of Arizona households experience food insecurity, and diabetes is the seventh-leading cause of death in the state. Taking the classroom to the community, Eliza Short and Jayati Sharma, students in the University of Arizona College of Agriculture and Life Sciences, are partnering with the Community Food Bank of Southern Arizona to establish a nutrition-based diabetes treatment program to help those most at risk.

Communities living with food insecurity, on average, face two to three times the prevalence of food-related diseases, including high blood pressure, high cholesterol and diabetes. Food and Resources Expanded to Support Health, or FRESH-2, is a collaborative project designed to produce a therapeutic food box to support food bank clients managing diabetes.

"As an undergraduate student, it's incredible to see that my college and the Department of Nutritional Sciences are willing to invest in community-based work," said Sharma, an undergraduate pursuing a dual degree in public health and molecular and cellular biology. "It's great to see how scalable it is and the long-term impact of our work."

The Community Food Bank of Southern Arizona serves five counties and more than 190,000 households, not including their senior programs or snack programs for the Boys and Girls Club of Southern Arizona.

"Throughout this whole project, we've been really focused on sustainability," said Short, a nutritional sciences doctoral student. "We're really trying to keep that central in our minds throughout the entire process and stages of development."

The FRESH-2 Project specifically aims to enhance the food bank's existing emergency food boxes. Supplied by the U.S. Department of Agriculture, the Emergency Food Assistance Program provides a three-to-four-day supply of food for those in need, including staples such as canned vegetables, canned fruit, pasta, spaghetti sauce, legumes and cereal.

"It's good staple food, but it is pretty heavy in carbohydrates. Not that that's a problem, but people who have diabetes, for instance, struggle with getting the right kinds of carbohydrates," explained Melanie Hingle, associate professor in the Department of Nutritional Sciences. "This is a fine starting point, but we're trying to figure out how can we tweak it to make it better."

Short and Sharma interviewed more than 200 food bank clients to evaluate overall diet quality and gather feedback on how clients currently use the Emergency Food Assistance Program foods. With support from Blue Cross Blue Shield of Arizona, the project is now developing a therapeutic food box to be test-piloted this fall.

"If we were going to put a price tag on it, we couldn't afford it," said Rhonda Gonzalez, Director of Health Initiatives at the Community Food Bank of Southern Arizona. "It's a tremendous asset. We could not do this without the work of these students."

Zeroing in on Diabetes Prevention in Native Populations

A member of the Turtle Mountain Band of Chippewa Indians tribe in North Dakota, University of Arizona College of Nursing student **Rhea DeCoteau** chose a career in nursing to follow in her mother's footsteps.

"She would tell me stories about her work, how she saved lives and the pride she got from that," DeCoteau says. "That's really where it started: I wanted to do what she did."

DeCoteau's passion is preventative education, as it offers a chance to curtail budding health issues before they develop into serious problems. Currently, DeCoteau is a diabetes specialist for the Turtle Mountain Band of Chippewa Indian Health Services.

"I'm a diabetes nurse, and I'm the only one here, not only in our Indian Health Service but in our area as a whole," she says. "Everybody knows me as the person to go to for diabetes education."

Her passion to help her community extends to her academic work as an online student in the College of Nursing's doctoral program. DeCoteau, who was awarded the Western Institute of Nursing's American Indian/Alaska Native/First Nation conference award, plans to center her dissertation on diabetes among the Native American population.

"My main focus right now is diabetes self-management skills amongst Native American adults ages 18-40," she said, explaining that the Turtle Mountain Band of Chippewa Indians faces multiple challenges, including punishing winters that discourage exercise and steep costs for fresh fruits and vegetables. "So many different things need to be studied, from children all the way up to older adults. Within diabetes, there are issues such as the way we react to medication, the way we understand education, and the way we have disparities that really impacts a person's ability to take care of their diabetes."

Seventy-seven students received their undergraduate diplomas from the University of Arizona this summer, not in Tucson, but halfway around the world in Qingdao, China.

Each graduate earned two degrees: a Bachelor of Arts in Law from the University of Arizona and a Bachelor of Laws from Ocean University of China, also known as OUC. The commencement marked the first four-year cohort of microcampus students to graduate.

Several graduates of the inaugural cohort received early acceptance to top law schools in China, the U.K., the U.S., and Australia to pursue graduate degrees. Xueda Qiu will begin a Master of Laws program, or LLM, at Northwestern University in the U.S. this fall.

"During the application process to Northwestern, they showed a lot of interest in the dual degree program between the UA and OUC," Qiu said. "It was an adjustment at first to learn about legal thinking and writing from a different perspective, but the University of Arizona professors were very patient. The program also helped me with my writing in English and my communication skills with English speakers."

Qiu thought he would study mathematics at OUC before discovering an interest in law. He hopes to discover more passions once he arrives in the U.S., where he might pursue a Juris Doctor or MBA.

Justin Stinnett

Inaugural Microcampus Class **Graduates in China**

The first four-year microcampus cohort to graduate from the University of Arizona and a partner university celebrated commencement in late June at Ocean University of China.

"This program created so many opportunities," Qiu said. "My classmates and I can choose to pursue a license, another position or to further our education in the U.S. or China. We have more choices, so why not choose this program? It was a transformative experience for me."

Entirely unique to the University of Arizona and its partners, microcampuses operate at universities worldwide, where students earn degrees from both institutions, typically in the time it takes to earn one.

In addition to Qingdao, the University of Arizona currently operates microcampuses in Ajman, United Arab Emirates; Amman, Jordan; Jakarta, Indonesia; and Phnom Penh, Cambodia. More microcampuses will open in the coming year, including locations in China, Southeast Asia, Africa and South America, delivering education in business, communication, cyber operations, engineering and the arts—all collaboratively with a network of partner universities.

"The vision is to build a powerful multi-university network to deliver high-quality transnational education, conduct research across borders and connect faculty across multiple countries," said Brent White, vice provost for global affairs and dean of global campuses at the University of Arizona. "It is an integrated network were we all connect, teach and solve problems together."

Michael Christy/Arizona Athletics

Women's **Golf**

After claiming the 2018 National Championship in thrilling fashion, the Wildcats entered the 2018-2019 season as one of amateur golf's most talked-about teams. Arizona delivered on that promise by winning three tournaments and securing seven top-three finishes, as well as posting runner-up showings at the Pac-12 Championships and the NCAA Regional. The Wildcats entered the 2019 NCAA Tournament as the No. 6 seed, defeating No. 3-seed USC 3-2 before bowing out in the semifinals to the eventual national champions from Duke. Head coach Laura Ianello was named the Pac-12 Conference Co-Coach of the Year, with sophomore Yu-Sang Hou (pictured with Assistant Coach Justin Bubser) and senior Bianca Pagdanganan earning spots on the Pac-12 All-Conference team. Hou finished in the top 10 six times this past season, and Pagdanganan was named Pac-12 Golfer of the Month in March. Senior and All-Conference honorable mention honoree Haley Moore finished tied for eighth at the Pac-12 Championships and scored a top-10 finish at Augusta National this spring.

From a Glint of Light to a Miniature World, Bennu Begins Revealing Its Secrets

This time last year, the asteroid Bennu resembled an indiscriminate pebble in the sky.

Since then, the University of Arizona-led OSIRIS-REx spacecraft, decked out with a suite of instruments created to tease out the rock's mysteries dating back to the solar system's earliest days, has caught up to its target, detected the presence of ancient water, commenced a record-breaking orbital dance and imaged every inch of its surface to determine four potential sample collection sites.

The mission's objective is to collect about two ounces of dust, dirt and rock particles from the near-Earth asteroid and return it to Earth. OSIRIS-REx will be the first NASA mission to do so, and the science that emerges could shed light on the history of the solar system and the formation of Earth. Upon arrival on Dec. 3, 2018, OSIRIS-REx began zipping around Bennu's north pole, equator and south pole. The space-

This mosaic image of asteroid Bennu is composed of 12 PolyCam images collected on Dec. 2, 2018, by the OSIRIS-REx spacecraft from a range of 15 miles (24 km). (inset) University of Arizona alumna **Keara Burke** spent her first summer as a college student studying abroad with the Honors College, visiting eight countries in two months. As a systems and data analyst engineer on the OSIRIS-REx NASA mission, Burke has expanded her exploration of humanity well beyond Europe's borders – indeed beyond Earth's atmosphere.

craft eventually dipped closer than one mile from the asteroid's center, allowing for the first direct measurement of Bennu's mass and detailed surface observations. OSIRIS-REx then switched from stellar navigation to navigating by the features of the rocky body.

The maneuvers broke records, making Bennu the smallest body in the solar system ever orbited, and, at less than 0.4 miles, the most closely orbited body as well. The European Space Agency's Rosetta spacecraft was the previous record holder when it circled about four miles from the center of the comet 67P/Churyumov-Gerasimenko in May 2016.

Once Upon a Wet World

Soon after arrival, the mission's science team—headquartered at the University of Arizona—discovered traces of past water. Bennu is now too small a body to host water, but the spacecraft's two spectrometers—the OSIRIS-REx Visible and Infrared Spectrometer, or OVIRS, and the OSIRIS-REx Thermal Emissions Spectrometer, or OTES—detected molecules locked within the rock indicating that liquid water was once present on Bennu's parent body, a much larger asteroid.

The Odd Ball

OSIRIS-REx has been exploring the asteroid from above with various instruments, providing mission scientists with data on the asteroid's exact shape, chemical composition and physical properties influencing how it is affected by the sun and the surrounding space. In fact, heat radiating from the sun and the asteroid overpowers the its gravitational pull on the spacecraft.

The science team was also surprised to learn that Bennu is rockier and dotted with more boulders than anyone imagined. Its surface brightness also varies widely, presenting a challenge for the lasers of the spacecraft's lidar system, which was designed to guide the sample acquisition approach.

Site Selection

In August, NASA announced the mission's final four candidate sampling sites. They were chosen based on spacecraft safety, the amount of collectable material available, maneuverability in and out of the site and scientific interest.

When the OSIRIS-REx team developed its sampling strategy based on what was known about Bennu at the time, they expected large swaths of relatively smooth surface. In reality, the spacecraft identified only a few hazard-free regions. As a result, the final four sample sites are each only about 10 meters in diameter. Instead of having the equivalent of half a football field in which to navigate, the spacecraft will have to operate within the confines of sampling sites smaller than half a basketball court.

"Despite these newly found challenges, our team is confident that we will meet the science objectives," said Dante Lauretta, OSIRIS-REx principal investigator and professor of planetary science at the Laboratory. "The OSIRIS-REx team designed the mission with flexibility and capabilities to deal with the unknown, and we are prepared to answer the challenges Bennu has given us."

Starting in October, OSIRIS-REx will begin a series of flyovers to obtain high resolution maps of each of the four sites. The primary and backup sample collection sites will be announced in December.

Sample collection is scheduled for the latter half of 2020 when OSIRIS-REx will touch the surface for five seconds to gather a sample of the asteroid before heading home and ejecting the Sample Return Capsule for landing in the Utah desert on Sept. 24, 2023.

"The true nail-biting moment will be the sample collection." Lauretta said. "The best times are ahead of us, so stay tuned. The exploration of Bennu has just begun, and we have a lifetime of adventure ahead of us."

OSIRIS-REx stands for Origins, Spectral Interpretation, Resource Identification, Security-Regolith Explorer. The economic impact of the OSIRIS-REx mission to the state of Arizona is $230.5 million. Since its launch on Sept. 8, 2016, it has traveled over 1.7 billion miles, and since Bennu became visible in October 2018, the spacecraft has delivered 16,485 TAGCAMS navigation images of the asteroid.

Stellar Students

Keara Burke began interning with the OSIRIS-REx team during her sophomore year. She was tasked with identifying the safest sample sites for the spacecrafts Touch-And-Go Sample Acquisition Mechanism that will collect rocks older than the Earth smaller than an inch in diameter. While the TAGSAM's task is limited to a few seconds, a rocky, hazardous area could compromise the mission.

"It's incredible to be able go to work every day and know that what I'm contributing to the conversation matters," Burke said as OSIRIS-REx arrived at the asteroid. "Being able to be part of this type of mission—I don't think I would have gotten this opportunity anywhere else."

She is one of more than 150 students, both at undergraduate and graduate level, who have been working on the mission so far.

Agrivoltaics Proves Mutually Beneficial for Food, Water, Energy

Building resilience in renewable energy and food production is a fundamental challenge in today's changing world, especially in regions susceptible to heat and drought. Agrivoltaics, the co-locating of agriculture and solar photovoltaic panels, offers a possible solution, with new University of Arizona-led research reporting positive impacts on food production, water savings and the efficiency of electricity production.

Agrivoltaics, also known as solar sharing, is an idea that has been gaining traction; however, few studies have monitored all aspects of the associated food, energy and water systems, and none have focused on dryland areas—regions that experience food production challenges and water shortages, but have an overabundance of sun energy.

"Many of us want more renewable energy, but where do you put all of those panels? As solar installations grow, they tend to be out on the edges of cities, and this is historically where we have already been growing our food," said Greg Barron-Gafford, a professor in School of Geography and Development. "We started to ask, 'Why not do produce both in the same place?' And we have been growing crops like tomatoes, peppers, chard, kale, and herbs in the shade of solar panels ever since."

Using solar photovoltaic, or PV, panels and regional vegetables, the team created the first agrivoltaics research site at Biosphere 2. Professors and students, both undergraduate and graduate, measured everything from when plants germinated to the amount of carbon plants were sucking out of the atmosphere and the water they were releasing, to their total food production throughout the growing season.

They found that the agrivoltaics system significantly impacted three factors that affect plant growth and reproduction—air temperatures, direct sunlight and atmospheric demand for water. The shade provided by the PV panels resulted in cooler daytime temperatures and warmer nighttime temperatures than the traditional, open-sky planting system. There was also more moisture in the air in the agrivoltaics system.

"We found that many of our food crops do better in the shade of solar panels because they are spared from the direct sun," Baron-Gafford said. "In fact, total chiltepin fruit production was three times greater under the PV panels in an agrivoltaic system, and tomato production was twice as great!"

Jalapenos produced a similar amount of fruit in both the agrivoltaics system and the traditional plot, but did so with 65% less transpirational water loss.

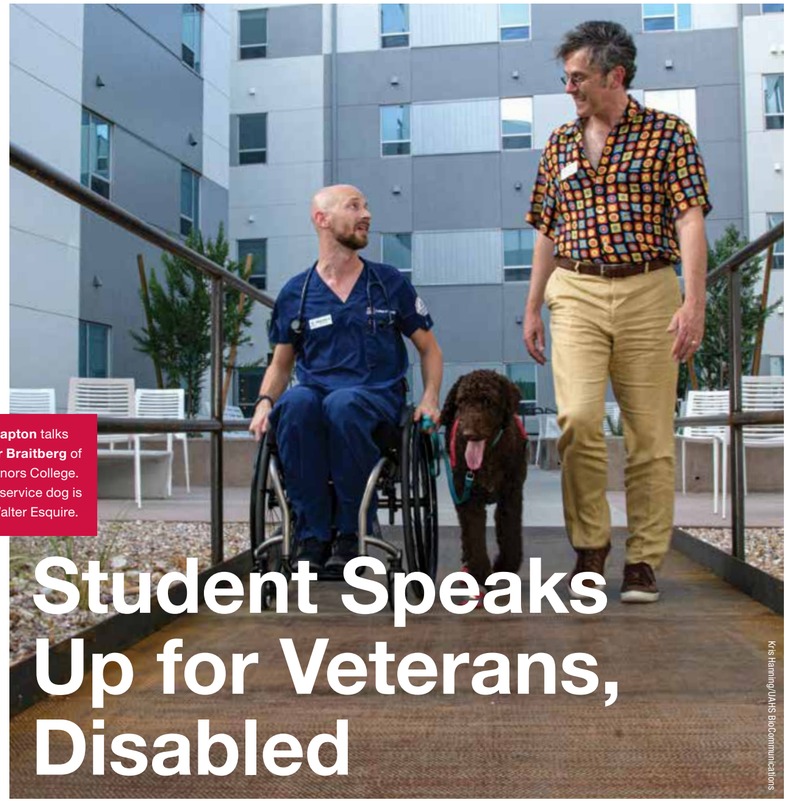
"We found that each irrigation event can support crop growth for days, not just hours, as in current agriculture practices. This finding suggests we could reduce our water use but still maintain levels of food production," Barron-Gafford added, noting that soil moisture remained approximately 15% higher in the agrivoltaics system than the control plot when irrigating every other day.

The researchers also found that the agrivoltaics system increased the efficiency of energy production. Solar panels are inherently sensitive to temperature—as they warm, their efficiency drops. By cultivating crops underneath the PV panels, researchers were able to reduce the temperature of the panels.

"Those overheating solar panels are actually cooled down by the fact that the crops underneath are emitting water through their natural process of transpiration—just like misters on the patio of your favorite restaurant," Barron-Gafford said. "All told, that is a win-win-win in terms of bettering our how we grow our food, utilize our precious water resources, and produce renewable energy."

(far left) A traditional open-sky garden is situated next to an agrivoltaics system, in which plants are grown under solar photovoltaic panels. The study was conducted at the Biosphere 2, which can be seen in the background. (right) From left: University of Arizona students **Alyssa Salazar, Leandro Phelps-Garcia** and **Isaiah Barnett-Moreno** conducted the agrivoltaics research at the Biosphere 2 under the guidance of associate professor **Greg Barron-Gafford.**

Student Speaks Up for Veterans, Disabled



Kris Hannig/UAHS BioCommunications

Nick Knapton talks with **Victor Braitberg** of the UA Honors College. Knapton's service dog is Herbert Walter Esquire.

Nick Knapton always assumed the Americans with Disabilities Act made everything accessible to people with disabilities, but he quickly learned that is not the case. In response, he got involved with the Disability Resource Center to increase accessibility on campus.

Nick Knapton, a graduate student in the University of Arizona College of Nursing, needs a wheelchair, but not as a result of being shot and wounded while serving in the Army. He was paralyzed much later by Lyme disease.

Knapton's experiences fuel his passion to help people. He advocates for veterans' services on campus and works with the University of Arizona Disability Resource Center to improve access for those whose mobility is challenged. One of his most important tools is his story, which he tells to inspire compassion for others in similar situations.

After high school, Knapton joined the Army, performing intelligence and counterintelligence work. He served multiple deployments, including in Afghanistan, where he was shot (his bullet-resistant vest absorbed the rounds) and took shrapnel in his back and legs. Those wounds healed, but the hardest blow to recover from was inflicted in Kandahar City, where he witnessed the killing of one of his best friends.

"I held myself responsible for his death for a long time," said Knapton, who suffered from post-traumatic stress disorder. "It was his family who said, 'This wasn't your fault. He saved other people. If that rocket-propelled grenade hadn't struck him, it might have struck you or some children nearby.' They helped me recognize that instead of feeling guilty, I can feel thankful and appreciate the sacrifice he made."

Not long after, Knapton's father lost his battle with cancer.

"I remembered the last thing my father said to me was to do what makes me happy and take care of myself," Knapton recalled. "I realized he wasn't doing either of those things."

The back-to-back losses of his best friend and his father motivated Knapton to make a change. He left the military and enrolled at the University of Wisconsin, where he became involved in the veteran services organization, eventually serving as president.

After transferring to the University of Arizona to complete his undergraduate degree in physiology, Knapton continued to advocate for veterans. One of Knapton's professors, who knew Knapton was a veteran, asked him to talk to a class about post-traumatic stress disorder. The students were learning about the physiology of PTSD.

"If you talk about it, people who don't know what you've been through can begin to understand," Knapton said. "It was eye opening. I hear veterans say, 'People don't understand what I went through.' My philosophy has always been, well, explain it to them."

Knapton's journey took another turn two years ago. While still a physiology undergraduate, he was diagnosed with Lyme disease.

"I started to get migraine headaches and could not get out of bed. Then, I couldn't control my blood pressure. It would just plummet, and I would faint for no reason. I couldn't understand what was going on," he said.

His doctor tested Knapton for Lyme disease—the result was positive. Before he could be fully treated, the disease ate away at the nerves in his spine, paralyzing him from the waist down.

"In three months, I went from very healthy, to waking up paralyzed."

Knapton credits his time in Afghanistan with helping him adapt to being in a wheelchair.

"I was able to experience a culture that is more concerned about whether they or their family is safe, and whether they are going to be able to eat or have water today," he said. "In spite of these worries, you see children laughing, people smiling, still enjoying life. I knew I can handle this. Other people handle far worse on a daily basis."

Knapton connected with the Disability Resource Center to help him adjust to taking classes in a wheelchair. He said he always assumed the Americans with Disabilities Act made everything accessible to people with disabilities, but he quickly learned that is not the case. In response, he got involved with the Disability Resource Center to increase accessibility on campus.

Knapton also helped develop the Disability Cultural Center, one of very few in the nation to provide a space for students, faculty and staff to explore and celebrate disability identity, culture and community.

"Being disabled is really a culture. We experience things from a different point of view than the rest of the able-bodied population," Knapton said. "We need to celebrate our differences and talk about them so people can learn about them."

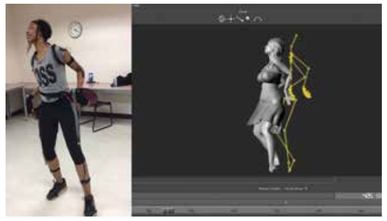
A recent physiology graduate, Knapton (center) now studies nursing at the University of Arizona.

Knapton also became involved in Arizona Adaptive Athletics, participating in and supporting the wheelchair racing and tennis teams.

"We have adaptive athletic teams that are winning national and world championships, and bringing home gold medals from the Paralympics Games. We should be proud and spread the word."

After finishing his undergraduate degree in May, Knapton started the Master of Science for Entry to the Profession of Nursing program at the College of Nursing. The 15-month program is designed for students holding degrees in other fields to become registered nurses.

"I never want to leave the University of Arizona," Knapton said. "The university is great in helping you find your passion, fostering it and developing it. I want to get my master's degree here, my doctorate in nursing practice here, practice nursing at Banner and teach at the university. My long-term goal is to become a nurse educator. If you want to change something, you teach."



Using motion capture technology, the movements of a professional dancer are transformed into a virtual representation of African dances for use in online courses. (below) Center for Digital Humanities Director **Bryan Carter** and Tech Core Director **Ash Black** observe student coders who are using advanced technologies such as virtual reality to create unique learning experiences.

Tech Core

Transforming the Humanities Through Technology

Imagine being able to walk around a Buddhist temple in China without leaving your desk or observing with the click of a button how African dances evolved. Those are just some of the ways digital technology is creating new opportunities to study who we are, where we came from and ultimately what it means to be human.

The University of Arizona's Center for Digital Humanities combines advanced computational technology with the world's most enduring questions about the human condition. That synthesis of different modes of thought and exploration can spark exciting new opportunities, says Bryan Carter, director of the Center for Digital Humanities, which funds research projects in the College of Humanities.

Praise Zenenga, director of the Africana Studies Program, received a digital humanities development award to pursue a project that allows him to teach his course on African dance to online students.

Zenenga uses motion capture to record the movements of a professional dancer, creating a virtual representation of dances that evolved from Africa, through the Caribbean and to the U.S. Students can examine the dances online from any angle and at any speed.

"Teaching from the humanistic perspective—not the fine arts perspective—my primary interest in the classroom is showing students how traditional dances have evolved over space and time," Zenenga said. "Three-dimensional motion capture can show students how these subtle variations evolved. It's easier for students to be taken back in time and to simulate a real experience through 3-D motion capture technology."

Another award from the Center for Digital Humanities allowed University of Arizona students studying French and Russian to connect with peers in borderland regions so they could explore the topic of borderlands together while working on language skills. The students were guided through a study of three borderlands regions, Québec-New England, Mexico-Southern Arizona, and Russia-Northern Kazakhstan, by faculty members Liudmila Klimanova and Emily Hellmich and their colleagues at the Cégep de Sept-Îles in Québec and Kostanay State University in Kazakhstan.

"Being close to the border here in Tucson is a lot different than the experience the students in Kazakhstan have in being next to the border with Russia," says Evan Rowe, a Russian major. "For people here in the United States, the border with Mexico is a huge topic, but when I talked to some of the students there, they didn't feel like they lived next to a border. It definitely helped understand the similarities and differences between the two cultures."

In addition to 3-D scanning and motion capture, the Center for Digital Humanities incorporates textual and data analysis, application creation, data visualization, GIS mapping, augmented reality, virtual reality, immersive technology, digital storytelling, social networks and cultural informatics into its projects.

Taking the digital humanities projects from idea to reality involves a collaboration between faculty researchers and student developers in Tech Core. Housed in the Eller College of Management, Tech Core is both a 100% Engagement experience for students and an affordable technological resource for partners on campus, says director Ash Black.

"It's a perfect example of letting the world's needs drive your learning, and what's great with the College of Humanities is the students are working in constant contact with the faculty members," Black says. "It's a very innovative partnership. Given the monumental transformation in the way technology is reshaping our world, the input of humanities faculty has never been more needed. There's no more important question now than what it means to be a human being. We have to inform the purpose of the technology."

Startup Seeks to Control Dust in a Dry World

Materials science and engineering doctoral student **Taehee Lee** uses a blower to create a 25-mph wind to measure generated dust concentrations from the surface where dust suppressants were applied two weeks prior. The tests were done at the closed tailings storage facility at the Asarco Mission Mine.

Minkyu Kim

People living in dry climates worldwide experience the problems wrought by dry air and blowing dust, which affects everything from respiratory health to cars and other machinery. To control dust in areas like mines and construction sites, the general practice is to spray the ground with water. While this method does keep dust levels down, sites require constant reapplication, especially in arid climates like Arizona.

To address the problem, researchers at the University of Arizona College of Engineering have developed an environmentally safe biocompatible polymer blend that, when added to water used for dust control, keeps the ground damp for more than two months, even when exposed to the open desert air.

Through Tech Launch Arizona, which commercializes inventions stemming from research, the university provided funding to advance the invention, protected the intellectual property, and licensed it to startup Clean Earth Tech to bring it to the marketplace.

"Most of my work has been about finding new things and contributing to science," says inventor and assistant professor Minkyu Kim, who is also a member of the BIO5 Institute. "I'm very excited to know that my work is benefitting all of society, not just academia."

The project was an epiphany for Kim, as his research career to this point has been focused on biomaterials, not air pollution.

"I learned that there were a lot of mining companies with air pollution issues," he says. "I saw this problem of water drying too quickly and thought about using these materials to keep dust wetter longer."

According to Kim, many companies have been using water along with commercial dust suppressants mostly based on salts or acrylic or vinyl polymers developed before the 2000s. Today, extensive research motivated by the desire to address environmental issues, not just air pollution control, has resulted in more options for materials to apply to the problem—especially materials that are safe to put into groundwater.

"I was surprised that these well-known materials in other research fields were not adapted for dust suppression technology yet," Kim says. "That's when I knew I had something special."

Because the material is biocompatible and safe for human consumption, it is not only perfectly suited for use in mining facilities, but could also be ideal for use by cities, counties, and farming communities—any environment where dust control is needed.

Building Community Across the Border

A binational tennis and art festival located on the border between Nogales, Arizona, and Nogales, Sonora, Mexico, provided a unique volunteer opportunity for students in the University of Arizona College of Education.

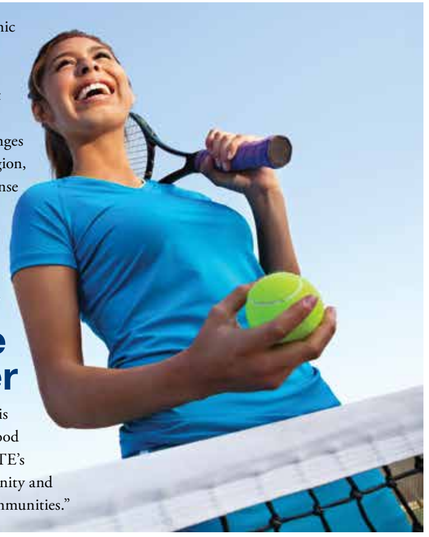
The festival, hosted by the Border Youth Tennis Exchange, featured music, art installations, and pop-up tennis on both sides of the border. UA College of Education Assistant Professors of Practice Matt Ostermeyer and Brandon Harris, and students Jaden Mickens, Rosie Harris-Makinen, Shannon MacNeil, and Alex Davood provided books and led arts and crafts projects.

The Border Youth Tennis Exchange, or BYTE, uses tennis and education to keep children off the street and build teamwork and self-esteem. One of 350 chapters in the United States Tennis Association's National Junior Tennis and Learning network, BYTE is the only program to operate internationally and in the border region.

"Our students shared that it was one of the most impactful experiences in their undergraduate careers," Ostermeyer said. "They got to experience firsthand, and help promote, the intended impact of BYTE, which provides a contrast to the negative and stereotypical discourse surrounding the border with the complex and beautiful, universal human realities in a place like Nogales."

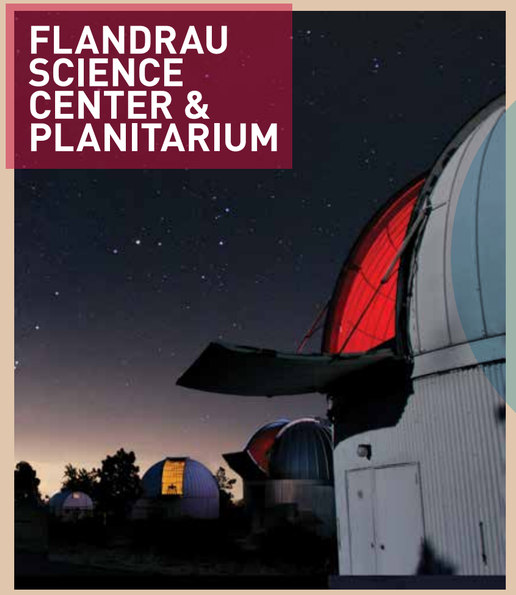
BYTE operates five sites in Ambos Nogales, offering programming to youth through four organizations. Students receive two sessions weekly, consisting of an hour of on-court tennis instruction and an hour of academic mentorship.

"The students said they were not only left with a greater understanding of the challenges faced in the border region, but also with a new sense of purpose in helping others, including their fellow students," Harris added. "They understood the importance of BYTE's efforts in promoting unity and resilience between communities."



HAVE YOU DISCOVERED THESE UA CAMPUS TREASURES?

FLANDRAU SCIENCE CENTER & PLANITARIUM



What makes Tucson special? From before the time Tucson became a U.S. territory, to the establishment of Arizona's first university, the recipe of the Old Pueblo holds many ingredients that have made Tucson the unique dish that it is today. A natural oasis set in the nationally recognized cultural landscape of the Santa Cruz Valley National Heritage Area; Tucson provides a window into a past with traditions and customs that live into the present. From the continued cultivation of indigenous foods, to the preservation of art, historic areas and landmarks, Tucson exists as a cultural hub that inspires the free spirit in all of us. Whether you're a new visitor or a native Arizonan looking to see more of your backyard, Tucson provides an exceptional experience of the Southwest.

UNCOVER THE PAST AT THE ARIZONA STATE MUSEUM

Discover the indigenous cultures of Arizona, the greater Southwest, and northern Mexico at the Arizona State Museum, the largest and oldest anthropology research museum in the Southwest located on the University of Arizona campus. Glimpse into what life was like throughout the region's 13,000-year human history. View the world's largest and most comprehensive collection of American Indian basketry and or embark on the Pottery Project tour and discover Southwest Indian pottery of the Hohokam, Mogollon, and ancestral Pueblo cultures.

WITNESS PHOTOGRAPHY'S ENDURING CULTURAL INFLUENCE

Nestled within the University of Arizona is the Center for Creative Photography (CCP), one of the world's finest academic art museums and study centers for the history of photography. Step into this treasure house and you might find yourself not only looking at Ansel Adams' luminous "Moonrise, Hernandez, New Mexico," but reading his handwritten diary to learn how he happened to make this famous image one afternoon in 1941.

The Center opened in 1975 and features the archives of five American photographers: Ansel Adams, Harry Callahan, Wynn Bullock, Aaron Siskind, and Frederick Sommer. Today, the Center includes 270 archival collections from prominent 20th century North American photographers and over eight million archival objects. The CCP also holds a mixture of exhibitions and events throughout the year, including lectures, book signings, and print viewings centered around celebrating the cultural significance of photography and helping to build a bigger appreciation for the visual artform.

ARIZONA STATE MUSEUM

INDULGE YOUR CULINARY CURIOSITIES

Tucson tastes like nowhere else in North America, with a rich culinary heritage spanning 4,000 years and a border that encompasses distinct Mexican and Native traditions in food and drink. Designated by UNESCO as the first City of Gastronomy in the United States and home to the Best 23 Miles of Mexican Food, Tucson offers an exciting modern food scene with local influences and ingredients reflecting the innovative agricultural techniques practiced in the region—from Sonoran Dogs to prickly pear jam.

Continue your journey of Tucson's agricultural history while fitting in your workout at Tumamoc Hill. Serving as an ecological reserve, the Pima County and University of Arizona College of Science's Desert Laboratory on Tumamoc Hill, combines a living lab with community.

EL CHARRO STEAK

Take a guided tour and see the ancient agave fields or hike up the hill.

As you make the trek to the top alongside cardio-loving Tucsonans, download the Tumamoc Tour App and listen to stories from locals and find out more about what once lived on the hill 2,500 years ago.

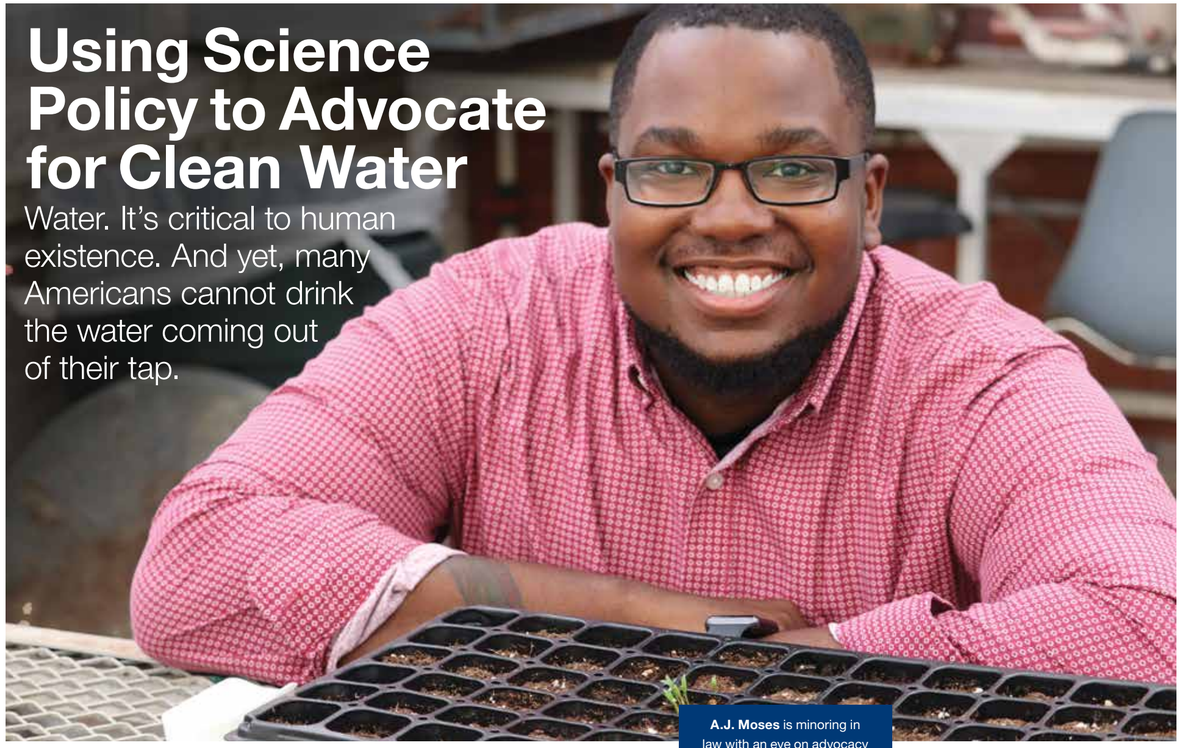
EXPLORE A CITY OF SCIENCE

Home to the University of Arizona, Tucson stands out as a city of science with access to real research in fields of astronomy, ecology and geology. Telescopes top Tucson mountains, taking advantage of the city's clean air and clear, dark skies to make it the "astronomy capital of the world." Indulge the eyes and take in Tucson's beautiful night skies—from the mountaintop observatory at Mt. Lemmon SkyCenter, to viewings at the Flandrau Science Center & Planetarium. Your watch will tell you it's time for sleep, but you may not want to close your eyes.

Whether you're here for a day or for a week, there's plenty of opportunities to take in the rich culture of the Old Pueblo. Free yourself and start your journey at VisitTucson.org.

Using Science Policy to Advocate for Clean Water

Water. It's critical to human existence. And yet, many Americans cannot drink the water coming out of their tap.



Caroline Mosley

A.J. Moses is minoring in law with an eye on advocacy in the future. "I believe that even if you do great research, it doesn't mean much if you can't translate it into actionable policy," he says.

"It's easy to say people need water," says Arthur "A.J." Moses, a doctoral student in the Department of Environmental Science at the University of Arizona, "but it's never that simple."

Moses wants to be an expert in water issues, from federal and state laws to the microbial make-up of the water in our rain barrels. And with that knowledge, he wants to go into environmental policy to speak for those who cannot speak for themselves.

To reach this goal, Moses works with assistant professor Mónica Ramírez-Andreotta and Project Harvest, a citizen science project with a mission to engage rural and urban Arizona communities about the health of their harvested rainwater they use for soil and plants. Moses works on the project testing harvested rainwater and soil for microbial contamination.

Moses' path to the University of Arizona and why he cares so deeply about water, be it in his hometown of Washington, D.C., or Tucson, Arizona, came from a personal revelation: even in 2019 and in one of the richest nations in the world, people don't know what's in their water and get sick because of it.

His first exposure to water crises was growing up in the nation's capital in the early 2000s, when a lead contamination crisis left thousands of children as risk and resulted in a regulatory crackdown. But it was a friendship that opened his eyes to how acute water crises can be.

After a troubled freshmen year at college, Moses decided to put his life into perspective and joined the U.S Marine Corps. Long training hours led to the exchanging of life stories, and he met many immigrants with vivid tales of walking miles just for clean water.

His perception on his own life shifted as he learned how people struggled for basic amenities, especially water.

Clean water wasn't just an issue abroad. During his training, a sign posted above the only water source stated that elevated lead levels were present in the water lines. When he informed his family, he learned his father, also a Marine Corps veteran, had received a letter about exposure to water contamination from the base water supply nearly 40 years earlier.

A Focus on Environmental Policy

Inspired by people and their stories, Moses returned to his studies when his military service ended, graduating from the University of Maryland with a bachelor's degree in geographical sciences. On his own time, he began to research water quality issues and law in different regions of the U.S., and he decided to pursue a graduate degree to get the expertise he deemed necessary to work in environmental policy.

Moving away from the East Coast, he was excited to talk to people about water rights and issues in the Southwest, a region where water is more precious than land.

Looking at initial data from the first year of Project Harvest, Moses saw the presence of E. coli in harvested rainwater and soil. This is not necessarily alarming; most strains of E. coli are harmless to humans and live naturally in our intestinal tract. However, E.coli is used as an indicator organism, meaning that its presence generally suggests fecal contamination and the potential for pathogenic microbes. Identifying the source of contamination is key.

To get answers, Moses wants to replicate how people care for their gardens. Many people use sources other than tap water to water their gardens, such as excess household water, or greywater, reclaimed water or rainwater. And there is very little research on harvested rainwater.

His doctoral research involves a greenhouse study that could reveal the origin of microbes and contaminants and help him create best practices for local communities. Moses is basing this study on participant surveys from Project Harvest and using common plants grown in Arizona, like romaine lettuce and cilantro.

For his doctoral thesis, Moses is researching the origin of microbes and contaminants in various types of water used in personal and community gardens.

Even as Moses dives deep into the intricate details of water contamination, he knows that he wants to work on science policy on a global scale.

He was recently named the 2019 Science Policy Fellow under the University of Corporation for Atmospheric Research, or UCAR, Next Generation Fellowship program, which supports graduate students from underrepresented communities in their professional careers as Earth system scientists. Moses will receive financial support for two years of graduate school and participate in two summer internships with UCAR and the National Center for Atmospheric Research. Based in Washington, D.C., he will brush shoulders with policymakers and learn from the inside about the bureaucracy of water and earth system sciences in the United States.

"Through this fellowship, I will be able to form research questions that can not only help American communities but also improve our scientific capacity as a country by answering the scientific questions of interest to our government," Moses said.

But during this time, he won't forget the communities he's worked with.

"I want to make sure people have access to clean water so they can sustain themselves," Moses said. "If you can't grow vegetables in your own yard, what kind of world are we living in?"

After the Fire: Firefighters Battle More Than Just Flames

Cancer is a leading cause of death among firefighters, who are exposed to cancer-causing chemicals on the job through inhalation and skin absorption. Measuring these exposures and determining how they cause cancer are essential steps in learning how to reduce cancer risk in firefighters.

"The university is committed to improving the lives of first responders," said Jeff Burgess, M.D., associate dean for research at the University of Arizona Mel and Enid Zuckerman College of Public Health. "Not only are we gaining insights into the development of cancer in firefighters, the research should lead to earlier detection and treatment and prevention strategies. Our goal is to create a model for fire departments across the country."

The work began with a pilot study in 2015 when the university received a $1.5 million grant from the Federal Emergency Management Agency, or FEMA, to help improve fire department safety in Tucson. The research was so successful that it led to an additional $1.5 million FEMA grant to expand the effort to fire departments across the country.

Firefighters are exposed to carcinogens when they breathe in smoke, diesel exhaust and other chemical gases, as well as when their skin is contaminated. The amount of chemicals the body absorbs internally is affected by many factors, such as the type of fire, the specific job task and how they clean their gear.

(above) **Jenna Norban,** a public health major with a minor in Spanish, is part of the Firefighter Multicenter Cancer Cohort Study research team. She spent the summer interning at the Orange County Fire Authority in California, one of the Zuckerman College of Public Health's fire service partners. (right) Doctoral student **Alesia Jung** with Deputy Chief Darin Wallentine of the Tucson Fire Department.

Kris Hennon/UAHS Biocommunications

Since cancer has a long latency period between exposure and the onset of disease, researchers need a way to link the early toxicological effects of carcinogen exposure to eventual cancer development, which could help them develop effective strategies for preventing disease.

Alesia Jung, a doctoral student in the epidemiology program at the Zuckerman College of Public Health, is project coordinator for the Fire Fighter Multicenter Cancer Cohort Study and works directly with firefighters in Tucson, Boston, California and Florida.

"We still don't understand which exposures cause the increased risk for cancer or how they do so," Jung said. "This information is necessary to determine the best ways to help prevent cancer in firefighters. I hope our work will be able to prevent future firefighters from developing occupational cancers and to affect laws and policies related to workers' compensation so firefighters who do develop occupational cancer receive the medical care they deserve."

"The research not only will help the fire service better understand how we are being exposed to carcinogens, it also will lead to safer practices on fire incidents and improved protective equipment that ultimately will lead to fewer firefighter fatalities," said Chief Ron Siarnicki, executive director of the National Fallen Firefighters Foundation.

Burgess said the goal is to continue the research for 30 or more years, which is the time it takes for many cancers to develop.

Students in Arizona Law’s IP Clinic Secure First Three Patents for Clients

The Intellectual Property Clinic at the University of Arizona James E. Rogers College of Law has secured its first three client patents from the United States Patent and Trademark Office.

Under the guidance of clinic director Allan Sternstein and supervising attorneys, law students counsel individuals and businesses on securing, maintaining, protecting and enforcing their intellectual property, or IP, rights, including rights in patents, trade secrets, trademarks and copyrights. Services are provided at no charge.

The first patents issued to clinic clients

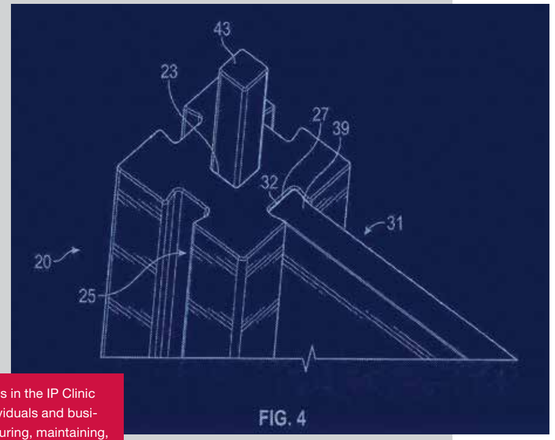
- Patent No. 9,993,074, for a do-it-yourself modular kit for storage, garden and entertainment structures, produced by the company Modular Home & Garden.
- Patent No. 10,180,016, for a product called the Delivery Safe, a safety bag that attaches to the user’s front door, in which delivered packages can be placed and locked, preventing the packages from theft, loss and inclement weather.
- Patent No. 10,238,729, for a groundbreaking vaccine and medical procedure for treating certain forms of skin cancer. The vaccine and process are in clinical trials, and additional patent applications are pending for expanded use of the treatment.

Working on a patent case is a long-term assignment for IP Clinic students. For the Delivery Safe, students began their review of the client’s invention in February 2017, filed the patent application in January 2018 and finally saw the patent issued a year later.

“The IP Clinic has been by far the most rewarding experience I have had while in law school,” says Alexandra DeArman, who worked on the Modular Home and Garden patent. “Prior to joining the clinic, my knowledge of intellectual property was limited. But through working one-on-one with clients, fellow students and our incredible advising attorneys, I have been able to grow my skill set in ways not possible through lecture alone.”

Blake Osecki, founder and president of Modular Home & Garden LLC, says the professionalism and insight from the IP Clinic students made his utility patent and two trademark applications run as smoothly as he could have imagined.

“It was a pleasure working with the clinic and especially the students,” Osecki says. “I enjoyed coming to campus to meet everyone who was working on my project in person.



Law students in the IP Clinic counsel individuals and businesses on securing, maintaining, protecting and enforcing their intellectual property.

This made a big difference to me, bringing 3D printed parts to physically show the invention to students and staff and highlighting what I wanted to protect and why.”

In addition to its own client work, the IP Clinic is also the designated US Patent and Trademark Office Pro Bono Program hub for the State of Arizona. Through its Arizona Public Patent Program, the clinic connects under-resourced inventors and businesses with pro bono patent attorneys.

Michael Chesly/Arizona Athletics

Women’s Basketball

In a season full of ups and downs, the Wildcats caught fire at the right time, riding a six-game winning streak into a program-defining Women’s National Invitational title. Arizona finished the season with 24 wins, the most since the 2003-04 season, to complete the largest turnaround in school history, as well as the largest turnaround of any school in the 2018-2019 season. The six postseason wins were played in front of a total crowd of 45,602 fans at McKale Center. Arizona broke program and Pac-12 attendance records with a sellout crowd of 14,644 for the championship game victory over Northwestern. Sophomore Aari McDonald earned a number of national accolades after breaking the school’s single season scoring record. McDonald was an Associated Press and WBCA Honorable Mention All-American while also being selected to the All-Pac-12 and Defensive All-Pac-12 teams. Cari Reese was a 2018-19 Pac-12 All-Freshmen Team selection after earning Freshman of the Week honors on three separate occasions during the season.

Taking ‘Do No Harm’ to Heart

Kris Hendrix/UAHS BioCommunications

Ike Royal Chinere’s fascination with the cardiovascular system in healthy states and disease states fuels his drive for medical innovation.

No doctor wants to treat a patient with a medication that’s worse than the disease. That thought is what drives Ike Royal Chinyere, a dual M.D./Ph.D. candidate at the University of Arizona College of Medicine – Tucson, in his quest to develop a system that may help doctors select the most effective and minimally toxic drugs for heart failure patients.

Born and raised in Kingman, Arizona, to Anselm and Stella, a pharmacist and a nurse who emigrated from Nigeria, Chinyere moved to Tucson for his undergraduate studies in physiology.

“I developed a deep respect for the heart and its intricacies,” Chinyere said. “It truly is amazing how electrical activity precisely controls the mechanical activity and they work together incessantly for decades.”

As an undergraduate in the Honors College, Chinyere began his research in the UA Sarver Heart Center under the mentorship of several physician-scientists. Since then, he has worked to develop a platform to evaluate drug effectiveness and toxicity for different conditions, such as heart failure and atrial fibrillation.

Now in his third year of the M.D./Ph.D. program, Chinyere’s studies focus on cardiac electrophysiology. Chinyere’s long-time mentor, Professor of Medicine Steven Goldman, M.D., has been developing a patch that has the potential to be one of the first regenerative therapies in cardiology.

Chinyere’s research revealed that this patch can be reformulated to treat more than just heart failure—it also can be used as a screening platform. It functions similarly to a real human heart and may predict drug effects better than current models.

“My vision is to incorporate components of precision medicine into the drug-screening world, to continue to avoid patient harm, but also ensure that revolutionary drugs make it through the development pipeline,” Chinyere said. “As our skill in creating therapies improves, our ability to screen these complex therapies must quickly follow suit, in order to protect the public.

“It is said that if you love what you do, you’ll never work a day in your life. I love where I am, and I love what I do.”

One-Day Job Shadow Leads to Full-Time Job Offer

The University of Arizona Job Shadow Program helped Samantha Grim gain the confidence and connections she needed to apply for a summer internship, which led to a job offer with Charles Schwab.

Samantha Grim

Samantha Grim (far right) and fellow Charles Schwab summer interns on the last day of their internships.

Samantha Grim is starting her senior year at the University of Arizona with a job offer in hand as a financial consultant trainee for Charles Schwab.

She couldn’t have known it at the time, but a one-day job shadow over the winter break helped Grim set a course for a future she barely imagined, but secretly hoped for.

“In the back of my mind, I always wanted to go into financial services,” says Grim, who started her freshman year majoring in pre-nursing before switching to political science with a minor in economics. “I never thought it would be possible because of my major. I never wanted to take the risk in fear I would be wasting their time, as my discipline isn’t common in financial services.”

When she learned about the University of Arizona Job Shadow Program, a one-day opportunity to shadow the professionals such as those at Charles Schwab, her career curiosity quickly overruled any fears. Grim only spent eight hours at a Charles Schwab branch, but it was long enough to provide her with valuable insights into the business.

“I was able to see what a day-in-the-life would be working in financial services,” Grim said. “And it met many items on my career checklist: I would be able to help individuals, every day would be different, and it’s a happy work environment—the people who work there, want to work there. I realized I could see myself doing this.”

Grim then applied for and was accepted into Charles Schwab’s summer internship program. She spent her summer in Scottsdale getting up at 5:30 a.m. for an hour-long commute, but loving her workday. She and the other interns—primarily finance and accounting majors—worked in Investor Services, learning on the job as they answered phones and studied for the security industry essentials exam, a mandatory test for prospective securities industry professionals.

In the end, all of her hard work paid off: she accepted a job offer in Schwab’s Financial Consultant Academy in Dallas.

Tackling 21st Century Sustainability Challenges on the Navajo Nation

Nikki Tulley grew up on the Navajo Nation. Now, as a doctoral student in environmental science at the University of Arizona, she is enrolled in the Indige-FEWSS program.

Twelve University of Arizona graduate students have teamed up with undergraduates on the Navajo Nation to design a solar-powered water filtration system that can provide 50 gallons of safe, clean water to 30 Navajo families per day.

The students are part of the first cohort of trainees to participate in a five-year, $3 million National Science Foundation grant that enables an unprecedented collaboration between the University of Arizona and Diné College. The goal of the program is to teach the next generation of science, technology, engineering and mathematics professionals how to confront food, energy and water challenges among Indigenous communities while letting traditional values guide their work.

Indige-FEWSS, which stands for Indigenous Food, Energy and Water Security and Sovereignty, combines research internships, teaching and cultural immersion.

“We want to enable these trainees to tackle critical, real-world food, energy and water problems with an understanding of culture and sovereignty of Indigenous people,” said Karletta Chief, who is leading the project and is an associate professor of environmental science at the University of Arizona.

The Navajo Nation is the largest reservation in the U.S. Up to 35% of its residents don’t have running water due to rugged terrain and low population density. While Navajo Nation EPA policy prohibits human consumption of water from unregulated sources, Navajos without access to piped water routinely drive long distances to haul water for drinking, cooking and bathing. Often this water comes from unregulated sources, like livestock wells and springs that can exceed drinking water standards for contaminants like arsenic and uranium, an impact of earlier mining activities.

At a community event held at Diné College, participants in the Indige-FEWSS program demonstrate how the water filtration system works and provide clean drinking water to Navajo Nation community members.

The use of unregulated water sources is the greatest public health risk associated with drinking water for the Navajo Nation.

Influenced by traditional Navajo culture and ecological knowledge, the Indige-FEWSS students tackled the problem by designing a $25,000 system that reflects lifestyles and culture on the reservation. It sits on a flatbed trailer that can be towed to a water source, and the system comprises materials that are largely available at a hardware store.

The solar-powered water filtration system can purify up to 1,500 gallons of water per day, removing nearly 100% of dissolved contaminants such as arsenic and uranium—well below the concentrations to meet drinking water standards—without the need to be connected to centralized water or power. Using the system, Navajo Nation residents can continue to haul water from wells while also ensuring its safety and cleanliness.

“Trainees in the Indige-FEWSS program are not doing research to be put on the shelf, but we’re doing research to have real impact and solve real problems that our community has,” said Chief, who grew up on the Navajo Nation.

“Through Indige-FEWSS, I’m able to fulfill a promise I made to my family, saying that I’ll never forget where I come from,” said Nikki Tulley, a doctoral student in environmental science. “My place in the universe will always be bringing resources and services to the Navajo Nation.”

Inventions Help Legally Blind to See

Paul Tumarkin/Tech Launch Arizona

(top left) **Kennedy Nyairo,** Tech Launch Arizona licensing manager for the College of Optical Sciences, gets a demo of the eSight system from inventor **Hong Hua.** (above) The eSight system centers around electronic glasses that deliver the ultimate combination of image quality, field of view, size, weight and affordability.

Low vision has an immense impact on mobility, independence and quality of life for people who “When I originally met with the eSight team, I was intrigued by the broad social impact of the project,” said Hong Hua, professor of optical sciences at the University of Arizona James C. Wyant College of Optical Sciences. “They said they were developing a system to help low-vision people, and the more I listened to them, the more I thought they were doing something really useful and helpful, and I wanted to be a part of it.”

Hua is highly recognized for her research in innovative 3D display technologies, complex visualization systems and novel image acquisition systems. Working with graduate student Jason Kuhn, Hua developed the technology and worked with Tech Launch Arizona, the commercialization arm of the university, to patent the technologies and license them to eSight Corporation.

Specifically, Hua and Kuhn developed a wedge-shaped prism eyepiece design with free-form surfaces that provides both high resolution and a large exit pupil—a combination and level of image quality that has not been previously achieved.

eSight has integrated the inventions into electronic glasses that work by capturing images with a small camera, enhancing them, and then projecting them onto screens in front of each eye in real-time, providing more visual data to the brain and triggering an increased reaction from the eye.

Medical Students Start Street Medicine Phoenix To Help Homeless

Two University of Arizona students have started a program to help Phoenix's homeless population by providing individualized health care and connecting them with free health-care services and resources.

Justin Zeien, a third-year medical student at the College of Medicine – Phoenix, and Jeffery Hanna, a graduate student in the Clinical Translational Science program at the college, created Street Medicine Phoenix in May 2017 after learning about similar programs in other metro areas.

With the help of a grant provided by the BHHS Legacy Foundation, the pair conducted a needs-assessment survey to determine how they might be able to eliminate racial disparities in the homeless population and reduce Phoenix homelessness in general.

"Street medicine is a way to provide compassionate, humanistic care to underserved, vulnerable, and often forgotten homeless people," Hanna said.

Zeien and Hanna reached outside of their college to staff Street Medicine Phoenix, involving students faculty from the colleges of nursing, pharmacy and public health, as well as the Northern Arizona University physician assistant, occupational therapy and physical therapy programs.

Since November 2018, the group has conducted 23 outreach events—called "street runs"—in downtown Phoenix, where they have completed 390 health screenings and provided 81 referrals to community resources. Through a partnership with Midwestern University's optometry program and New Eyes for the Needy, Street Medicine Phoenix has completed vision screenings for 24 people and given 14 vouchers for free eye exams and 17 new pairs of prescription glasses.

Zeien and Hanna are working with other street medicine initiatives across the U.S. to develop a a curriculum to equip students to care for people experiencing homelessness using a holistic, person-centered approach.

Jennifer Hartmark-Hill, M.D., is the primary faculty adviser and medical director for Street Medicine Phoenix, which is one of the programs under the Student Health Outreach for Wellness Community Initiative umbrella at the University of Arizona. Other faculty advisers include Cecilia Rosales, M.D., and LeeAnne Denny, M.D.

"This is a team-based experience that students are not going to get anywhere else," Hartmark-Hill said. "It's an opportunity to help patients who've fallen through the cracks of the health-care system. Interprofessional students and clinicians are able to provide care to patients in the context of their current environment and condition, before they present to the emergency department. We want to get patients connected to services that address social determinants of health, like housing, access to food and employment."

Zeien and Hanna hope to expand their outreach by offering Hepatitis A vaccinations and veterinary services for homeless individuals who own pets.

Jeffrey Hanna

Justin Zeien

(above) **Jeffery Hanna,** a graduate student at the UA College of Medicine — Phoenix, provides free health care services to the homeless population through Street Medicine Phoenix. (left) Third-year medical student **Justin Zeien** provides free health care resources as part of Street Medicine Phoenix, a program he helped start in 2017.

Softball

Led by one of the nation's most powerful offenses and best pitching staffs, the 2019 Wildcats finished the season 48-14 and made the program's return to the Women's College World Series for the 23rd time in school history and first since 2010. Arizona finished tied for fifth at the Women's College World Series and was ranked No. 5 in the final poll, its highest final ranking since 2010. The Wildcats' trip to the NCAA Tournament was their 33rd consecutive appearance – the longest streak in NCAA softball history. Arizona's 23 tournament appearances are second nationally to only UCLA's 29. No other school has more than 14. Arizona had five All-Americans, including three first-teamers, both the second most in the country and the most at Arizona since 2001. Pitcher Taylor McQuillin, catcher Dejah Mulipola and outfielder Alyssa Palomino-Cardoza were named first-team All-Americans while second baseman Reyna Carranco and shortstop Jessie Harper were named to the second team.

Michael Christy/Arizona Athletics

College of Medicine – Phoenix

Medical Student Incorporates Resiliency Training for EMTs

Neil Vigil already had served 13 years in the U.S. Army as a Blackhawk helicopter pilot, infantry platoon medic and air mission commander when he entered medical school at the University of Arizona College of Medicine – Phoenix in 2017.

His time as an Army medic was his first experience in the medical field and the foundation for his desire to become a physician. As a first responder, he saw the emotional toll the work had on firefighters and emergency medical service professionals.

"On the worst days of our life, we know that firefighters and EMS professionals stand ready to respond at a moment's notice, even at the risk of their own personal safety," said Vigil, 34. "They are community heroes who sacrifice an incredible amount to be there for us in our time of need. I feel that it's our community's duty to help identify and minimize the risks associated with their service."

Each UA College of Medicine – Phoenix student must undertake a scholarly project, which includes publishing their work. Now a third-year student, Vigil knew he wanted to investigate suicide rates among emergency responders. His project resulted in the first peer-reviewed publication that specifically studied Arizona EMTs.

His research found that Arizona emergency medical technicians' risk for suicide is 39% higher than the general public. Previous studies, notably a 2014 North American survey conducted by the National Registry of Emergency Medical Technicians, suggested EMTs have a 10-fold higher incidence of suicidal thoughts and attempts.

"Although we were bracing ourselves to find an increase in suicides among our EMTs, I was really shocked that it was that large," said Vigil, who was a Tillman Scholar in 2018. "These findings helped move the discussion of EMT suicide beyond the anecdotal and personal experiences and added hard data showing there is a problem that needs to be addressed."

The results surprised Vigil and his scholarly project mentor Bentley Bobrow, M.D., formerly of the University of Arizona and now chair of the Department of Emergency Medicine at McGovern Medical School at the University of Texas.

"We started by asking the basic question, 'What is the suicide rate of EMTs in Arizona?'" Bobrow said. "It was not an easy question to answer because no sole-source EMT suicide database exists. So, we attempted to answer the question using a combination of Arizona death record data."

Their data covered a five-year period ending in December 2015.

"We were surprised at how many actual EMT suicides we found every year in Arizona—on average nine per year," Bobrow said.

They hypothesized that the causes of the high suicide rates are multi-factorial and likely related to work stress, shift work, a culture of not wanting to ask for help, repeat exposure to seeing suicide and other tragedies.

Vigil wanted to act quickly to find effective solutions, so he and Bobrow teamed up with the Arizona Department of Health Services to develop an EMS website that presents educational materials and resources to help build resiliency and reduce EMS suicide.

U.S. Army veteran **Neil Vigil** started medical school at the College of Medicine – Phoenix in 2017 and has focused his research on suicide rates among emergency responders. Vigil spent 13 years in the U.S. Army as, among other things, a Blackhawk helicopter pilot.

Neil Vigil

His initial study has generated additional projects: Vigil is conducting a 10-year analysis, looking at EMS suicide compared to the general public across 26 states. And, he is measuring the effectiveness of an eight-week mindfulness-based training program with Golder Ranch Fire District firefighters. He also is working with state officials to see if resiliency and suicide prevention training can be incorporated into the EMT certification process.

Lab Provides Hands-On Experience for High School Students to Post-Docs

Yi-Jen Yang is entering her junior year at Oro Valley BASIS High School, but she held her own this past summer working side-by-side with undergraduate, graduate and post-doctoral students, as well as faculty members, in a major laboratory at the University of Arizona.

The 16-year-old spent the summer working in a laboratory headed by internationally noted physician-scientist Marvin J. Slepian, M.D., Regents Professor and professor of medicine, professor and associate department head of biomedical engineering and a McGuire Scholar in the Eller College of Management. As a member of the lab team, Yang conducted research, presented findings and helped make real-world biomedical research advancements.

Kris Hanning/UAHS BioCommunications

(from left) Graduate students **Alice Sweedo, Samuel Miller-Gutierrez** and **Daniel Palomares** with **Dr. Marvin Slepian.**

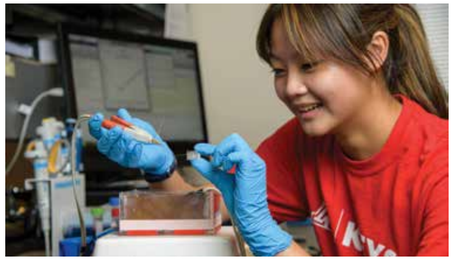
Funded primarily by grants from the National Institutes of Health, the Slepian Lab is based at the Arizona Center for Accelerated Biomedical Innovation, or ACABI, a translational research-and-development center supported by the UA Health Sciences and Tech Launch Arizona. The ACABI serves as a university-wide creativity center, functioning as an "inventor's workshop" for faculty, students and domestic and global communities.

"Being a high school sophomore, with only basic chemistry and biology lab skills, going into a professional university setting with college students and post-docs definitely was an intimidating transition," Yang said. "I was so nervous I would make mistakes or that I wouldn't meet my lab mentor's expectations. But all of my doubts washed away on the first day of lab. The lab members' kindness, patience and consideration blew me away."

She also found Slepian to be extremely supportive. "It was so nice to hear someone so strongly support my passion for medicine and science."

"Providing a lab experience early on for students allows them to see firsthand that they, too, can get involved, become scientists, engineers and innovators, and make a difference," said Slepian, who is also also a member of the Sarver Heart Center and the BIO5 Institute. "It converts what seems too far-reaching and complicated to something real, fun and tangible. Our entire lab always emphasizes to students the value of science, engineering, research investigation and creativity for our collective future. The concept is that these students will become next-generation problem-solvers—as physicians, biomedical engineers or other health professionals—and, more broadly, as biomedical innovators."

Innovation long has been a hallmark of the Slepian Lab and the ACABI. Over the years, Slepian's laboratory has focused on the development and use of novel biomaterials for tissue engineering, drug delivery and medical device development.



High school student **Yi-Jen Yang** works on a device that tests whether blood has functioning platelets that can properly aggregate and coagulate.

The lab has developed many novel diagnostics and therapeutics now in clinical use, including: drug-eluting stent technologies; stent coatings; "polymer paving," surgical anti-adhesive barriers; stretchable and biodegradable electronics; synthetic tissue sealants; and cardiovascular prosthetic devices, including the total artificial heart. The lab also collaborated on the development of a device used in the emergency room, operating room and blood banks that delivers life-saving platelet function data to the health-care provider in six minutes at the point of care.

Lucas Hawley, a sophomore majoring in biomedical engineering at the University of Arizona, first became interested in research in high school when he attended an engineering academy at the university and spent time in Slepian's lab.

"I've always been interested in research so this has been a huge opportunity for me," said Hawley, who now works at the lab and wants to attend medical school and focus on wilderness medicine.

Kaitlyn Ammann, a post-doctoral research associate in the lab who studies vascular and wearable devices, mentors younger students.

"I think the lab is pretty unique in that we actually want the younger students to work on research projects that will contribute to the field they're interested in," Ammann said.

Some of the high school students have had their names included on academic journal articles.

"I think the students are always surprised how much work goes into such articles," she said. "But the ones who decide to stick it out and put the work into it get their names on papers."

Yang was placed in the Slepian Lab through the University of Arizona KEYS Research Internship Program, a seven-week-long selective summer internship program managed by the BIO5 Institute.

"I am contributing to the research and development of a new point-of-care device known as the MICELI chip," Yang said. "To better understand a patient's capability to stop bleeding on their own, this device tests whether their blood has functioning platelets that can properly coagulate."

The laboratory experience further has inspired Yang to pursue a career in medicine.

"My main goals are to attend the University of Arizona and major in bioinformatics and business, along with a pre-med track. After my undergraduate years, I hope to attend medical school at the UA. I love children and research so it would be an absolute honor to work in the future children's hospital."

Making the Navajo Language More Accessible Through Technology

Emma Mendenhall

Garrison Tsinajinie's doctoral research centers around creating assisted technology solutions specific to the Navajo language.

When Garrison Tsinajinie was offered a scholarship from the National Leadership Consortium in Sensory Disabilities to return to the University of Arizona for a special education doctoral program, years after completing his master's degree, he was thrilled to accept.

After graduating from the College of Education with a master's in special education, Tsinajinie worked for five years as an itinerant teacher for visually impaired students in Window Rock, Arizona, near his hometown of Kinlichee. He worked with children and adults, ages 3-21, on the Navajo Reservation and used a wide range of technology, including a braille writer and braille notetaker, to match the needs of each student.

Now, as a doctoral candidate, he focuses on how students can access the Navajo language using assisted technology. Being of the Black Streak Wood People (Tsi'naajinii) born into the Big Water Clan (Tótsohnii) from the Navajo Nation, he is committed to finding ways to support indigenous community members who have visual impairments.

"The unique symbols on top of the letters indicate whether tones are high or if they are nasal tones. So I'm researching how you can integrate these details of the Navajo language into assisted technology," Tsinajinie says.

In the last two years, the development of the Navajo braille code has been a significant contribution to his field of work. Prior to its development, people with visual impairments had no way of reading the Navajo language.

"Engaging in research that will ultimately benefit my community and the students back home is the driving force of my work," he said.

Keeping Preschool Gardens, Playgrounds Safe for Children

Caroline Mosley

Digging in the dirt and romping on playgrounds should be a part of anyone's childhood. But for children who grow up near old mines, those everyday occurrences are risky due to potential exposure to contaminants, like arsenic, cadmium and lead.

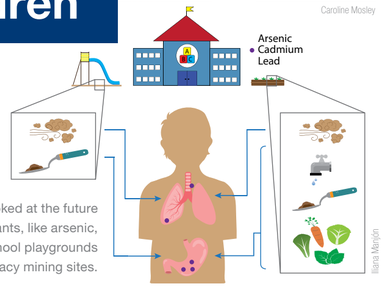
Playgrounds and preschool gardens, specifically, can expose children to contaminants not only through the soil, but also through the vegetables that are produced. The extent of that exposure and risk was the subject of Iliana Manjón's research for her master's degree in environmental science at the University of Arizona.

Manjón's project, which expanded on work by the Cancer Prevention Institute of California and Sierra Streams Institute, focused on communities in Nevada County, California, that are impacted by legacy gold mining. When compared to the rest of the state, this county has one of the highest rates of breast cancer.

Describing her research project as nontraditional, Manjón dug deep into environmental analysis, community engagement and human health.

"Not only did I work in the lab to analyze for contaminants in water, soil and plants, but I also worked alongside the community throughout the process to best address their concerns about environmental quality in their area," Manjón said.

Manjón worked with assistant professor Mónica Ramírez-Andreotta in the Department of Environmental Science as part of the citizen science project, Gardenroots.



Iliana Manjón

Iliana Manjón's research looked at the future exposure and risk of contaminants, like arsenic, cadmium and lead in preschool playgrounds and gardens near legacy mining sites.

After earning her undergraduate and graduate degrees from the University of Arizona, **Iliana Manjón** was accepted to the College of Medicine – Tucson, where she is pursuing her dream of becoming a physician.

Funded by the National Science Foundation, Gardenroots focuses on engaging community members, especially those in underserved populations, about the health of their soil, water and plants.

"We found elevated levels of lead in a couple of gardens and playgrounds and are working with the county to remediate the soil," Manjón said. "We also determined that preschool garden-grown vegetables were major contributors to the children's overall arsenic and cadmium exposures."

Manjón, who has a bachelor's in physiology from the University of Arizona, integrated environmental monitoring of the gardens with a novel dietary assessment specific to the community. She also conducted training on the proper collection of water, vegetables, soil and dust from the gardens.

Simultaneously, Manjón engaged with the people impacted, collaborating with a local community organization and Community Advisory Board consisting of breast cancer survivors and community advocates.

"My work provided the necessary framework to improve future exposure and risk assessments." said Manjón. "This kind of research is essential to protect vulnerable populations living near active and legacy mining sites."

Now, the schools have the information they need to help the parents and teachers make informed decisions about reducing the children's exposure to contaminants. And Manjón, a medical student at the College of Medicine – Tucson, is determined to use her knowledge of environmental health in her future work as physician.

Parkinson's Drug May Treat Macular Degeneration

A better treatment for age-related macular degeneration is in sight, thanks to the work of University of Arizona researcher Brian S. McKay and his mentee, 2018 graduate Anna G. Figueroa.

That's exciting news for the more than 10 million people in the United States who have age-related macular degeneration, or AMD, the most common cause of blindness in those over age 55. AMD is particularly prevalent in Arizona, where more than 1.2 million people are age 65 or older.

People with the degenerative disease of the eye's retina eventually are unable to see what is directly in front of them.

"Faces are the first thing that individuals with macular degeneration will start to miss because they no longer have central vision," Figueroa said.

With limited treatment options, many patients whose AMD has progressed from "dry" to "wet" —where abnormal blood vessels grow under the retina—opt for shots in the eye, hoping to prevent further deterioration of their already severely impaired vision. The painful, and expensive, injections must be repeated every four to six weeks.

In contrast, the potential treatment for AMD is an inexpensive drug that can be taken by mouth and is used to treat Parkinson's disease: L-dopa.

McKay, associate professor of ophthalmology and vision science, discovered that L-dopa can prevent and delay AMD. L-dopa is a naturally occurring molecule made in all pigmented tissues including the retina, where it has a role in maintaining a healthy macula, the part of the eye that provides the most detailed color vision.

Figueroa began working in the McKay Lab as an undergraduate in the summer of 2016 and, after graduating with a bachelor's degree in neuroscience and cognitive science and minors in physiology and anthropology, is continuing as a research technician while applying to medical schools.

In the lab, Figueroa and McKay are investigating pigmentation from tissues involved in AMD.

"I put together a review article on pigmentation, the GPR143 protein and AMD, which will be published in a research journal in a few months. Brian and I are authors," Figueroa says.

"Anna will go to medical school having published the first prospective data treating AMD in people," McKay noted.

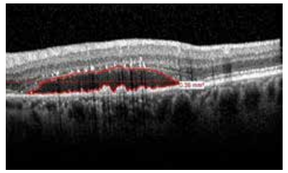
The McKay Lab is unique in that it bridges the gap between basic laboratory sciences and clinical studies. In addition to research, Figueroa is collaborating on three clinical trials to test the effect of carbidopa-levodopa, an FDA-approved combination drug for Parkinson's, on AMD.

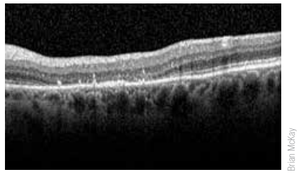
The studies are aimed at determining if the drug stops the progression of AMD, reduces or prevents the need for eye injections in newly diagnosed wet AMD, and stops or reduces the progression of geographic atrophy observed in late-stage dry AMD, when retinal cells die in a pattern that resembles a map.

Working with Tucson ophthalmologist Robert W. Snyder, M.D., the studies' principal investigator, and internist Timothy Fagan, M.D., Figueroa measures the focusing ability of study participants' eyes, monitors their visual acuity, captures images of the central retinal thickness and analyzes the data over time.

"Being part of the clinical trial has allowed me to see the impact that our research has on people," Figueroa says. "It's been an incredible experience. One of my patients sent me a digital book of her painting work, and at the end of her email, she said, 'This disease is not going to stop me, and thanks to you and Dr. Snyder, I have hope.'"

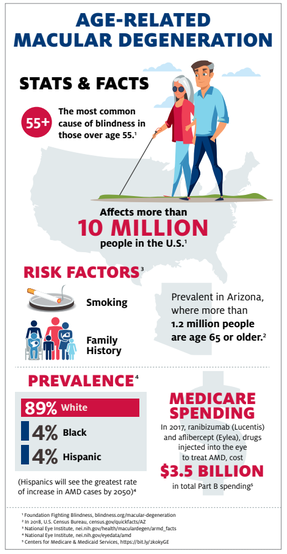
Kris Herring/UAHS BioCommunications





Brian McKay

(top) **Anna Figueroa** conducts a visual acuity test on a study patient. (above) Looking at a Western Blot image, Anna Figueroa and **Brian McKay** evaluate the presence of a protein found on the surface of the cells studied in the lab. (right) An image of the same macular region showing retinal fluid outlined in red and (far right) afterwo months taking l-dopa, illustrating the retinal fluid completely resolved.



Student Designs Become **Real-World Solutions**


Photo Anoohi and Thomas Yazzie

Architecture students often design buildings and infrastructure for communities, schools and parks as academic exercises, but occasionally, the plans become reality.

Last year, the Pima County Regional Flood Control District asked a studio class taught by Courtney Crosson, assistant professor in the University of Arizona College of Architecture, Planning and Landscape Architecture, to help with flooding problems in different pockets of Tucson.

The task for then-undergraduates Amal Anoohi and Thomas Yazzie was to mitigate flooding while providing additional benefits to the Miramonte neighborhood on Tucson's northeast side.

"The city and county officials already had a basic understanding of the existing flooding issues and were happy to see whatever we had to offer," Yazzie said. "The tougher crowd was the public and the community."

"Having several lenses into the project gave us a better understanding of how to make the design efficient and specific to the liking of the Miramonte neighborhood user," Anoohi added.

Their design involved a roundabout at the intersection of Second Street and Camino Miramonte that allows storm water to flow into the curb, median and roundabout basins. It also designated car, bike and pedestrian lanes to help control traffic flow.

"The students identified that what was really needed in this super-wide road was more pedestrian safety, more bicycle safety, shaded areas and areas for residents to be able to stop and have a conversation," assistant professor **Courtney Crosson** said.

The technical drawings were approved by Tucson Department of Transportation Director Diana Alarcon, and the city and county will now move onto the design phase of the project.

"The city uses partnerships with the University of Arizona frequently, because the students and professors have technical expertise we often don't have," said TDOT Deputy Director Robin Raine.

"This is one project in a larger, ongoing initiative with Pima County Regional Flood Control District, the city and UA," Crosson said. "This semester, students are designing six new projects throughout the city that face similar flooding challenges and have broader potential for improving community livability."

The real-world experience benefited Anoohi and Yazzie, who both graduated in May. Yazzie is now employed by WSM Architects in Tucson, while Anoohi is working for Bohlin Cywinski Jackson in Seattle.

Bike Ajo Program Is Model for Rural Communities

A partnership meant to increase physical activity and prevent chronic disease has led to the creation of a community cycling center in Ajo, Arizona.

Located in western Pima County, Ajo is a former mining town with a total population of 3,525. Like many rural communities, Ajo has its challenges, with 71% of families living below the federal poverty line and a 15% unemployment rate.

Nearly half of Ajo residents identify as Hispanic or Latino, a group that continues to experience significant chronic health issues, such as diabetes and cardiovascular disease. Data from the Ajo Unified School District shows that each grade has an obesity rate of at least 32%, with sixth grade reaching an alarming 57%.

"The residents of Ajo have significant disparities, including a lack of opportunities for physical activity and other resources necessary to prevent chronic disease," said Martha Monroy, program manager and lecturer at the University of Arizona Mel and Enid Zuckerman College of Public Health.


Bike Ajo

(top) Bike Ajo and the Desert Senita Community Health Center hosted Bike & Hike in observance of National Diabetes Month in the Organ Pipe Cactus National Monument. (right) A child rides along a course at the Ajo Unified School District Bike Hub.

Donna Lewandowski is the bicycle and pedestrian program coordinator for the Arizona Department of Transportation and a University of Arizona master's student with a concentration in public health policy and management. She joined forces with Monroy to apply for the Arizona Planning Association's Plan-4Health grant, and as a result, the Bike Ajo Coalition was formed.

Today, Ajo has two bike hubs open to children and their families. Bike Ajo has 40 bicycles and provides helmets, education on bicycle safety for recreation and transportation, and resources for bicycle repair and maintenance. The program also trains local community members on bicycle repair, certifies community members as League-Certified Cycling Instructors, and holds an annual community bike and hike at Organ Pipe National Monument.

Antonio Chavez-Hernandez is majoring in microbiology and plans to attend medical school to pursue his dream of becoming an emergency room doctor. Working as an emergency medical technician on the University of Arizona campus gives him the opportunity to help people while he gains valuable career experience.

Microbiology Major Passionate About Helping People

University of Arizona sophomore Antonio Chavez-Hernandez discovered his professional calling while rushing into a situation most people try to avoid.

AntonioChavez-Hernandez spent the summer before his senior year of high school shadowing his aunt, a doctor in an emergency room at a Texas hospital. When a bell sounded for a "code blue" one day, Chavez-Hernandez watched as more than 30 doctors and nurses worked to save the patient's life.

"It was crazy and overwhelming, but eye-opening," Chavez-Hernandez said. "It's something that will always stick with me, because I wanted to be able to help but couldn't. It made me realize what I want to do."

The experience led Chavez-Hernandez to pursue an internship in the cardiovascular intensive care unit at Banner University Medical Center during his senior year of high school.

Chavez-Hernandez was also selected to participate in a University of Arizona BIO5 Institute KEYS Research Internship in the summer of 2018. He worked in Kristen Limesand's lab in the Department of Nutritional Sciences, helping her team seek a cure for post-chemo-radiation dry mouth in head-and-neck cancer patients.

"I didn't realize the work that goes into research," Chavez-Hernandez said. "I think it took us three months to get the smallest bit of data, and there's probably 100 more of those small pieces you need to accumulate for the project. It humbles you."

Limesand, who has been involved with the Keys Internship Program for a decade, said she hopes students can find out if they enjoy research while also having fun.

"Antonio came in very excited about doing the work, and through the seven weeks, he became more patient," Limesand said. "He learned it's OK to slow down and take it all in."

Chavez-Hernandez now attends the University of Arizona College of Agriculture and Life Sciences, where he is majoring in microbiology. His goal is to become an emergency room doctor; in the meantime, he's working for the University of Arizona Emergency Medical Services, where students who are Arizona certified emergency medical technicians provide care until local first responders arrive on campus.

"It's the most immediate way to help people there is," Chavez-Hernandez said.

Kennerly Archive Finds Home at Center for Creative Photography

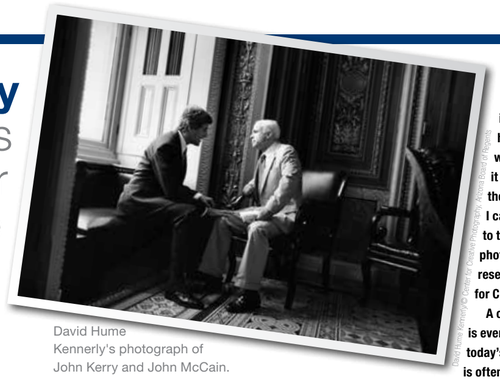


Photo © David Hume Kennerly, Courtesy of the Center for Creative Photography

David Hume Kennerly's photograph of John Kerry and John McCain.

The University of Arizona has acquired the archive of Pulitzer Prize-winning photojournalist David Hume Kennerly.

Kennerly has been a photographer on the front line of history for more than five decades years. He won the Pulitzer at age 25 with a portfolio that included work from the front lines of Vietnam, Cambodia and East Pakistan, as well as the Ali/Frazier "Fight of the Century" in New York City. He has spent his career being in the room for some of the most important moments in history, including inaugurations and resignations, campaigns, summits and, most recently, the Robert Mueller testimony before Congress.

The archive, which will be housed at the Center for Creative Photography, comprises more than 1,500 fine print photographs and 380 linear feet of archival material. It is now a resource for students and faculty, offering unprecedented access to some of the most important news photographs in history and the background material that supports them.

Having a collection connected to a living photographer also allows the opportunity to hear from the maker and gain more insight into his work, motivations and career. Kennerly will be working with faculty across campus to expand on the collection as well as giving public presentations in his role as a university Presidential Scholar.

"I love that I'm studying at a university that puts such an emphasis on the arts and interdisciplinary studies and acquires archives like Kennerly's," said Cammy Stevenson, a senior majoring in finance and art history. "Because his work is so far reaching it is relevant to many of the classes I take, and I can connect my work to the work of an iconic photographer through research at the Center for Creative Photography."

A collection like this is even more important in today's world where the truth is often challenged.

"Journalists, photographers, are the people that keep us informed. We're the truth tellers," Kennerly said. "My job is to tell people what they don't want to see, and it's how they find out what's real."

A Genetic Approach to **Treating Glioblastoma**

Kris Hamming/UANS BioCommunications

Third-year UA College of Medicine medical student **Nicholas Gravbrot** (left) has teamed up with physician-scientist **Baldassarre "Dino" Stea, M.D.** (right) to unravel the genetic mysteries of glioblastoma, which is treated with DNA-damaging radiation during which the patient wears a mask to hold the head in place and ensure the radiation hits its target.

Glioblastoma, a deadly brain cancer that has grabbed headlines for claiming the lives of Sens. Edward Kennedy and John McCain, someday might be "tricked" into sparing more of its victims.

A team of University of Arizona researchers searched for genetic differences between glioblastoma cells from long- and short-term survivors. Individuals who survived longer, they found, produced a protective protein that someday might be harnessed to extend survival—although they say they are many years and millions of dollars away from potential translation into treatments for patients.

"Glioblastoma is notoriously aggressive, but some glioblastomas behave more aggressively than others," said Nicholas Gravbrot, a third-year medical student at the UA College of Medicine – Tucson. "Some patients survive only a few months, others survive a couple of years and a select few survive more than five years."

As a key member of the research team, Gravbrot probed electronic medical records to gather essential information. Using brain-tissue samples, the team matched each sample's genetic profile with what they knew about the patient's survival.

"We compared the different sample groups, which resulted in a list of genes that were significantly altered," Gravbrot said. "The findings offer a glimpse into how cellular behavior differs among non-malignant brain tissue, less aggressive glioblastoma tissue and more aggressive glioblastoma tissue."

After sifting through 800 genes in 23 glioblastoma samples, the team made a crucial connection: Long-term survivors appeared to pump out an abundant supply of a protein called WIF-1, which suppresses the Wnt signaling pathway, a collection of genes that is normally involved with tissue maintenance but can fuel tumor growth if it becomes overactive.

"The Wnt pathway is 'deranged,' and WIF-1 is the police. Cancer grows when there aren't enough police to keep the deranged person in check," said Baldassarre "Dino" Stea, M.D., head of the UA College of Medicine – Tucson Department of Radiation Oncology. "Some people are endowed with more WIF-1 and survive longer."

Although testing for the WIF-1 gene someday may help predict which patients will survive longer, a greater hope is this work will lead to a drug that targets glioblastoma tumors with more precision than standard treatment, "tricking" cells into tamping down Wnt signaling.

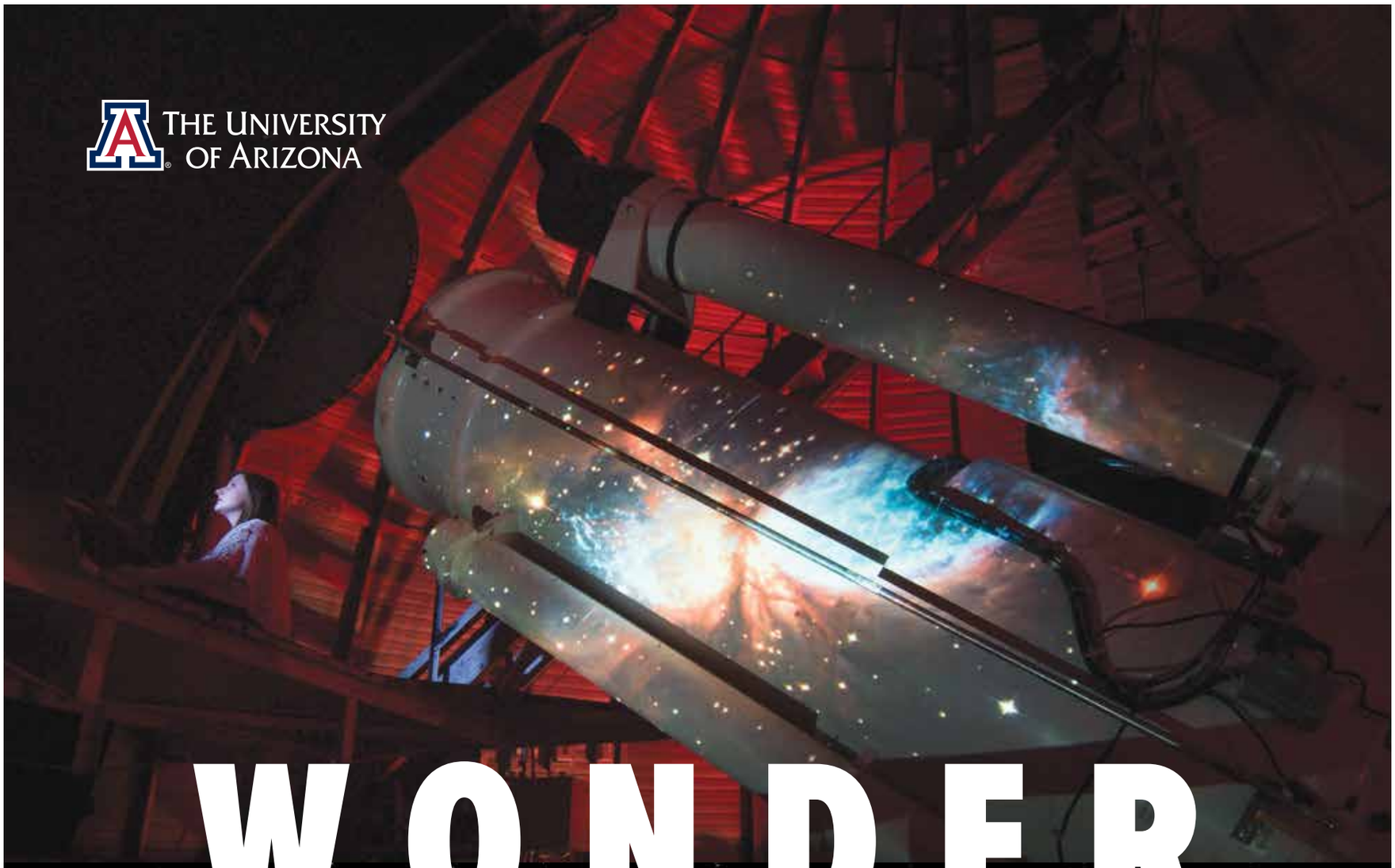
"In the past 15 years, only one drug—temozolomide—has been invented, whereas the rest of the cancer field is zooming forward. We hope to create a drug to suppress the Wnt pathway so that everybody survives longer," Stea said. "It would be the pot of gold at the end of the rainbow.

"I think we have reached the apex of what the surgeon can do and have achieved the most we can with radiation," he added. "The cure will not come from more radiation or more surgery—glioblastoma is a genetic problem that we have to solve genetically."

One potential benefit of enlisting human genetics in the fight against glioblastoma is to enhance the effects of radiation, which kills cancer cells by damaging their DNA. Glioblastomas have a special ability to repair this DNA damage, diminishing radiation's effectiveness. By taking cues from WIF-1, scientists might be able to weaken glioblastoma's ability to repair radiation-damaged DNA.

Gravbrot says he's been fascinated by the brain for years, and before coming to Tucson he had the opportunity to explore that interest in depth at the Barrow Neurological Institute in Phoenix. That experience drove him to learn more in medical school.

"The brain is remarkably complex, and the fact that we know so little about how many aspects of it work piqued my curiosity," Gravbrot said. "I was fortunate to continue research in this field in medical school. Dr. Stea's interests are directly in line with my own, so it was a great fit."



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