uncg research

Spring 2023

Research, Scholarship, and Creative Activity

IN ALL WAYS HUMAN

Disrupting dehumanizing narratives about Black boys and men p16

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Cover: *"When people look at me, they assume that my past is what defines me." See Jequan Mister's story and many more at* ***InAllWaysHuman.com****.*

UNC GREENSBORO
Office *of* Research *and* Engagement

Last year, in a culmination of ten years of consecutive growth, UNCG external funding climbed to the highest level in the University's history. These dollars represent impact and expertise flowing out in the form of research and engagement initiatives to all 100 counties in North Carolina, as well as close to 40 countries.

From groundbreaking patents to community-engaged research and service-learning, from Grammy-nominated faculty and alums to Fulbright and AAAS Scholars, and with creative and scholarly products netting prestigious and international acclaim, UNCG has amassed a distinguished record. What's the winning combination? At the core are exceptional faculty and students. But as you will see within the stories of this magazine, innovation requires a fertile environment to thrive. Impact requires investment.

In this issue, we highlight the comprehensive array of state-of-the-art research instrumentation now available at UNCG, including a 3T MRI, field emission scanning and transmission electron microscopes, a micro-CT scanner, mass spectrometers, an x-ray diffractometer, and more. Such equipment serves as scaffolding for the ingenuity of our researchers, as well as a significant draw for future faculty members and students.

Similarly, facilities like the UNCG Plant and Pollinator Center serve as hubs for integrated research, student training, and public education and community engagement. Read our Part of the Hive feature to trace connected discoveries, grants, patents, and spin-off companies that support our understanding of the connections in nature that underpin human health and wellness, the foods that we eat, and the environments in which we live.

The work featured in several of these stories sparked thanks to UNCG internal seed grant mechanisms or matching funds. Other grants created unique educational opportunities for students, who are mentored by exceptional faculty to start their own journey of excellence. A wide portfolio of competitive federal funding for student training from the Health Resources and Services Administration, the Department of Education, NSF, and NIH also helps us fulfill UNCG's commitment to accessible excellence and contribute to the diversification of the scientific workforce.

Dedication to inclusive academic excellence, a deep infrastructure for community engagement, cutting-edge instrumentation, strategic centers focused on the critical issues of our lives, mentoring mechanisms for both faculty and students – these tools of the trade have brought UNCG outstanding returns on investment. Read on to see those returns illustrated in our ongoing research, scholarly, and creative excellence.

TERRI L. SHELTON, PHD
Vice Chancellor for Research and Engagement

UNCG Research is online. Enjoy additional photography, shareable stories, and more at **researchmagazine.uncg.edu**.

FEATURES

Tools of the Trade

What do 55-million-year-old fossils, shrews with shrinking skulls, studies on Alzheimer's and exercise's impacts on the human brain, and tiny tech for a less toxic world have in common? The cutting-edge new tools driving discovery at UNCG.

In All Ways Human

Dr. Smith Lee's work to reclaim the humanity of Black boys, men, and families through visual storytelling and narrative change comes to fruition. See the results of the In All Ways Human campaign, which launched last year in Baltimore and online.

Part of the Hive

Researchers investigate bee child-rearing practices, gut health, and more to help hives – and humans – thrive. Explore the Plant and Pollinator Center's impacts on foundational science, forays into national policy, and entrepreneurial activity.

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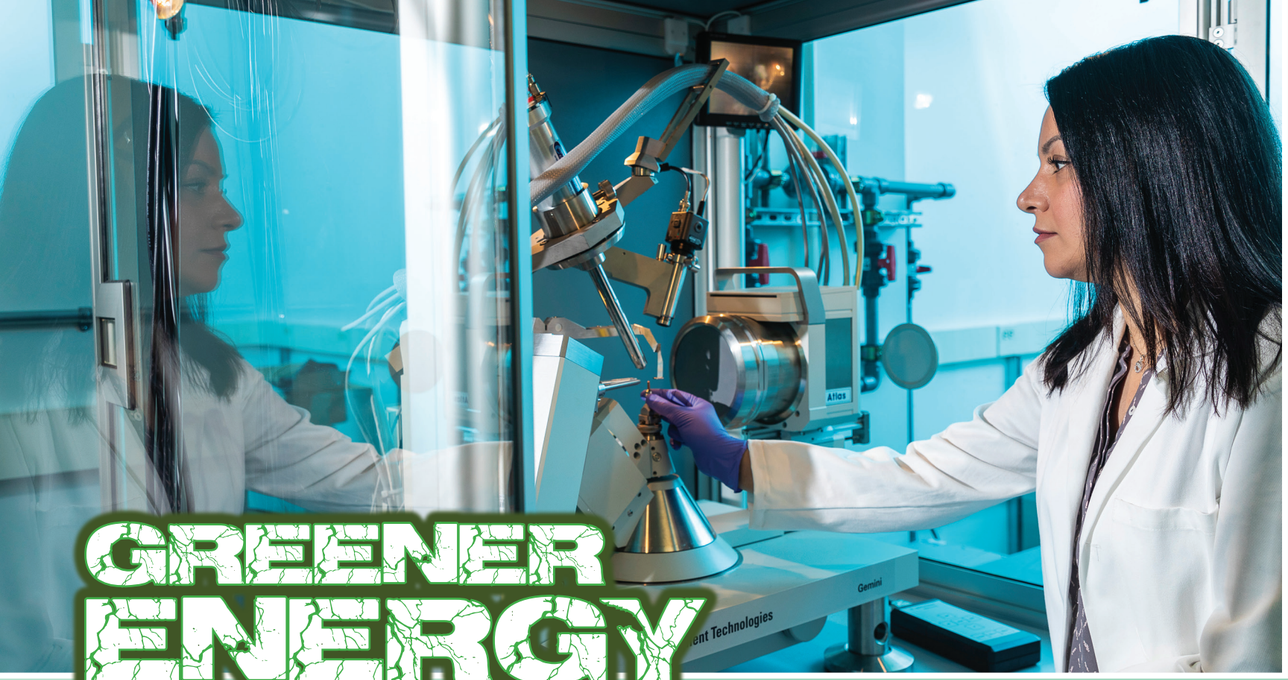
DEPARTMENTS



GREENER ENERGY

Harnessing light and air for cleaner processes

From photosynthesis in plants, to every breath we take and every thought we think, life is animated by complex chemical reactions that pass electrons back and forth between molecules.

Dr. Shabnam Hematian has focused her research on the metals — iron, copper, and others — that are foundational to these processes.

"The cool chemistry that happens in your body – metabolism of drugs or hormone biosynthesis – all of them are governed by a series of iron proteins," the Bernard-Glickman Dean's Professor in chemistry and biochemistry says.

Inspired by nature, Hematian is working to understand how light and air, along with common metals, could catalyze industrial reactions, to design more efficient and environmentally friendly technologies.

Understanding how they could be harnessed to drive electron transfers in industry could change the design of high-capacity fuel cells, for example, and allow companies to create them without more expensive and more toxic metals such as platinum or ruthenium.

INSPIRED BY NATURE

As a researcher with expertise in both synthetic chemistry and light-driven biological reactions, Hematian brings a natural process lens to industrial questions.

"Nature started working and figuring out how to do transformations with just the bioavailable elements," she says. "We don't have any enzymes that have ruthenium in them, but we have a lot of enzymes that have iron in them." Those enzymes may provide models for more environmentally friendly reactions.

Light and air are abundant and, Hematian explains, light's color, intensity, and other properties can be precisely controlled. Thus, it has the potential to become a sensitive tool to drive chemical reactions. In the future, she says, adjusting the color of light might allow scientists to activate one part of a molecule but not another.

In the spring of 2022, Hematian was awarded a prestigious two-year $250,000 grant from the National Science Foundation's LEAPS initiative, which is designed to support promising mathematicians and physical scientists early in their careers.

With the funding, Hematian is developing new ways to transform carbon-based materials into oxygenated materials. These kinds of reactive materials, like ethanol, are valuable in industry, but making them currently requires harsh chemicals, high temperatures, and high pressure.

"They're very expensive types of reactions," says Hematian. "We want to develop catalysts that can absorb light to give us the energy for these transformations instead."

In another example of applying natural inspiration to a 21st century challenge, Hematian is looking at molecules found in certain fungi that could be useful in liquid batteries.

The work is emerging from a collaboration with Patricia A. Sullivan Distinguished Professor of Chemistry Nick Oberlies. The natural products chemist and his team assess compounds found in fungi for medicinal applications, but Hematian has recognized the potential in some of their findings for electrochemistry.

Liquid – or "flow" – batteries store more energy than current solid state battery technology and are the wave of the future, she says. "Many startups are currently working on figuring out which compounds are most efficient and durable for use in them."

CATALYZING LEARNING

The NSF LEAPS grant also supports another of Hematian's interests: mentoring students from a variety of backgrounds.

She's recruiting undergraduates, community college students, and even some high school students to work in her lab alongside graduate students. She also wants to involve home-schooled students.

"I'm hoping this is going to connect what they learn in their textbooks to life – now they're doing it in the lab."

The goal is to give students first-hand experience that not only reinforces classroom learning, but also helps them understand how original research is done. "We may get results we don't understand at the beginning. How can we go about handling that?"

The work will expose the students to researchers and science-based career opportunities.

As a researcher who has benefited from strong mentorship and similar opportunities, Hematian says it's important to her to continue that tradition.

"I'm very invested in passing the knowledge to the next generation," she says. "That's my passion: to influence people and the future."

APPLIED POTENTIAL

Even during his first year at UNCG, Marcos Tapia had heard that doing research as an undergraduate could boost his chances of success after graduation. But he had no idea how to get started.

UNCG's First Year Experience course helped him bridge the gap. Tapia, who has always excelled in chemistry and had chosen it as his major, was assigned an informational interview with someone in his field.

He chose Hematian. Tapia was drawn to her focus on environmentally friendly technologies and her background – the bioinorganic chemist is from Iran and learned to navigate American higher education without the benefit of guidance from family with experience in that system.

Within a few weeks of the interview, Hematian had invited Tapia to work with her. She was impressed with his drive.

"In December – during the holidays – he finished all of his safety training and the other things he had to do before starting work in the lab."

Since then, Tapia has become a near daily presence in Hematian's lab. He's also carved out his own area of expertise: doing experiments in electrochemistry using cyclic voltammetry.

In cyclic voltammetry, chemists measure the current produced by a substance under different voltages, giving them insight into how that substance accepts or loses electrons. It's valuable for Hematian's research into how electrons flow in certain materials and chemical reactions, which has the potential to make a wide range of technologies cheaper, more efficient, and environmentally friendly.

Learning the skill also provides Tapia with a skill that's marketable. "Just by knowing that technique you can go get a job," Hematian says. "For example, electrochemistry is foundational to battery science."

Last summer, Tapia attended a three-day cyclic voltammetry bootcamp. He was the youngest

attendee and one of only two undergrads.

"Marcos was one of the most engaged researchers," says UNC Chapel Hill Professor Jillian L. Dempsey, who ran the bootcamp. "He asked deep, probing questions about electrochemistry and the associated theory, a true testament to how deeply engaged he is with his own research project."

In Tapia's current work in the Hematian lab, the focus is on understanding how oxygen atoms can be added to a material, and how reversible that process is. As a freshman, he applied for, and won, funding from UNCG's Undergraduate Research, Scholarship, and Creativity Office to support a research project on oxygen chemistry and copper. Now, as a sophomore, he has his first publication, co-authored with Hematian and other researchers in her lab.

"Being in a research group actually makes you think about what you are doing," Tapia says. "We do these weekly presentations, and we have to take our data and actually present."

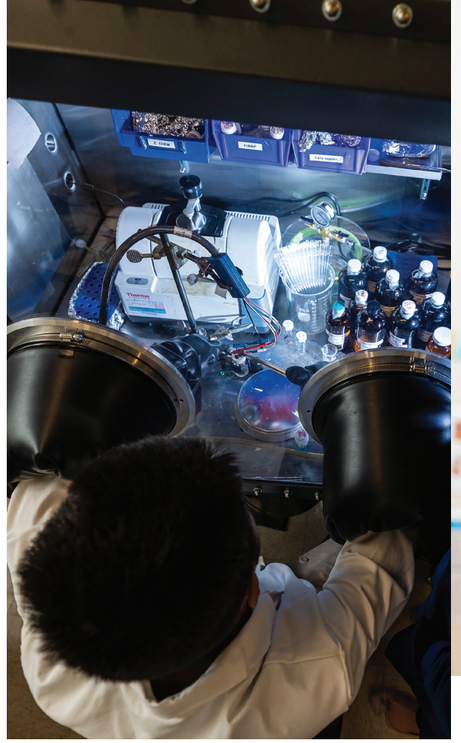
The lab's training prepared him to present his research at conferences, including the Southeastern Regional Meeting of the American Chemical Society in Puerto Rico.

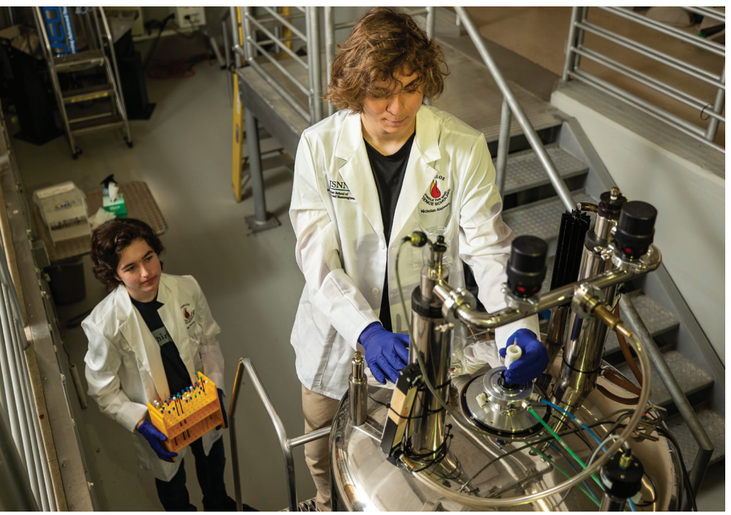
He's also thinking about life after he earns his bachelor's degree. He has dreamed of becoming a doctor but graduate school in chemistry is another option to weigh.

"I'm thinking more about my future – undergraduate research has really helped me out with that because I get to talk to people with PhDs, master's degrees," he says.

"I get to interact with a community of science that I've never been exposed to as a first-generation student."

by Marc Tosczak
learn more at ***chem.uncg.edu/hematian***





DRAELOS SCHOLARS **High school student researchers Fully Porter and Nicholas Alejandro load samples into a nuclear magnetic resonance spectrometer. Learn more at *go.uncg.edu/draelos***

Nurturing the next STEM GENERATION

As part of her mentorship work, Hematian participates in the Draelos Science Scholars Program, which aims to inspire future scientists and engineers to pursue STEM careers. For six weeks each summer, promising Triad-area high school juniors have the opportunity to don white coats and work in university research labs.

More than 100 high school students have been through the program – a brainchild of local doctors Zoe and Michael Draelos – and it grows each year. Aidan Hunt, now a third-year student majoring in computer science and linguistics at UNC Chapel Hill, says his 2019 Draelos experience working with Hematian gave him an inside look at the life of a scientist.

"I learned more about what it meant to be doing research at that level," he says. "What it meant to actually choose research as a career, what the grad students and professors in the lab were doing."

SPEAKING SCIENCE

BILINGUALTEK **Méndez and La Paro lead a training for Head Start teachers.**

Sitting criss-cross in a circle, five preschoolers reach out to touch pieces of fabric their teacher spreads in front of them. As the children pat the leather, denim, and cotton, she starts a conversation about which they like best. "Do you wear clothes that feel like these fabrics?" she asks.

The teacher then shows her students a turkey baster filled with water. "What do you think will happen if we get the fabrics wet?" she wonders aloud. In a matter of minutes, she introduces her students to two new words: "absorb" and "repel."

Even though English isn't their first language – and they're not yet familiar with the scientific process of observing, forming a hypothesis, and experimenting and analyzing – the children relate to these concepts.

"Everybody wears clothes, so the experience is naturally engaging," says Dr. Lucía I. Méndez, a UNCG communication sciences and disorders researcher. Her team designed the activity as part of Bilingualtek, a research program that incorporates language and science to support young dual-language learners.

This is year two of her $1.6 million National Science Foundation-funded project. To develop Bilingualtek, Méndez brought together a multi-institution team that includes science education researchers from East Carolina University and NC State University, as well as UNCG human development and family studies researcher Dr. Karen La Paro.

Over the next two years, the team will continue to refine Bilingualtek and gather evidence for an integrated language-science approach to instructing Latino preschoolers.

"Language is so important for science learning because, in order to even think about science concepts, you also need the words," Méndez says. "Children with limited vocabularies face challenges with science, reading, or math – especially by the time they get to the 4th grade. They may read fluently, but if they don't sufficiently understand what they're reading, they can experience difficulties learning."

Dual language preschoolers who receive English-only instruction may be missing early science learning opportunities, she says. "In our country, we have an increased number of Latino dual language learners entering preschools, a shortage of bilingual childhood educators, and limited science training for teachers at this level." As a result, low-income Latino preschoolers are at a higher risk of being left behind in STEM.

Bilingualtek gives monolingual teachers the tools they need to help bilingual children engage with and talk about their natural world – thus increasing their scientific vocabulary going into elementary school.

As part of a unit exploring recycling, for example, the team created an ebook about a Latino family celebrating their abuela's birthday. Children in the story catch fish for a special birthday dish of ceviche and reuse found objects to make a gift. As students and teachers read together, they take advantage of specially designed sections with Spanish narration and animations to illustrate science concepts.

The culturally responsive elements also give children a sense of pride. "It helps teachers appreciate their students' home language and culture," Méndez explains.

That matters, as these students bring important knowledge and skills to the table. "Their cultural and linguistic experiences enrich their learning and the classroom environment," Méndez says. "Different languages have different ways of expressing concepts, and having access to that opens our minds and gives us a better understanding of the world."

by Robin Sutton Anders
learn more at go.uncg.edu/ChildLanguageLab

TREADMILL TREATMENT

A dozen mice keeping pace on a half-pint treadmill could be a key to prolonging the lives of cancer patients and others with chronic diseases.

This is the scene in Dr. Traci Parry's exercise oncology research lab, one of just a handful at the forefront of exploring how exercise can increase survival rates and longevity in cancer patients.

"We're interested in exercise as therapy for cancer cachexia, but we're also interested in exercise as a potential adjuvant therapy, alongside traditional types of treatment," says Parry, who is an exercise physiologist by training.

Cachexia is a muscle and fat wasting disorder that occurs in patients with chronic diseases such as cancer and HIV. It can affect up to 80 percent of cancer patients and is responsible for about a third of cancer-related deaths.

"I'm really curious about what exercise is doing to the tumor, to its initiation and growth and development," says Parry, pictured above with student research collaborator Louisa Tichy. "And then whether or not that is going to help aid traditional forms of treatment."

Parry's mice trials show that the larger the tumor, the worse the level of cachexia. They've also found that when exercise is implemented early in life, it reduces cancer-related issues later on – protecting skeletal and heart muscle and slowing tumor growth. More frequent workouts also increase benefits.

These findings negate prior research suggesting that the size of a tumor is not necessarily related to the level of cachexia.

"So far in our studies, those things go hand in hand," Parry says. "That is really powerful."

Parry says often patients will progress to a later stage of cachexia before they're diagnosed, and there is no standard treatment.

"It's almost the kiss of death," she says. "Once a cancer patient is diagnosed with cachexia, they stop responding to traditional types of treatments, like chemotherapy and immunotherapy."

Cachexia accelerates the breakdown of skeletal and heart muscle, leading to lower survival rates, which is why Parry's studies are focused on the ability of exercise to protect the musculature.

Exercise-training the mice prior to implantation of tumor cells correlated with significantly slower tumor growth. Exercising once the tumor cells were implanted showed similar, though less robust results. Allowing the tumor to grow before beginning an exercise regimen for the mice provided the smallest benefits.

"The major point is that exercise initiated at any time point in the cancer continuum offered some protection," Parry says. "This is huge for the field of exercise physiology." It hammers home the idea that physical activity can have a serious impact on slowing disease progression.

For Parry, the findings highlight her dream of exercise becoming a standard of care for cancer patients. Parry's grandmother and cousin both passed away from cancer complications, so the research hits close to home.

"It gives me hope that, down the road, we could create cancer rehab programs prescribed like cardiac rehab," she says.

Parry is a first-generation college graduate with degrees in sport and exercise science. As an undergraduate, she found a job working with faculty who were researching if exercise would protect the hearts of rats on the drug adriamycin.

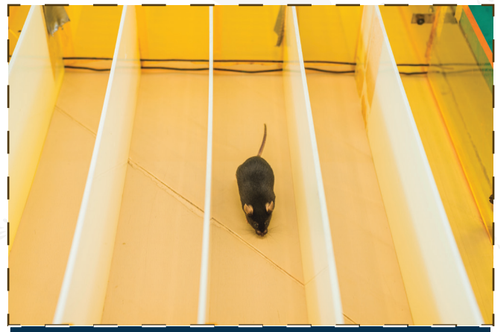
"It was one of the most rewarding things to be a part of," Parry says of her undergraduate research experience. "I was hooked."

Seeing how powerful exercise might be to cancer survivors helped her choose her career path. She went on to complete postdocs in pathology and laboratory medicine before landing her first faculty position at UNCG in 2018. "The work is a dream come true," she says.

"There's a whole field that's interested in making athletes bigger, better, faster, stronger. While I think that stuff is amazing, that was never really what drew me. I'm much more interested in how exercise can help us live longer, healthier lives, and particularly how it can help prevent and rehabilitate chronic diseases."

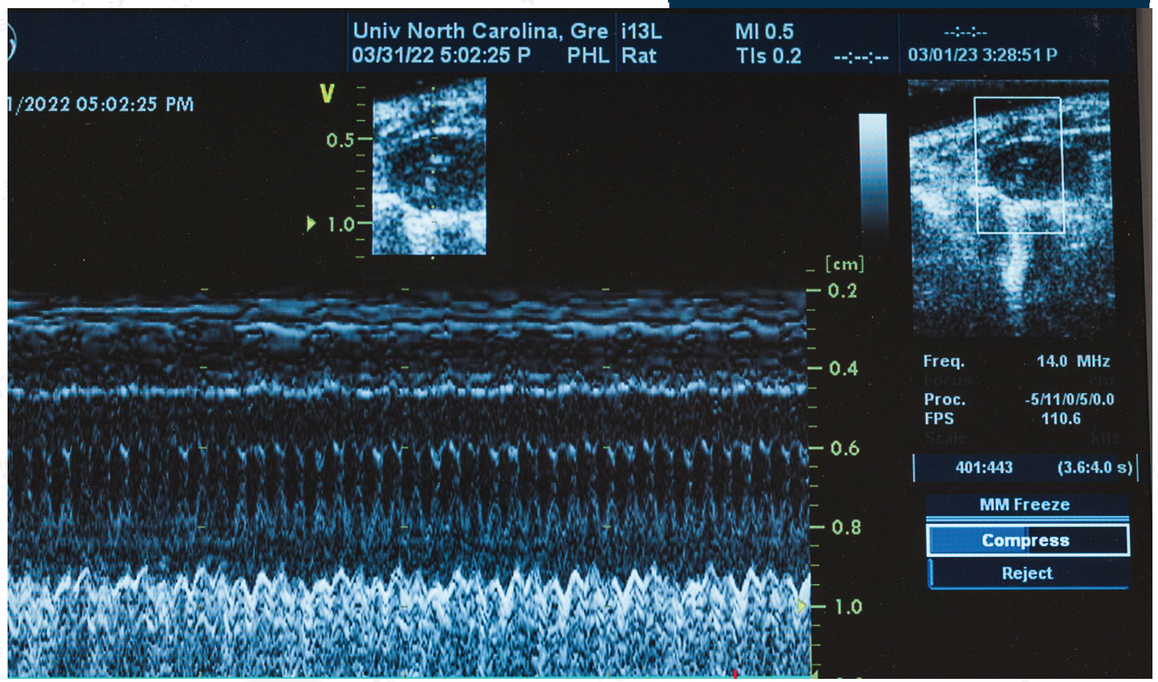
Her cadre of mice is a huge part of that work. Dr. Parry says she is known as "the mouse girl" on campus – she is the only animal researcher in the kinesiology department. But it's a term she doesn't seem to mind.

"For me," Parry says, "it's an honor to work with them."



"All forms of exercise – initiated at any time point in the cancer continuum – offered some protection."

FULLY EQUIPPED **Mouse echocardiograms give Parry's team insight on heart muscle cachexia. Mice that exercised on the lab's treadmill saw slower tumor growth and reduced levels of cachexia.**



SLOW WALK TO SLOW CANCER

One critical finding from Parry's lab was spearheaded by student Louisa Tichy, whose mouse trials have shown that low-intensity exercise can be effective in slowing tumor growth and protecting musculature.

"High-intensity exercise can be daunting to someone suffering from an illness. We wanted to see if getting a patient to walk 45 minutes a day, just to get them moving and their metabolism up, could help in their prognosis, as well as quality of life," Tichy says.

Tichy, who came to UNCG from Germany as an undergraduate on a golf scholarship in 2016, was drawn to Parry's lab in part after watching her grandfather waste away due to cancer-related cachexia. She originally had plans to attend medical school, but once she discovered Dr. Parry's lab, everything changed.

As a kinesiology major, Tichy conducted undergraduate research in UNCG's applied neuromechanics research lab during her junior year. But the next year, she discovered Parry's exercise oncology lab and realized that she was much more drawn to learning about cell functions in the body and studying the physiological effects of exercise and cancer.

She loved her work with Parry so much that she decided to pursue graduate research in exercise physiology at UNCG. Through the combined MS-PhD program, she has already completed her master's and is on track to graduate with her doctorate in Spring 2025.

Tichy knew from prior research with her mentor that – at least in mice – high-intensity exercise can increase survival rates and longevity in tumor-bearing mice with cachexia. But that level of exercise is not always feasible for the human patients she and Parry hope to help.

They wondered, could other exercise modalities provide similar outcomes?

As the only graduate student in her lab, Parry says, Tichy did most of the heavy lifting on the study, spending hours alone, coaching her team of mice to run on the small treadmill.

After a period of time, Tichy would measure the tumors with a caliper and record the size. She was often amazed by the results.

"It's the tumor measurements that surprise me every time," Tichy says. "We always see a consistent pattern, no matter what exercise modality. Sedentary mice have way bigger tumor volume and mass compared to exercised mice. That's so interesting and so cool – that's why we're doing this research and what we want to see in humans as well."

Parry says Tichy's findings matter because many patients suffer from cancer-related fatigue due to the disease itself or treatments. The findings also mean a more manageable program for those who never had an exercise routine or patients living in rural areas without easy access to a gym or hospital.

Going for a walk once a day or a couple of times a week might be enough to increase survival and longevity.

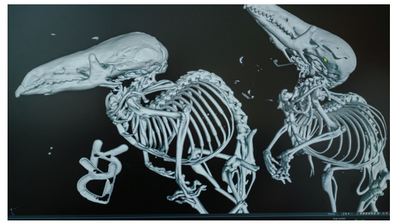
Tichy's research with Parry has already garnered her a publication in Frontiers in Cell and Developmental Biology and a first place poster award at the American College of Sports Medicine Southeast Chapter meeting. In September, she will present her work in the American Society for Investigative Pathology's Young Investigator Keynote Seminar Series.

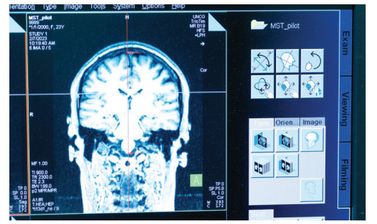
For her dissertation, she is exploring how low-intensity exercise might affect the efficacy of immunotherapies on cancer.

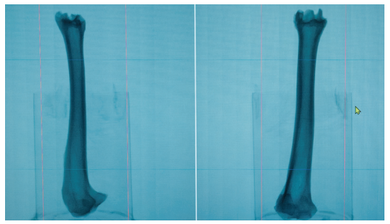
"Cancer is one of the leading causes of death, and we still don't know how to manage it," she says. "Finding a better way to treat cancer, and to make the patient feel better, is important to me."

by Elizabth L. Harrison • learn more at kin.uncg.edu/research

TOOLS OF THE TRADE







Observation has always been fundamental to research – in the field or in a tightly controlled lab.

At the Joint School of Nanoscience and Nanoengineering, or JSNN, millions of dollars' worth of major scientific instruments are allowing faculty and students from across two universities to drive their scholarly projects forward with powerful, precise observation.

"Just for them to have access to these facilities, it enables us to move the research quicker," says JSNN Dean Sherine Obare. It also facilitates collaborations. "Easily a fourth of the usage comes from industry partners."

Among the major scientific instrumentation that now lives at JSNN are an MRI, a micro-CT scanner, and electron microscopes – including one that allows researchers to see objects as small as a single atom.

The multiple instruments together can give researchers a more complete view. "I need all that information together to really map out exactly what's going on," Dr. Obare says.

Without those instruments, researchers in kinesiology, anthropology, biology, nanoscience, and other fields would have to drive to other universities and pay hundreds of dollars per hour for access to equipment or try to negotiate access from busy hospitals.

"Even when researchers get access to those instruments, the time is restricted due to demand," UNCG's Vice Chancellor for Research and Engagement Terri Shelton notes. "You might only be able to get access late at night. Logistics like those can make it difficult to recruit research subjects and are disruptive for researchers and their students."

The presence of these scientific instruments makes UNCG a more attractive destination when Obare and other leaders are recruiting new faculty and graduate students.

"The fact that we have these facilities at the Joint School opens doors for us to attract really high-quality faculty because they know that what they need is going to be in the building," Obare says. "And faculty who are on the main campus at UNCG know they can just hop in the car and go three miles down the road – it means that they're going to be able to easily get data."

Students from UNCG and NC A&T – especially graduate students who may one day themselves be leading research labs at universities – get hands-on access to the equipment, facilitating their research and giving them the opportunity to develop expertise with the devices, Obare says.

"There's a humongous gap in knowledge, in terms of student training, when a student just takes a sample and sends that sample for analysis at a different location without being physically there," she says, "versus them actually preparing their sample and being able to image it themselves."

SEEING THE INVISIBLE: HOW ANIMALS CHANGE OVER TIME

For the last few years, vertebrate paleontologist Robert Anemone would take fossils he was studying, drive more than an hour to Duke University, and pay $120 per hour for time on a micro-CT scanner.

Computerized tomography scanners, long used in medicine, have become a standard research tool for paleontologists and other scientists interested in the anatomical structure of plants and animals.

"It really has revolutionized paleontology," Dr. Anemone says.

A CT scanner works by taking thousands of x-rays of a fossil or bone sample at different angles. A computer knits together those images to create a precise, three-dimensional rendering.

That enables scientists like Anemone to precisely visualize, measure, and analyze skeletal structures. Sometimes, Anemone says, he doesn't even have to separate the fossil from the rock it's preserved within.

But driving to Duke ate up precious time and research funds.

Now, thanks to a $642,892 major instrumentation grant from the National Science Foundation, Anemone only has to drive from the UNCG main campus to the Joint School of Nanoscience and Nanotechnology, where he and other researchers have access to their own micro-CT scanner.

It was installed in March 2022. Anemone, JSNN's Obare, and biology faculty member Bryan McLean led the grant effort, which was successful in part due to its multidisciplinary focus.

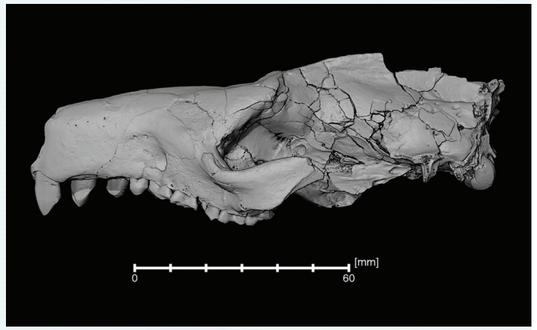
"We've got the same machine they have at Duke University, just a much newer model," Anemone says. "It's been great for us, for our students. We've trained some of our students already in biology and anthropology to use the scanner here."

The machine is helping UNCG graduate students and faculty dig into important research questions and shed light on how animals interact with their environment, and how changes in their environment – whether across the change of seasons or over millions of years – affect animals.

By measuring different parts of a skeleton or analyzing marks left on bones and fossils, scientists can glean insights into the animal and the environment it lived in. How much and what kind of food was available? How did the animal move? How big was its brain?

By examining changes in animal morphology over millions of years and comparing those to other data about that time period, Anemone can learn how changes in the environment – such as climate change – affected animal species.

For example, around 55 million years ago, a period of warming birthed the earliest primates, with fossils found in Europe, Asia, and the North American Rocky Mountains. But then the climate cooled again and primates disappeared. "You don't find primates in the Rockies after 35 million years ago or so," Anemone says. "Global climate change is a dangerous thing – it leads to extinction and all sorts of unpredictable changes in biological communities."



A 55-MILLION-YEAR-OLD DEER-LIKE MAMMAL

Conducting fieldwork in Wyoming, Anemone's team discovered the most complete skull specimen of Esthonyx seen thus far. "Most of the time we find isolated teeth. An entire skull is a trove of information – brain size, nasal cavity, ear structure – giving us information on diet, how they balanced and moved, and more."

Dr. Bryan McLean, the biologist, is interested in both evolutionary changes in mammals over long time periods, as well as short-term changes in individuals from one season to another.

He's studied how rodents around the world adapt in both similar and different ways to underground environments, including how their bodies change to allow them to dig. Some species use their forelimbs, some their hindlimbs, others make more use of their mouths.

"We're interested in the nuance that goes along with that," he says. "The extent to which there's trade-offs – the forelimb becomes enlarged, the other limbs aren't." By studying the animals' anatomy, he hopes to gain insights into how the environment can shape evolution.

He's also interested in how short-term variations, such as changes in food availability and the weather, can prompt physiological changes – specifically, ones he can track through changes in anatomy. For example, he and his students collected mice from the Appalachian Mountains in North Carolina and discovered that during the winter, when food is scarce, their digestive tracts lengthened by about 35 percent. That should allow them to extract more nutrients from what food they are getting, McLean says.

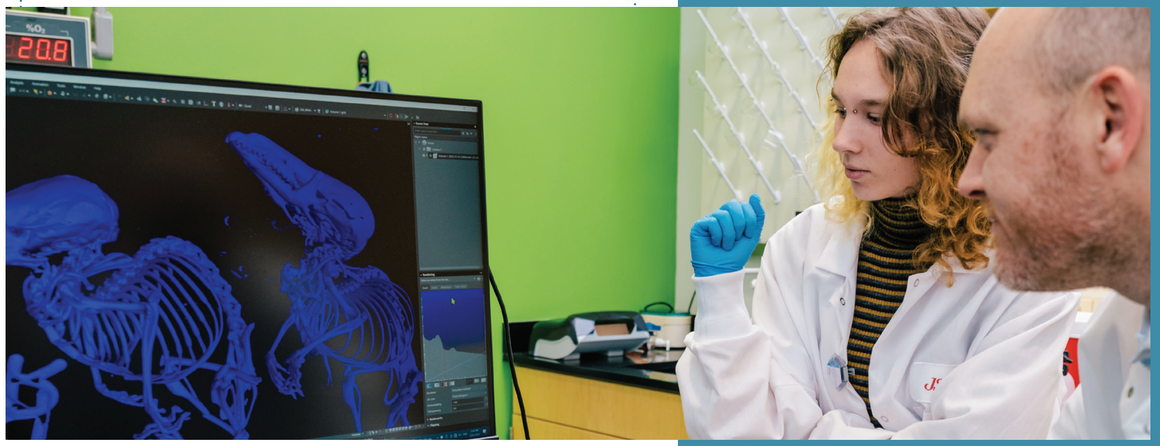
Now, he and his students are measuring the skulls of Sorex shrews – a group of animals that includes dozens of species and subspecies in Europe, Asia, and North America. Research has shown that one European species will reabsorb part of its brain matter – resulting in smaller skulls – when food supplies shrink.

"We have more species in this one genus, Sorex, than exist in Europe, but the phenomenon has never been shown here," McLean says.

So, McLean and his students go to the western part of the state each season to trap shrews and bring them back to Greensboro for analysis. The micro-CT scanner allows them to create precise, detailed images of the animals' anatomy.

SKULL SIZE IN RESPONSE TO FOOD SUPPLIES

Undergrad researcher Leo Ivey and McLean gather data on shrew size, shape, and brain volume. The scanner means they don't have to clean, preserve, and then measure individual skeletons – something that could take years, McLean says. "It's speeding up what we can do."



INTO THE TISSUE: ACL AND THE BRAIN

UNCG researchers are using a magnetic resonance imaging machine, or MRI, to peer inside joints and take pictures of study volunteers' brains. Their goal is to better understand how our bodies and brains function – and why things go wrong – to find ways to prevent common problems.

"It never ceases to amaze me that here at UNCG we have access to this amazing tool to help us ask the questions that we really want to ask," says Randy Schmitz, professor of kinesiology and director of musculoskeletal imaging at the Gateway UNCG MRI Center, where the MRI is housed.

"This has torn down barriers," he says. "Our researchers no longer have to go to a medical institution here in town or another academic institution 60 miles away."

MRIs create high-resolution images of tissues that have water in them – virtually all tissues in the human body.

Powerful magnets in the machine cause protons in water molecules to align, and then the machine emits radio waves that tickle those water molecules. The water molecules give off energy the machine detects to create pictures of tissues. It can even measure blood flow in the brain.

Schmitz and Dr. Sandy Shultz, another kinesiology faculty member, use the machine in their study of anterior cruciate ligaments, which connect the thigh bone to the shin bone. ACL injuries are common in the United States among both athletes and nonathletes.

They are interested in figuring out why some people might be more prone to ACL injuries. Differences in knee and ACL structure could be the key, and might lead to better methods of injury prevention. Recently they patented a device to measure knee laxity – a strong predictor for future injury among young athletic females – across all three axes of motion.

Other researchers are using the MRI machine to investigate interactions between the brain and the body.

Dr. Jennifer Etnier, professor of kinesiology, is exploring how exercise may delay the onset of Alzheimer's. In one large research study with $3.4 million in National Institutes of Health funding, she recruited middle-aged and older adults who may have a genetic risk of Alzheimer's disease.

MRI scans of the volunteers' brains are one of the ways Etnier is assessing the impact of exercise on the volunteers' Alzheimer's risk. Among people with the highest genetic predisposition for Alzheimer's, brain changes can be detected as early as in someone's 40s. Etnier hopes to be able to assess whether exercise delays those harmful changes in brain structure.

Psychology faculty member Brittany Cassidy has used the MRI to study what parts of the brain are involved in different activities involving learning and memory.

One study, for example, examined how connectivity in the brain's default network affects mnemonic discrimination — an important kind of memory we use in daily life.

"It is looking at whether you can distinguish existing memories from similar perceptual experiences," Dr. Cassidy says. "For example, on a table full of coffee mugs, how can you remember which one is yours when you get back from a coffee break?"

Cassidy, along with her undergraduate and graduate researchers, has also used the MRI to study why older adults tend to be more trusting of others than younger adults — especially when the other person behaves negatively. The MRI showed that during the learning process, different parts of older adults' brains were more active when learning about someone's reputation for trustworthiness, or lack thereof.

DEVELOPING EXPERTISE **"From the first day of my doctoral program, I was excited to use the MRI scanner," says Dr. Alexis Ganesh, pictured below with Etnier. Ganesh worked with UNCG's machine as a grad student and then postdoc.**

Brain-body connections are also the research focus of kinesiology's Derek Monroe. He's trying to better understand the physiological and neurological results of traumatic brain injuries

"After a head injury, you might assume that damage will be localized to brain areas near to where the impact occurred," Dr. Monroe says. But his studies, conducted across different sports and populations, hint at more widespread effects.

"In my preliminary findings, the processes that regulate our basic bodily functions seem to be affected. However, there is still a lot of work to be done for us to understand the when, why, and how."

Monroe and his collaborators combine MRI data with information from the field, such as symptom reports and impact data recorded by specialty mouthguards.

He's also interested in the benefits of exercise. "We're exploring how exercise can help brains recover from injury and how it contributes to general brain health across our lifespan."

Monroe, whose focus is on behavioral neuroscience, was drawn to UNCG in 2020 after a postdoc at the University of California-Irvine medical school.

"The MRI, the facility, the resources, and other faculty who were already users of the technology are a big reason why I got excited about the position here at UNCG," he says.

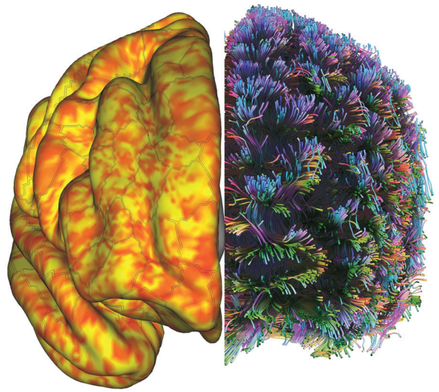
GRADUATE TRAINING **Monroe teaches students to use the MRI. To become proficient, they must learn about multiple disciplines, like physiology, physics, psychology, and data science.**

Monroe is also teaching students how to use the MRI machine. "I want to get graduate students now, and hopefully undergraduates in the near future, into courses – get them exposure to a machine that they would not have access to anywhere else," he says. "In the graduate course we spend two weeks, and we go over and we measure our brains. We then spend the second half of the course analyzing our brains."

Students learn how to upload the data and analyze it on powerful computers, and how to ask scientifically valid questions and understand the answers the MRI provides.

None of that, Monroe says, would be possible without both the equipment and a UNCG culture that encourages learning and interdisciplinary collaboration.

"We're open for business. You can schedule here, you can scan here. Top to bottom, the support is incredible," says Monroe.



DATA ON STRUCTURE AND FUNCTION **Monroe is interested in how exercise shapes the brain. For example, he and kinesiology's Dr. Donna Duffy have found that roller derby athletes at rest exhibit unique brain patterns. On the left is a map Monroe generated of the grey matter surface of a subject's brain. Areas in orange are functionally connected while the subject is in a resting state. On the right is a diagram of how deeper, white matter fibers connect different parts of the brain.**

AT THE NANOSCALE

Atoms make up everything we can see – from one-celled organisms only visible under a microscope to miles-high mountains. But individual atoms and the complex structures they can form are too small to be seen by the naked eye, even under the most powerful optical microscopes.

That's a challenge for scientists like the JSNN's Dr. Hemali Rathnayake, who has devoted her career to studying and creating materials at the atomic scale.

To see, for example, openings that are big enough to let through some molecules but too small to let through others, she and her research collaborators use powerful microscopes that don't rely on light at all. Instead, they use beams of electrons.

Nanoscience is the study of objects and phenomena on the nanoscale, or one-billionth of a meter. For comparison, a sheet of paper is about 100,000 nanometers thick. Or, put another way, if the diameter of the earth was one meter, then one nanometer would be about the diameter of a marble.

"If we didn't have access to these electron microscopes, then actually most of our research would not move forward in the nanoscale," Rathnayake says. "We would be unable to do a lot of new science."

The JSNN's field emission scanning electron microscope, or FESEM, allows scientists and engineers to see structures down to 2 nanometers in size – smaller than the diameter of a strand of DNA. It allows researchers to see the surface of materials, Rathnayake says, and understand how that surface is structured: Are they crystals? How are they arranged?

The FESEM also enables scientists to examine the material's chemical composition to determine the elements comprising them.

Rathnayake won a $422,400 grant from the U.S. Department of Agriculture for the JSNN's FESEM, which was installed and operational in January of 2022. Another $599,000 grant from the Department of Defense funded the purchase of the transmission electron microscope, or TEM, installed in 2021.

The TEM projects a beam of electrons through a sample, allowing scientists to view the interior of a structure at an atomic scale. It allows for resolutions 10 times higher than the FESEM – down to about one-fifth of a nanometer, smaller than the diameter of a single atom of gold.

"That really opens up for us more capabilities to understand nanomaterials at, really, near atomic scale," Rathnayake says. Rathnayake's research is focused on developing nanomaterials that can protect and improve the environment. Her team has created, for example, specially designed materials that can capture lithium or other waste materials in water, allowing them to be recycled for commercial uses while also cleaning up the environment.

"I wanted to make the nanoworld more environmentally friendly, more sustainable, and nontoxic," she says. "If we are polluting the environment, we are not doing anything inventive."

Without these microscopes at the JSNN, Rathnayake would have to use NC State University's equipment. That makes the process of getting nanoscale images more time-consuming and expensive. It also reduces opportunities for UNCG students to get firsthand experience with the instruments.

"Joining UNCG was a clear choice for me as the university provided access to advanced instruments, such as FESEM and TEM, for studying materials at the nanoscale," says Kelvin Adrah, a PhD nanoscience student who works with Rathnayake (pictured above).

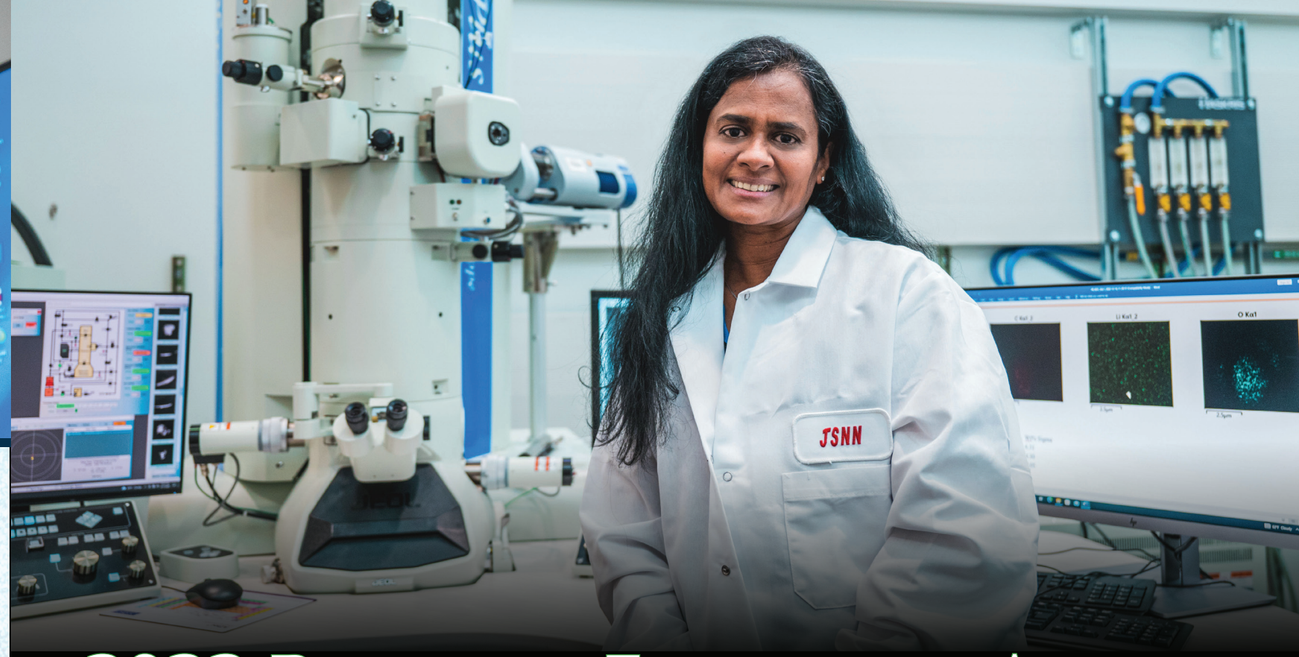
Having the FESEM and TEM on-campus provides UNCG students opportunities they wouldn't otherwise have, Rathnayake says. "They can become an expert on these instruments. Student training is a major reason we got this equipment."

Beneficiaries range from high school students in UNCG's Draelos Science Scholars Program to undergraduate researchers and graduate students – including those in the JSNN's recently launched 12-credit Nanoscience Certificate Program. "It's about growing the nanotechnology workforce," says Rathnayake.

Adrah, who entered the doctoral program to study materials that can be used for environmental remediation, has used both electron microscopes for his work. He says, "Having direct access to these instruments has been crucial for our research."

While the structures he studies are breathtakingly small, Adrah hopes that his education and research at JSNN will lead him to very visible rewards. "I aim to leverage my knowledge and contribute to the scientific community," he says, "ultimately entering industry to conduct research that benefits society."

by Mark Tosczak • learn more at jsnn.ncat.uncg.edu



2022 Research Excellence Award

Dr. Hemali Rathnayake, associate professor of nanoscience, received UNCG's 2022 Early Career Research Excellence Award for her work on designing and making innovative nanomaterials that have the potential to build a greener, more sustainable future.

She's had more than 40 papers published in peer-reviewed journals, as well as several book chapters, and has been PI or co-PI on more than $1.7 million in grants at UNCG. She also co-founded UNCG spin-off company Minerva Lithium, which focuses on harvesting rare and technologically valuable minerals while simultaneously reducing water pollution.

ENVIRONMENTAL FOCUS

"At UNCG I've directed my research toward the design and manufacture of nanomaterials for environmental sustainability applications – energy harvesting, energy storage, water purification, and critical minerals. We've designed a series of novel nanomaterials. One can selectively extract critical minerals while also purifying wastewater. We also make nanomaterials that are biomolecules, which can self-assemble into very thin metal wires that you can use in the semiconductor industry for patterning transistors."

GREEN CHEMISTRY

"There are a lot of harsh, toxic chemicals used to make nanomaterials. While we're making these nanomaterials to solve environmental problems, their production is actually toxic to the environment. My lab prefers to use green chemistry to avoid pollution.

"Green chemistry means most of the reactions are done with nontoxic solvents. You consume less energy for your reactions, and you do the chemistry at room temperature. There's much less toxic waste."

COMMERCIAL POTENTIAL

"The nanomaterial we developed using agricultural waste makes a very environmentally friendly biomass-based nanomaterial. It can absorb the most important critical minerals that we use for batteries in electric vehicles – for example, lithium. We can make it cheaper and at room temperature, using minimal water. The commercial potential is huge. The economic impact that we can make is huge if we can solve the problem of directly extracting lithium from water resources."

BECOMING AN ENTREPRENEUR

"I participated in UNCG's NSF-funded I-Corps training and advanced to the national level of the program. I learned a lot about thinking outside the box from a commercial perspective. I stepped in, took the risk, and I've learned a lot. It's paid off. Now I see the academic research point of view and the commercial point of view. I see myself as an academic entrepreneur."

MENTORING STUDENTS

"I give them a small problem in the lab, and they try to solve it. During the first year I work with them in the lab training them. I help them understand the science behind the problem. Rather than teaching them the theory directly, I teach them scientific concepts through this hands-on approach. Building critical thinking – that's what I focus on. We need to make sure they're not technicians, that they become scientists."

Interview by Mark Tosczak

IN ALL WAYS HUMAN. ALWAYS.

In 2020, Dr. Jocelyn Smith Lee was awarded an extremely competitive $100,000 Grand Challenge Award through the Bill and Melinda Gates Foundation. Her winning proposal – one of 28 selected from over 1,200 – sought to disrupt dehumanizing narratives of Black boys, men, and families and reclaim their humanity.

Now, the faculty member in Human Development and Family Studies and her team have launched their narrative change campaign, In All Ways Human, in Baltimore, Maryland. The results of their work bring hope in the aftermath of Covid, skyrocketing gun violence, and the visible loss of Black lives to police violence.

"This right here will change the perspective on how people look at us," says Kevin Harvey, Jr., participant and community advisor. "Every portrait up here is gonna change the world."

Centering Black voices

Smith Lee, who has personally lost loved ones to gun violence, has centered her work on examining how violence affects the health and development of young Black men. The storytelling campaign grew out of a need she uncovered through her own doctoral research: to help Black boys and men navigate issues of trauma, violence, loss, and healing.

"My Centering Black Voices research program aims to affirm humanity, prevent violence, and promote healing in the lives of Black boys, men, and families through research and action that advances racial equity," she says. In addition to creating loss and grief support groups, her work has led to policy recommendations and community mental health interventions.

And yet, she recognized the need to do more. "I wanted to amplify the voices of Black boys and men, to co-create a platform where they could show up as they wished and control the stories told about their lives."

Storytelling for change

With a goal of shifting the narrative and getting in the ear of the public and policymakers, Smith Lee teamed up with photographer Zizwe Allette and creative consultant Zun Lee, plus a host of community advisors and students. Allette and Smith Lee are longtime collaborators. They met at the Historic East Baltimore Community Action Coalition's Youth Opportunity Center, where Smith Lee's research began over ten years ago and Allette is a GED instructor. Their resulting In All Ways Human project relies on various mediums of storytelling to transform how Black boys and men are seen.

EXPLORE THEIR STORIES
INALLWAYSHUMAN.COM

So far the team's efforts, supported by Gates and Robert Wood Johnson Foundation funding, have culminated in an online repository of stories with photography and video, a life-size mural installed in East Baltimore, a Starbucks exhibit, and digital ad campaigns throughout the city.

"We want to spread the simple and profound truth that Black boys, men, and families are always and in all ways human," says Smith Lee. "Whether a toddler, like my daughter, or young adult, or young at heart, whether college educated or GED-pursuing, community leader or celebrity, we are deserving of dignity, safety, care, and opportunity."

Mural of the living

Fifty life-size intergenerational portraits of Black boys and men, ranging from ages 2 to 77, are mounted side-by-side along the 1100 block of North Wolfe Street in East Baltimore. This mural is currently installed on a former elementary school wall, opposite a redeveloped neighborhood near the campus of Johns Hopkins Medical Center.

"We are calling it a mural of the living, which is an opportunity to center Black boys and men in life, not just in death," says Smith Lee.

"Too often the stories that catch the attention of the media are those that are traumatic and dehumanizing in nature. These portraits allow Black boys and men the opportunity to show up as they wish to be seen and to push back against those mugshot images that circulate the nightly news."

The team held a mural dedication on June 5, 2022, to close National Gun Violence Awareness weekend and to coincide with Men's Health Month. Around 100 people attended, with many of the participants bringing their families to see their portraits.

"I'm proud of what we accomplished," says In All Ways Human participant and community advisor Leon Fountain III. "Hopefully the city can come together. Hopefully we can destroy the image that society helped us create … for us. As soon as we destroy it, we'll be better off, the whole world would."

WHEN PEOPLE LOOK AT ME "They assume I won't amount to anything because I was born in poverty. In reality, I have worked so hard. I earned my GED. I have a steady job. I just got married to my high school sweetheart. I love God." Eric McKnight, The Ambassador

Starting a conversation

On June 3, 2022, a pop-up exhibit was added to a Starbucks just one block from the mural site and two blocks from the Youth Opportunity Center. It features 10 life-size portraits in the windows.

"I'm stumbling over my words because coming in here and seeing this, I almost cried," says Harvey, who is one of those pictured. "To see it in a place like Starbucks, that's amazing. It's overwhelming, really."

The exhibit is already creating impact in the community. The Starbucks operator allowed the pop-up to become a standing exhibit – and he's now donating food to a shelter above the youth center.

The sites are also meaningful for their proximity to the Johns Hopkins Medical Center. The relationship between the local Black community and Hopkins is complicated, Smith Lee says. While it offers economic opportunity and access to health care, the center is also as a reminder of displaced Black residents and evokes mistrust related to its treatment of Black people.

"The physical presence of the mural images on that wall is an intentional placement of Black boys and men in a space from which they have been pushed out. It's also an invitation to Hopkins employees who park nearby or live in high rises across the street to engage with Black boys and men as their neighbors and not social problems," says Smith Lee.

Nationally, Starbucks has been a site of criminalization and displacement for Black males too, and Smith Lee hopes the cafe exhibit will bring patrons – including customers affiliated with nearby Hopkins – into the conversation. "That space should facilitate dialogue with Hopkins employees, trainees, and patients."

In addition to working on a documentary about the project and social media efforts, the team is now in conversation with Cincinnati leaders about replicating the project concept there. "I'm excited to grow the work in Baltimore, but scaling nationally, that is the goal," Smith Lee says.

student profile

PATHWAYS TO HEALING

Doctoral student Youselene Beauplan says she's always had a heart for underserved people.

"I started volunteering with the Boys & Girls Clubs of Broward County the summer after eighth grade, and I've been invested in working with youth ever since," says Beauplan. "They tug at my heart. It feels like this is what I'm supposed to be doing."

Beauplan's undergraduate coursework in adverse child experiences sparked her interest in studying youth trauma and led her to graduate school at UNCG. Her master's thesis investigated the impact of homicidal bereavement on young Black men and their life trajectories. Her passion for helping vulnerable and marginalized youth deal with trauma and loss connected her with Smith Lee.

"Youselene brings unique passion to the work because of her own lived experiences and her commitment to improving the health and well-being of Black boys, men, and families, including the ones she's a part of," says Smith Lee.

Beauplan has filled various roles for In All Ways Human, from social media coordinator to representing the project at conferences. "The most rewarding piece was engaging with the participants," she says. "It was beautiful to see their reactions to the portraits."

In addition to her work with Smith Lee's project, she is conducting her doctoral research on emotion socialization among Black father-son dyads.

"Our mental and emotional health impact how we perceive things and how we act," she says. "I want to study how Black adolescents and emerging adults can be empowered to experience a full range of emotions." The study will focus on cultural assets in Black families.

"We have the potential to help youth navigate trauma and chronic stress – not just to survive it, but to thrive," she says. "I love connecting with people and thinking through real world implications and applications of my work."

Ultimately, the UNCG Minerva Scholar and first-generation student knows she wants to work directly with youth, families, and communities.

"I want to conduct research and do program evaluation and policy work. Having a social justice lens is important to me, and I see myself at the intersection of scholar, practitioner, and advocate."

by Amanda Saber • In All Ways Human photography by Zizwe Allette

PART of the HIVE

Bees have a big following. With superorganism status and a queen-based structure, they've captured the minds and hearts of countless scientists, artists, and hobbyists.

It's not only bees' behavior that fascinates humans: they are also essential to our food supply.

Across the United States, bees pollinate an estimated 130 fruits and vegetables, which amounts to a value of about $18 billion annually, according to the USDA. Within North Carolina alone, bees' pollination of a variety of crops, from peaches to peanuts, equates to about $186 million dollars, according to the North Carolina Cooperative Extension.

But not everything is peachy with bees.

The essential organism faces serious threats, including parasites, pathogens, poor nutrition, and the mysterious colony collapse disorder. From April 2021 to April 2022 alone, the national Bee Informed Partnership estimates that over one-third of bee colonies were lost.

Researchers working out of UNCG's Plant and Pollinator Center are part of worldwide efforts to better understand bees and help them – and the organisms that depend on them – thrive.

BEE BUSINESS

From a grad school discovery to launching a company, two UNCG alums take a big swing for bees

It's not easy being a baby bee.

The hive doesn't revolve around the developing insect. Instead, the brood – consisting of the eggs, larvae, and pupae – are part of a larger whole, whose health holds higher stock than any one individual.

Diseases and mites are the hive's most significant threats, including the famed Varroa destructor mite. Beekeepers are losing up to 40% of their colonies every year due to these threats, says Dr. Kaira Wagoner, a research scientist at UNCG.

But some honey bees have sniffed out a curious method to reduce disease in their hives.

These specialized adults can smell when a developing bee is unhealthy and will uncap its cell, so the unhealthy brood can be inspected and, if found sick enough, removed from the hive. Scientists call the pheromone-driven process "hygienic behavior."

"Making the sacrifice of an individual unhealthy bee improves the health of the colony," Wagoner says. "We think of a honey bee colony as a superorganism. The focus is on the colony as a whole."

During her doctoral studies at UNCG, Wagoner became curious about how bees communicate to perform this hygienic behavior. She discovered that elevated levels of certain compounds on sick baby bees serve as a signal to adults.

"Specific cuticular hydrocarbons were slightly elevated if the honey bee pupa was unhealthy," she says. "Bees are so sensitive in their ability to smell that they can detect these tiny changes."

Wagoner had answered her question, but she wasn't done.

"I love to take science and turn it into something that's really applied and useful," she explains. "I think it's important to not only communicate science, but to use it to do good."

ENCOURAGING BROOD INSPECTIONS **Wagoner's team tests hives with their proprietary pheromone mixture.**

Cutting-edge science in a spray bottle

Beekeepers, Wagoner knew, used a variety of tactics to identify and selectively breed for bees that had a knack for hygienic behavior. One of the most common was freezing brood with liquid nitrogen and testing how much removal of the dead brood happens over 24 hours.

But Wagoner's compounds offered the possibility of identifying more sensitive hygienic bees with less harm to the brood.

Chemists at UC Riverside and UNCG helped Wagoner synthesize her target compounds in the lab. Then she and her collaborators put a mix of those compounds to the test.

In Wagoner's assay, pheromones are sprayed on a section of capped brood, which is then placed back in the hive. If the bees can sense the elevated compounds, they will uncap the brood cell to inspect it. After two hours, the researchers measure the percentage of uncapping in the treated area.

Since the hive will eventually recap healthy brood, the assay leaves them unharmed.

Using this test on multiple colonies, the researchers gave each colony a hygienic score.

"Higher-scoring hives," Wagoner, pictured above, explains, "have fewer mites, lower virus loads, and can be bred to produce bees that are less reliant on beekeeper interventions to survive."

The new test, the researchers found, was not just less detrimental to the brood – it was also more accurate.

The science solidified a business product: a spray bottle containing their compounds, for beekeepers to identify their most hygienic bees for breeding. It also resulted in three patents for Wagoner and her Ph.D. advisor.

From a lab lunch to launching a business

As a postdoctoral fellow, Wagoner was exploring how to bring her product to market. Unexpectedly, a lab lunch led to her next big step.

Her labmate, master's student Phoebe Snyder, had an entrepreneurial upbringing. "I grew up observing my mother launching multiple businesses," Snyder says. "I knew I eventually wanted to do that too." As Wagoner explained her ideas over lunch, the two began brainstorming – jotting notes down on a napkin.

"I still have the napkin on my fridge. It's a little sentimental," Snyder says with an easy laugh. "That was one of those moments where I realized this was going to propel my career in another direction."

Wagoner and Snyder have come a long way since these napkin musings.

They reached out to InnovateUNCG, the university's innovation and entrepreneurship arm, to gain insight to make their idea a reality.

"The office guided us through the process," Wagoner says. "We were scientists with an invention, and we became entrepreneurs with an up-and-coming product."

They went through UNCG and NC A&T's regional NSF iCORPS program – a sort of bootcamp for researchers seeking to launch their innovations in the marketplace. Their success there got them into the national iCORPS program.

In those programs, they interviewed about 200 beekeepers. "This process gave us a laser-focused kind of view of what the needs actually are and such a better understanding of the industry," says Snyder.

The duo have acquired funding – receiving 13 out of the 15 grants they've applied for – and are cultivating worldwide partnerships. Their successes include an NSF Small Business Technology Transfer Grant, or STTR, of over $250,000, a One NC Small Business Program matching grant, and collaborations to conduct independent field tests in U.S., Canada, Belgium, the Netherlands, and Australia.

As the partners work to refine their product, they have a waiting list of beekeepers and business collaborators already eyeing their product.

"Bees are critical for 30% of the foods we eat, so we're hoping to help improve food security and pollination services on a global scale. That's a big thing, but our ambition is grounded in good science. We expect big results, from flower, to farmer, to fork."

OPTERABEES.COM **Optera launched in 2020. "It means wings," says COO Snyder, seen above with Wagoner.**

BEYOND THE GUT

A faculty-student team explore how microbiomes impact bee health

Depending on your affinity for science, the word "microbiome" may be gibberish.

But if you have ever discussed your skin, gut, or a pesky infection – and how these commonplace topics connect to antibiotics, probiotics, or prebiotics – then you, too, are conversing about microbiomes.

The term refers to a community of tiny organisms, from fungi to bacteria, living together.

"You can have a soil microbiome, a carpet microbiome, a dish sponge microbiome – but I would say that the general public is usually going to associate the microbiome with animals," says Dr. Kasie Raymann, a faculty member in the Department of Biology.

The human microbiome has piqued people's interests, but studying it can be tricky, she says. Our diets change. Our genetics are complex. Lifestyles vary widely. These shifting factors can make it murky to design a controlled experiment.

Much of the nitty gritty about the microbiome remains a mystery: That's where bees come in.

"The honey bee is a really good model system for us because they have a relatively simple microbial community that lives inside their gut," says Raymann, pictured above with graduate student Lexi Hoopman. "But unlike fruit flies and other simple insect systems, honey bees acquire their microbes socially, like mammals."

Raymann's lab is among a handful of research groups dedicated to answering fundamental questions about bee microbiomes.

With a $800,000 National Science Foundation Bridging Ecology and Evolution grant – aptly abbreviated "BEE" – her team is investigating what factors influence the composition of a bee's microbiome. The research is also supported by $152,000 in USDA funding.

It's timely work, given that up to half of honey bee colonies are lost each year. But for Raymann, it's largely about improving our understanding of fundamental processes. "When we start to understand how microbiomes work and are shaped in bees, then we are one step closer to understanding them in humans," she says.

Raymann has found that tetracycline, an antibiotic beekeepers commonly use to protect bees from infections, significantly alters honey bee gut microbiomes – and increases mortality in the hive over time.

The Birds & The Bees

A NEW MICROBIOME

A major step for the Raymann lab sparked with the arrival of graduate student Lexi Hoopman – leading to nearly $862,000 in grant funding and a novel discovery about honey bees.

"Lexi is not like any other graduate student I've met," Raymann says. "She has the research, maturity, and drive and insight of someone much further along in their career."

As an undergraduate at North Dakota State University, Hoopman made a curious observation that would become key down the road: antibiotics killed bees' sperm. And neither Hoopman nor the rest of the scientific community knew why.

So when Hoopman found Raymann's work on antibiotics and honey bee gut microbiomes, reaching out was a no brainer – even if it meant doing her PhD at a school 1500 miles away.

Together, Raymann and Hoopman discovered that honey bees have bacteria that live in their reproductive tissues – a reproductive microbiome.

"We know that mammals have reproductive microbiomes, and there have been some reports of some insects having them, but no one had ever looked in honey bees," says Raymann, pictured in the field below. The duo plan to publish their findings about bacteria in the honey bee reproductive microbiome this year.

IN-HIVE MEDICATIONS

Raymann and Hoopman, in collaboration with Dr. David Tarpy at NC State University, leveraged their early findings to net a $682,000 USDA grant. "Our big question is whether antibiotics and other in-hive treatments impact reproductive fitness in bees," Raymann explains.

A National Institute of Food and Agriculture predoctoral fellowship awarded to Hoopman brought in an additional $180,000 from the USDA and let the team explore their question not just in the field but also in the laboratory.

The researchers are specifically investigating tetracycline and amitraz – an antibiotic and a miticide commonly used in beekeeping.

They want to know if these medications accumulate in reproductive tissue and if they impact sperm viability, body and organ weight and size, and the reproductive and gut microbiomes in honey bees.

Early results track with the researchers' suspicions.

"Ingesting tetracycline is reducing the diversity and amount of bacteria in drones' reproductive organs," says Hoopman. "And, in vitro, we've seen that tetracycline kills honey bee sperm in doses eight times smaller than what's used in a typical hive treatment."

Antibiotic treatments may also be killing immature bees. "Developing drones exposed to tetracycline at the same concentration as an in-hive treatment die in four days, and even at half that dose, larvae die in seven days," she says. Queens, too, seem to be affected. "Antibiotics can reach and be absorbed by the queen reproductive organs at shocking concentrations."

While the work is still in early stages, Hoopman hopes it will ultimately serve as a wakeup call.

"Hopefully, our results will be an eye-opening push for antibiotic alternatives for beekeeping – and also just highlight the dire need to reduce antibiotic use everywhere."

She's thrilled to be at the forefront of bee knowledge.

"I think I'm coming in at this really perfect time where people are understanding how important these microbiomes are across our entire bodies and environments."

The *BUZZ* about **Bee Probiotics**

Another doctoral student in Raymann's laboratory, Megan Damico, is investigating a popular but problematic beekeeping product: probiotics.

"Beekeepers, especially commercial beekeepers, are treating their hives with probiotics at large scales," says Raymann.

They hope probiotics will combat negative impacts of antibiotic use in hives. Unfortunately, those hopes may be unfounded, say Raymann and Damico.

"Bee probiotics are regulated like food – the product ingredients have to be safe," says Damico. "But they're not regulated in the sense that their claims have to be true."

As part of her dissertation research, Damico is partnering with NC master beekeeper Burton Beasley. Their early findings match their expectations and previous studies in the area: After hives are treated with antibiotics, adding commercial probiotics that are currently available does not significantly replenish honey bee microbiomes.

Damico and Raymann caution that science is always evolving – a future probiotic could strike the scientific sweet spot and help bees. But in the meantime, they point out, probiotics on the market are expensive and seem to be a waste of both time and money.

Damico is working to get the word out about this through science policy and advocacy.

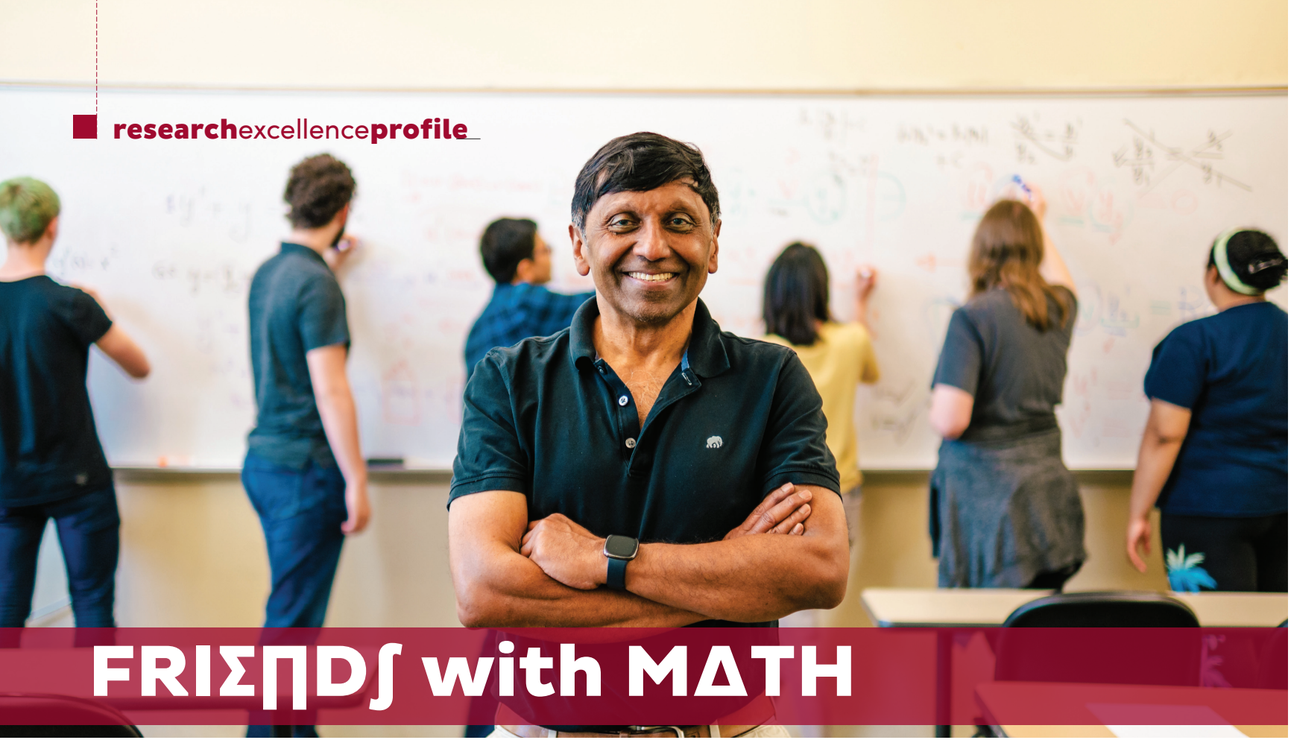
She has already completed Day One Project's Early Career Science Policy Accelerator, where she developed a policy brief calling for an extension of the FDA's animal drug approval process to cover probiotics and similar products, as well as methods to further educate beekeepers and veterinarians about antibiotic use.

Currently she's a policy entrepreneur fellow for the Federation of American Scientists, and closer to home, she spearheads UNCG's Spartans for Science Policy student group.

Damico says she's driven by the process of translating science into action. After graduating, she plans to pursue a career in science policy.

"I'm a first-generation college student, so being able to give back to the communities that helped raise me was really important."

by Rachel Damiani • learn more at biology.uncg.edu/ppc



FRIΣ∏D∫ with MΔTH

H. Barton Excellence Professor Ratnasingham Shivaji was awarded the 2022 UNCG Senior Research Excellence Award for his accomplishments in differential equations research as well as his lengthy record as a teacher and academic mentor. He is known as a passionate educator who burns the midnight oil working with students. This year, he also received UNCG's Excellence in Graduate Mentoring Award.

Over more than four decades as a mathematician, Dr. Shivaji has conducted research in partial differential equations, with a focus on reaction-diffusion systems. The work has applications in nonlinear heat generation, combustion theory, chemical reactor theory, population dynamics, and ecology.

An internationally renowned authority on positone and semipositone problems, Shivaji has 180 publications with over 4,000 citations, has given 24 plenary talks across the world, and is a Fellow of the American Mathematical Society. His successful funding record includes six major NSF research grants as well as a host of conference grants.

MATH IS FUN

"Students are my research collaborators and friends. We often form teams of PhD students, master's students, and undergraduates to work on a project. I love to see undergraduates experience the excitement of discovery. They often do not get this adventure in their classes.

"We all get together either in the department or in the coffee shop – we don't need labs. We will have coffee, have lunch, and we'll continue to have fun working on research problems.

"That's what I always emphasize for my students: 'Let's have fun doing research.'"

MATH AND SCIENCE INTERACTIONS

"I have worked with combustion theory problems. Now I'm working quite a bit in population ecology. I have a co-investigator who is a renowned ecologist at Louisiana State University. We're trying to model mathematically what his team discovers through field research.

"We're looking at competing and cooperating species inside a certain region – things like that. How the two species interact is complicated — they might cooperate in the interior of the region, but when they come to the boundary they might compete. In the past, mathematical ecology was more focused only on the interior of a region. Now we're looking at how exterior regions can also impact what's happening in the interior. We build mathematical models and analyze them to provide answers."

REACTION DIFFUSION SYSTEMS

"A region could be anything – a lake, a metal plate, or whatever. Then comes the issue that I'm very interested in: measuring a quantity – like population density or temperature – at a specific position at a specific time. The quantity changes due to reactions – like births and deaths and external forces, due to diffusion – like the effects of crowding, and due to the nature of the boundary. For example, if you're looking at a lake as the region and the exterior is land, that's a hostile boundary because crossing is impossible for many species. With other kinds of boundaries, an animal population might come into a region and then go back out more easily."

SOLUTIONS

"In these systems, I'm looking for long-term, steady state measures of a particular quantity – this happens when the quantity in a certain position essentially stops changing over time. That may or may not happen. We attempt to determine if there is a unique steady state, multiple steady states, or no steady states. Identifying steady states is very important to understanding time-dependent dynamics in a system.

UNCG EDGE

"One of the things I like about our program is that, even though I'm not a computational expert, all my PhD students are now experts in both analytical plus computational mathematics, thanks to fantastic colleagues in my department, like Dr. Tom Lewis and Dr. Yi Zhang. They are on my students' committees and work with them on the computational components. So we're graduating students competent on both sides. That's a big plus. They have a different flavor when they go into the mathematics job hunt."

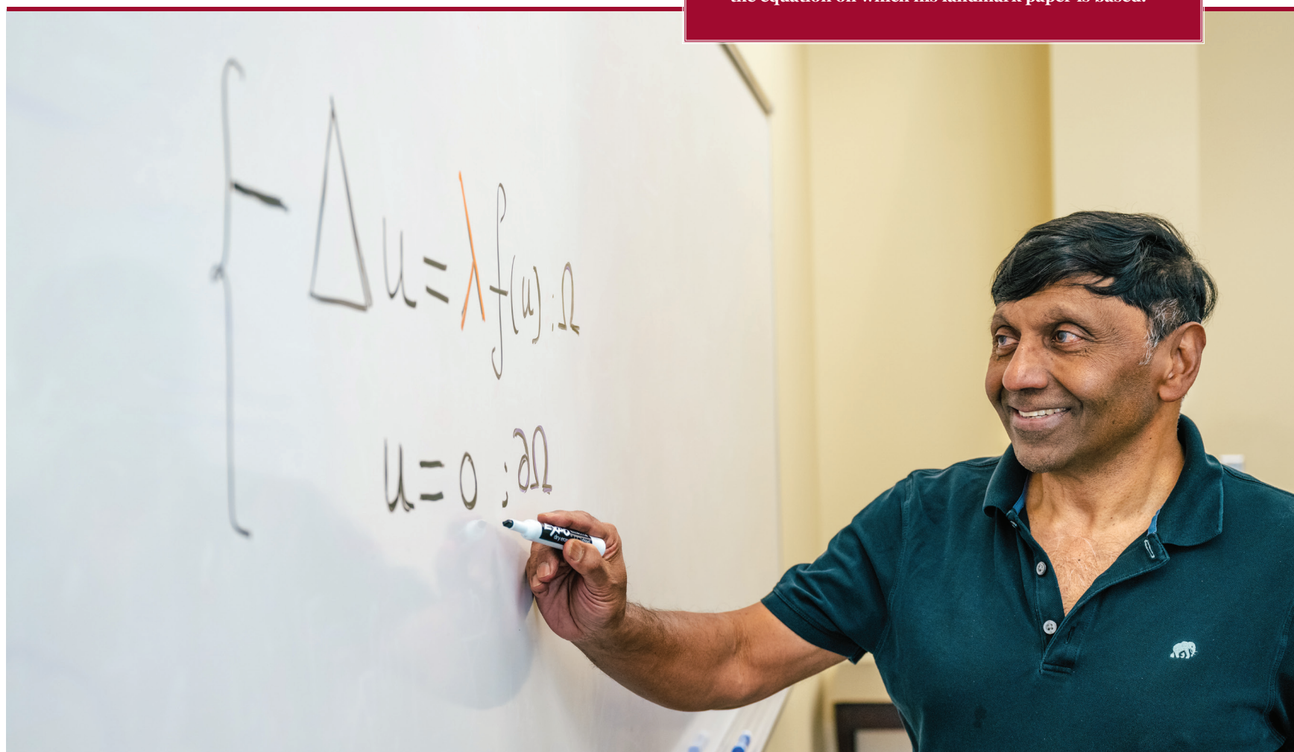
CAREER PHILOSOPHY

"I served as head of UNCG's Department of Mathematics and Statistics from 2011 to 2019. A department head, for me, is a servant leader. That was my model. But I don't want to go beyond the department because I need to stay close to mathematics. That's where my love is. Mathematics is the universal language that we all need to speak – it's important for logical reasoning.

"When it comes to teaching students, I want to share the beauty and power of mathematics. To help prepare the next generation of mathematicians who love research and teaching. And to expand my group of research buddies."

Interview by Mark Tosczak • *learn more at mathstats.uncg.edu*

WHEN f(0) < 0 **Shivaji and his collaborators pioneered the study of semipositone problems. On the board below, Shivaji writes out the beginning of the equation on which his landmark paper is based.**



RESEARCH AT PLAY

UNCG has joined the collegiate esports movement with a $2.4 million state-of-the-art facility. But gamers aren't the only ones stepping into the arena.

ESPORTS ATHLETE HEALTH

Public health education professor David Wyrick launched the UNCG Center for Athlete Well-Being for research on the physical and mental health of athletes of all ages.

Through the center, his spinoff company Prevention Strategies, LLC, and partnerships with major players in the industry – including the NCAA and NFL – Dr. Wyrick and his team takes their findings into the classroom and onto the court.

"Maximizing public health impact is my priority," he says. "Our commercialization efforts also inform the scholarship, leading to more manuscripts and grant proposals. So, it's this 360 degree cycle."

Now, Wyrick and his team are taking their expertise into the world of esports student-athlete health – an area where they say there is a strong need for foundational research.

"Collegiate esports athletes compete at a very high level that requires hours of physical, mental, and game-specific skills training," Wyrick says. "This can result in pressures and environments that challenge their well-being."

The researchers recently launched a survey to better understand the scope of esports athlete wellness. The groundbreaking study is led by Prevention Strategies' experts Dr. Annie Kearns Davoren – a former NCAA consultant – and Dr. Stephen Hebard.

"What we're doing is completely novel," Davoren says. "We're taking this 1,000-foot view of the esports student-athlete participant."

The survey, the largest so far of its kind, gathered data from 650 collegiate esports athletes and asked a broad range of questions about athletes' perceptions and experiences. Topics included academic experiences, relationships with coaches, mental health, the gaming environment, and substance abuse.

They hope to translate their findings into behavioral interventions and education that can help gamers.

"Once you start making data-driven decisions, things really start happening and changing for the better," Davoren says.

There's momentum and interest to positively impact the esports environment.

"Video games and competitive gaming are really accessible in a way that traditional sports aren't, and there's a massive investment in esports right now," Hebard says. "Our hope is that the data we're collecting can help make the argument to invest in the well-being of esports athletes."

EVIL AND MORALITY IN GAMING

Religious studies professor Gregory Grieve observes a group of gamers facing a dilemma. They have reached an infamous point in the 2009 video game "Call of Duty: Modern Warfare 2" – the controversial level known as No Russian – where players enter an airport and join a group of gunmen who attack bystanders at a security checkpoint.

Violence is par-for-the-course in Call of Duty. But these players, who are part of an evangelical Christian group, wonder if there's a way to avoid harming the unarmed civilians.

"How can they mesh their Christian notions of right and wrong with what's going on?" Dr. Grieve wonders.

It's these types of moral decisions that have piqued Grieve's interest since 2007 and prompted his research on the concept of evil in video gaming.

"A lot of times video games are just ignored or they're dismissed as frivolous entertainment, but a lot of them have deep ethical choices that the players have to make," says Grieve, who is director of UNCG's Network for the Cultural Study of Videogaming and a founding member of the International Academy for the Study of Gaming and Religion.

He defines evil as actions that most people would consider outside of ethical norms. "We just can't understand morally why someone would do it."

He calls evil in video games ludic evil – a phrase he developed using the Latin word for play.

Grieve, an ethnographer by training who specializes in religion and digital culture, uses multiple human-centered methods to explore how people perceive and respond to ludic evil.

For example, he will concentrate on one scene from a video game and play it multiple times himself. This methodology, which Grieve calls close play, is similar to a literature scholar's close reading of a text.

He also watches through the eyes of other players. "I'm looking at other people to see what they do," he says. "Their decisions are more interesting to me than what I think is right or wrong."

So far Grieve has three books and 37 publications related to gaming. In 2023, he and UNCG's Dr. John Borchert will release a "Religion and Video Games: An Introduction" textbook with prestigious publisher Routledge.

"Studying video gaming and the problem of evil fosters media literacy and allows us to make ethical choices in this brave new digital world," he says.

Ethical choices such as the one presented to the evangelical Christian group playing Call of Duty. Grieve follows the conversation thread as the group debates their options.

"They decide to turn their backs to all the violence and not engage with it," he says.

The players get through the airport and end up in the same spot they would have if they had chosen the violent route. And, Grieve says, they do so with their values intact – at least for this stage of the game.

Sometimes Grieve's 15 years of research on evil leads him to an unexpected place: hope.

student profile

Sophia Rosenberg, a sophomore double majoring in anthropology and religious studies, is an active member of the UNCG Network for the Cultural Study of Videogaming.

"For me, I've always loved gaming," they say. "The fact that academia is becoming more open to studying gaming and is now realizing that video games are very important cultural artifacts is extremely exciting."

As an undergraduate researcher they studied players of the survival game Valheim. The project, which explored power dynamics in ethnographic research, was a first place winner at the 2022 UNCG Thomas Undergraduate Research and Creativity Expo.

"Conducting research with Professor Grieve was something I never expected, but I would not trade it for anything else," Rosenberg says. "For me, it solidified what I want to do in my future career. I plan to go into user experience research, hopefully within the gaming industry."

STATE OF THE ART **Clockwise from top left photo, Dr. Gregory Grieve, undergrad researcher Sophia Rosenberg, and Dr. John Borchert are regular players at UNCG's new esports arena.**

COMMUNITY OF GAMERS

From freshmen to tenured faculty, UNCG gamers bond over shared interests, exchange ideas, and bring scholarship to the broader community, thanks to the new Network for the Cultural Study of Video Gaming.

Associate director Dr. John Borchert says the network, known as the NCSV, was founded in 2021 with the goals of fostering research, education, and outreach.

"What's really innovative about what we're doing is the integration of education and research," Borchert says. "This gives students and faculty a well-rounded approach to game cultures and esports."

Within the classroom, students and faculty are delving into curricula that connect gaming to well-established fields, from sports broadcasting to digital animation.

In the network's first year, faculty have developed 9 new courses. Examples include Playing Games and the Ancient World, Environmental Justice in Video Games and Literature, and Game Over: Video Gaming and Death.

"These courses offer a new avenue for student interest and for faculty exploration of new horizons in their research agendas," Borchert says.

The network is building on this momentum by launching the Videogaming and Esports Studies minor, which will be available to students beginning this fall.

"Students in the minor will have a unique combination of critical thinking and applied skills," says Borchert, "to engage in all aspects of the gaming and new media industries ranging from production, broadcasting, journalism, scholarship, and event and recreation management."

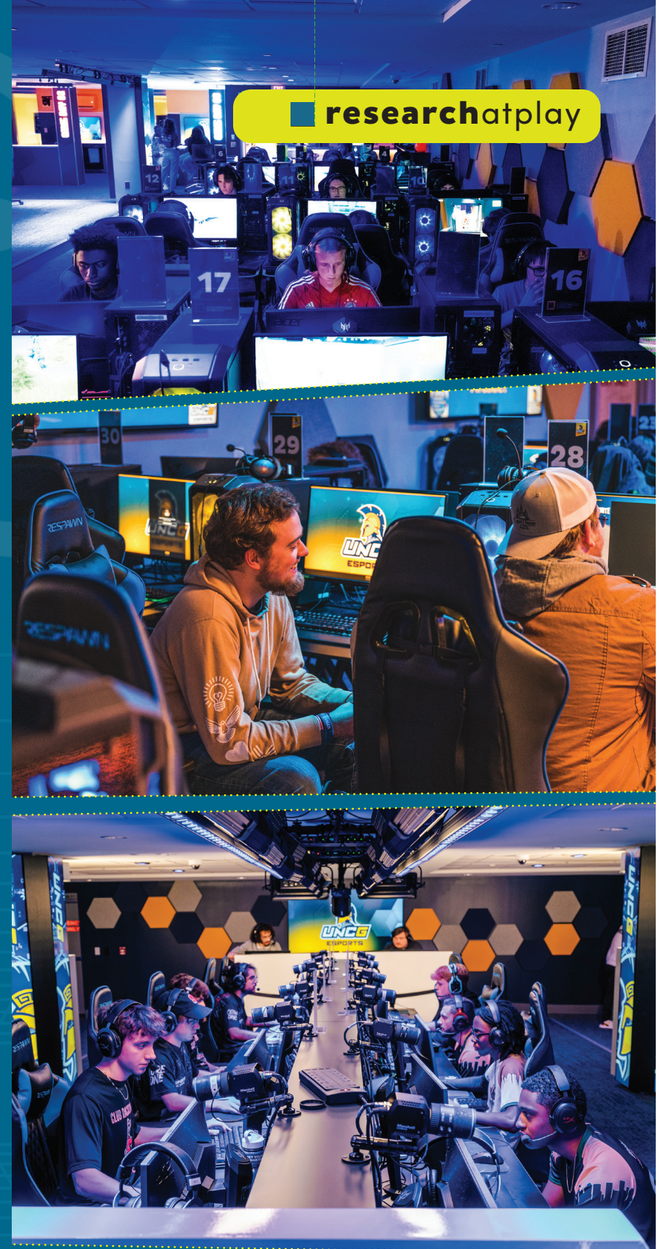
The NCSV engages in a range of outreach events to connect gamers. Last year, they helped launch the UNCG Esports & Gaming Summer Camp for 9 to 14 year olds.

The network is also fostering conversation on campus through the Ashby Dialogue series, a yearly discussion group bringing together about 20 faculty and students across disciplines for focused inquiry. This year their topic is identity and queer culture in the popular video game Zelda.

"Games in general have always been a space for the marginalized to find a sense of empowerment, expertise, and a community," says Borchert.

"Gaming is for everybody."

by Rachel Damiani • learn more at esports.uncg.edu



WEALTH OF OPPORTUNITY **"We're just getting started," says Wyrick, who – in addition to researching esport athlete health – serves as director of InnovateUNCG. "Esports is the most exciting thing I've seen in my career to help push translational research and innovation forward."**

From Military *to* Mental Health

A NEW WAY TO SERVE **The military-affiliated services office is a second home for many veterans during their time at UNCG. It was also a place to find participants for Miller's undergrad research.**

"Keep your head on a swivel."
"Flip the switch."
These are just some of the catchphrases David Miller heard regularly during his seven years in the Marine Corps. For good reason. Traits like being highly tuned in to your environment, known as situational awareness, can promote safety and survival during combat.

But what happens when this mindset is carried into everyday life?

The question changed Miller's trajectory as an undergraduate at UNCG.

Miller, like many veterans, says he had multiple "rough years" after being medically discharged from the Marine Corps. But in psychology laboratories at UNCG, he found a way to reclaim the part of his identity that thrived on supporting his comrade-in-arms.

"We lose a lot of our service members to suicide every day, and one of those things that drives me is trying to bring that number down – I want to be a light on people's darkest days," he says.

As an undergrad, Miller began working in Dr. Blair Wisco's research lab.

"I knew I needed research experience to become a clinical psychologist," he says. "But I thought I would hate it – the math, the statistics."

But it wasn't what he expected. "Listening to people just nerd out about psychology the same way I did was awesome." Wisco's focus on post-traumatic stress disorder resonated with Miller.

During lab discussions, Miller realized some behaviors associated with PTSD were commonplace in military training. "What if a person found these things really useful for 4 to 20 years?" he asked. How might this learned behavior then trickle into a veteran's civilian life?

His colleagues didn't have an answer, and, just like that: Miller was bitten by the research bug.

"Helping countless veterans through research and contributing something new to an entire body of thought – I couldn't ask for a better opportunity."

Miller applied to MARC U-STAR, a prestigious NIH-funded program at UNCG that supports undergraduates from diverse groups as they explore research, providing monthly stipends so students don't have to split focus between research and work, as well as funds for conferences and presentations and mentorship.

Psychology professor and director of clinical training Kari Eddington became Miller's mentor. In her laboratory, he explored how adaptive behaviors in the military can become maladaptive with changes in context and intensity.

"What's novel about his work is the focus on the military training environment and how that impacts psychological processes," says Dr. Eddington. "Often the focus is more on acute combat experiences and trauma."

Miller says he gained confidence and well-rounded skills by working with Eddington and Wisco.

"The smaller, more personal and teaching-oriented laboratory setting was a game changer."

These crucial experiences at UNCG prepared Miller for his next MARC-U-STAR program opportunity: a summer research internship in Duke's Traumatic Stress and Health Research Lab.

Miller excelled in the role – so much so that he received and accepted a job offer to work as a project manager in the same lab after graduating. He plans to continue cultivating his research skills in this position while applying to graduate programs in clinical psychology. He feels well prepared for this next step.

"What a lot of people have only done for six months or a year when they graduate, I was able to do for three years. And the confidence from that is just incredible."

by Rachel Damiani
learn more at psy.uncg.edu

HEARING *Dissonance*

Dr. Quinton Parker knows what it feels like to *stand out*

Parker, who grew up in Durham, North Carolina, attended multiracial schools throughout his childhood and went to an HBCU for his undergraduate degree in jazz performance. But when he enrolled at a college of music in Chicago for his master's degree, he began to notice a difference.

"There were very few people of color," Parker says. "It was very isolating. It was lonely."

Now, as a music education faculty member at UNCG, Parker is digging deeper into his personal experience.

"It led me to the question: Is this everyone's experience?" Parker says. "And what I learned is that it's not just that one school, it's really about the discipline."

From 2019-2021, Parker worked on his PhD at UNCG conducting research into the experiences of Black undergraduate music education students in predominantly White institutions. He wanted to get past quantitative data and tap into the students' personal stories.

"It's easy to describe it in numbers, but change can be brought about when you put readers into the shoes of the person experiencing it," Parker says.

Through in-depth interviews with nine students, he worked to encapsulate how it feels to be a Black student in a mostly White department and landed on a single concept.

Parker teaches a music education class.

"It's a dissonant existence," he says. "Across all zones of experience, it's inharmonious. They stood out because of the color of their skin, and it just reinforced the idea of 'I don't belong here.'"

Parker found that most of the students' feelings of dissonance started when they were younger. In elementary and middle school, they didn't have teachers who looked like them and they were often taught pieces created by White musicians.

As they grew up, they learned to move through the world carefully, paying attention to their tone when speaking or being mindful of how they wore their hair or how they dressed. Almost on a daily basis the students experienced racism both explicit and subtle – things they didn't feel comfortable sharing with anyone else.

As a result, Parker came up with recommendations for institutions to create more welcoming environments for their Black students. For starters, they need more Black staff and faculty.

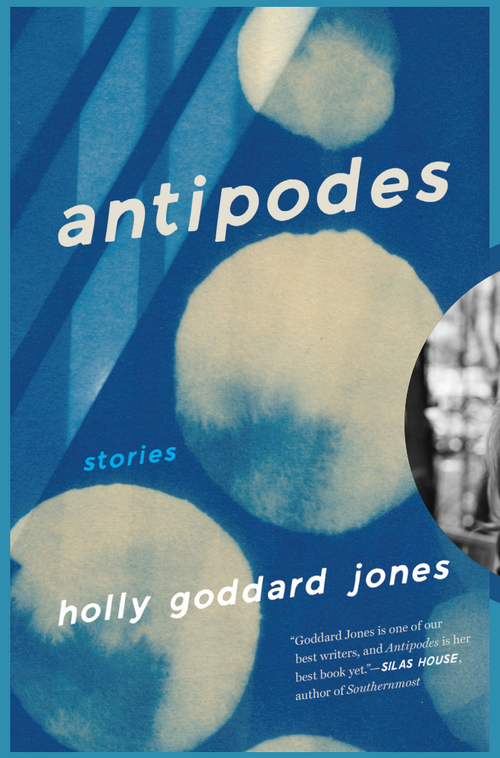
Additionally, universities should have measures in place for students to safely report race-related stressors. In a post-George Floyd society, Parker knows there's an appetite for this kind of work. But he says that stakeholders need qualitative information if they're to create effective change.

"I definitely see cultural changes," Parker says. "There's less public acceptance of racism and discrimination. UNCG has done a great job of addressing the issue, but sadly it's not the same in every institution. There's a huge cultural shift that needs to happen."

As far as being a role model for the next generation, Parker says the students in the study have helped him as much as he's hopefully encouraged them.

"This process really has made me think about how I exist as a Black person in music," Parker says. "It inspires you to keep pushing because I know it's not just me who experienced it; there's at least nine other people who motivate me to keep pushing."

by Sayaka Matsuoka • learn more at ***vpa.uncg.edu/music***



everyday life, **unexpected places**

Some of the short stories in Holly Goddard Jones's new collection, "Antipodes," incorporate dystopian or fabulist elements – the narrator of the title story serves as the "Historian" for a temple guarding an abyss, for example, and in "Visitation," a video game creature comes to life. Others adhere to strict realism. In "Shelter," a very pregnant woman fights against feeling like an outsider during a beach vacation with friends. In "Swallows," an art teacher struggles to accept her boyfriend's contentment with his job as a grocery clerk.

But each of the eleven stories is rich with the texture of everyday life: even the historian of the temple of the abyss needs to get her daughter to daycare on time. The result is a collection that feels endlessly surprising, yet consistent in its exploration of what it's like to be a certain kind of person living a certain kind of life.

"I try to access my characters on all levels," says Goddard Jones, a professor in the Department of English. "How they experience the specific time and place in which they live, how they strive to do good in the world, and how they sometimes fall short." She wants to understand not only how her characters see themselves, but also the subconscious thoughts they don't have access to.

On February 15, The Story Prize, which honors outstanding short story collections, announced that "Antipodes" was on its longlist. "It's nice to see that the book landed well with people who value short fiction," says Goddard Jones, whose writing has received glowing reviews from outlets ranging from the Chicago Tribune, to People and Garden and Gun magazines.

Her previous collection, "Girl Trouble," and her first novel, "The Next Time You See Me," were realist works, while her second novel, "The Salt Line," was set in the near future. This range serves her well in the classroom. She encourages her students to experiment with varied approaches. Sometimes, she finds, tweaking reality offers students the distance needed to get past what she calls a "craft fear" that they won't know how to tell a story that feels too big, or too immediate.

This semester, she drew on the expertise of her creative writing MFA students, who serve as editors for the Greensboro Review, to introduce her undergraduates to the journal submission process. The graduate students shared what they've learned from deciding which of the many submissions they receive merit publication. The undergraduates gained valuable insight into literary journals – "which are much easier to break into than the book industry," Goddard Jones notes – as possible venues for publishing their own work. "It was a productive nexus," she says. "Our version of a laboratory."

It's important to her that all of her students gain new tools for addressing unwieldy concerns – about social justice, for example, or climate change – at a granular level. But the best thing about teaching in the MFA program is more personal, she says. "It's seeing my students develop a writing community and relationships with one another that they will carry forward into the rest of their lives."

by Danielle LaVaque-Manty • photo by Angela Winsor
learn more at ***english.uncg.edu***

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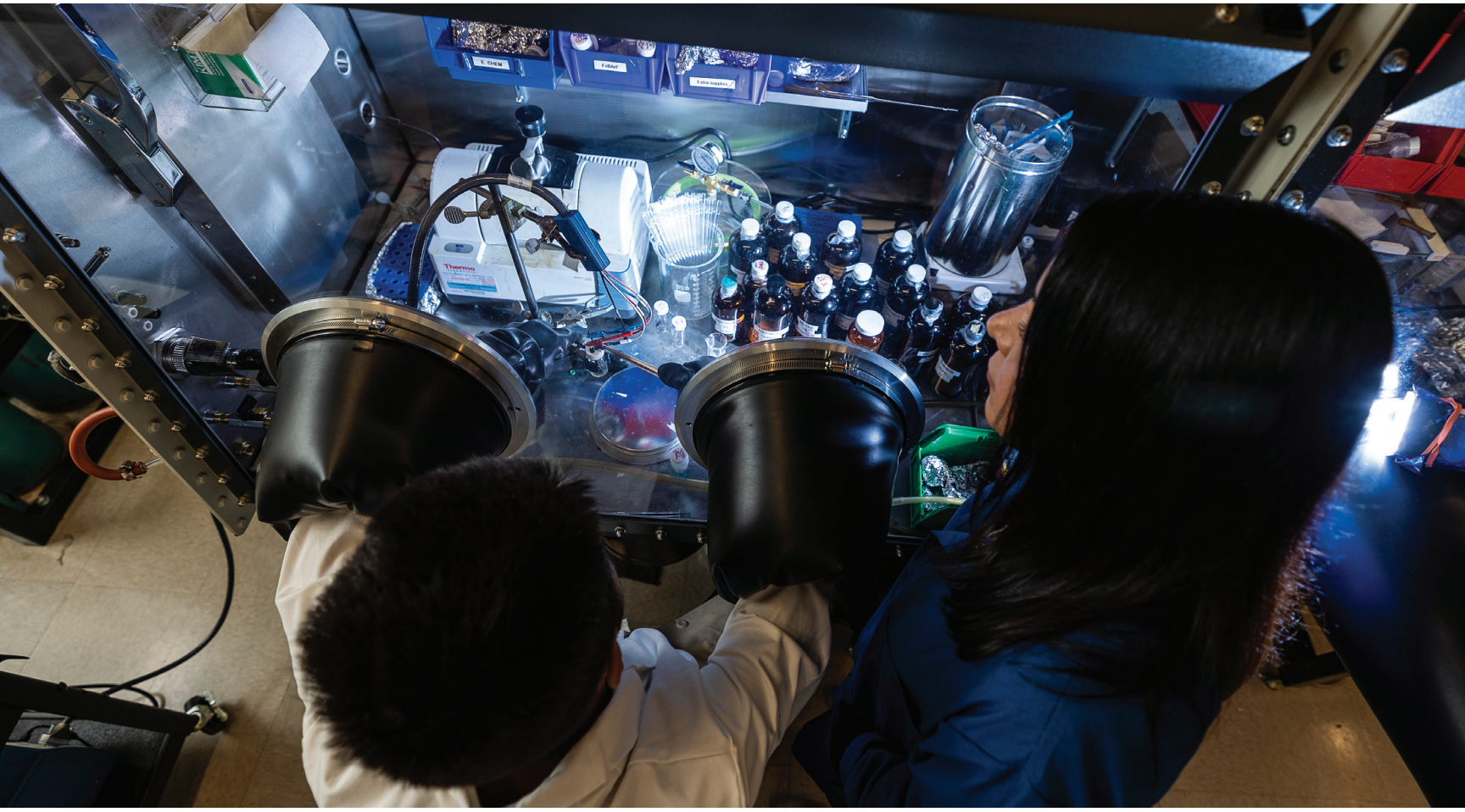

OPPORTUNITY FOR EXCELLENCE **First-gen undergrad Marcos Tapia dives into research, publishes, and masters an in-demand electrochemistry technique – and he's just a sophomore (page 3). UNCG's commitment to high impact experiences for undergraduates redoubles this year with the launch of the LSAMP Mountains to Sea North Carolina Louis Stokes Alliance for Minority Participation program. The NSF grant will support 100 STEM students like Marcos over the next four years.** ***go.uncg.edu/lsamps***