

NC STATE

Engineering

MAGAZINE



PIECING TOGETHER THE PROTEIN PUZZLE

PAGE 14

BALIGA WINS MILLENNIUM TECHNOLOGY PRIZE

B. Jayant Baliga, “the person with the largest negative carbon footprint in the world,” was awarded the Millennium Technology Prize in October 2024 for the invention, development and commercialization of the insulated gate bipolar transistor (IGBT), an energy-saving semiconductor switch he invented in 1980 while a researcher at General Electric.

The **Millennium Technology Prize**, awarded in Finland, is the most prestigious international award focused on recognizing technological innovation. It comes with a €1 million award.

Baliga is the Progress Energy Distinguished University Professor Emeritus of Electrical and Computer Engineering at NC State. Finland’s President Alexander Stubb presented him the prize on Oct. 30, during a ceremony that also celebrated the 20th anniversary of the award.

The IGBT changed the world. It reduced global carbon dioxide emissions by more than 82 gigatons over the past 30 years — the equivalent of offsetting carbon dioxide emissions from all human activity for three years. It improved energy efficiency by 40% in everyday products including cars, refrigerators and lightbulbs, and is a critical component of modern compact cardiac defibrillators.

“It is very exciting to have been selected for this great honor,” Baliga said. “I am particularly happy that the Millennium Technology Prize will bring attention to my innovation, as the IGBT is an embedded technology that is hidden from the eyes of society. It has enabled a vast array of products that have improved the comfort, convenience and health of billions of people around the world while reducing carbon dioxide emissions to mitigate global warming. Informing the public of this impactful innovation will illustrate the betterment of humanity by modern technology.”

Baliga’s arrival at NC State helped position the university to become the leader it is today in semiconductor research and development. Most recently, the university was named the lead on the Commercial Leap Ahead for Wide Bandgap Semiconductors (CLAWS) hub, one of eight Microelectronics Commons regional innovation hubs established by the Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act.

In September, the White House and Department of Defense announced the first year of funding, totaling \$19 million, for four additional projects managed by CLAWS. ■

In September, officials from the White House and Department of Defense visited campus to announce new semiconductor projects for CLAWS. Baliga was recognized for his Millennium Technology Prize and contributions to semiconductor development.



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CONTENTS

ON THE COVER: Biomanufacturing advancements in alternative proteins like those led by the Bezos Center for Sustainable Protein at NC State will help meet our future protein needs.



20

FEATURES

14 PIECING TOGETHER THE PROTEIN PUZZLE

NC State was awarded \$30 million from the Bezos Earth Fund to create a biomanufacturing hub for alternative proteins.

18 ON THE MOVE WITH AI

An AI-based training framework for robotic exoskeletons makes them easier for people to use.

20 READY FOR AN AI FUTURE

The College of Engineering is building on its strengths to become a preeminent center for applied AI in engineering and computer science.

22 SENSORS, CENTERED

With an applications-driven approach, a new institute at NC State is linking sensor developers and users across campus.



14

18



22



The 2024-25 academic year opened on a fun note during POP Back, which drew engineering students to the Oval for music, games, food trucks and more.

FROM THE DEAN

In a rapidly changing technological landscape, it's more evident to me every day that a strong foundation in engineering and computer science research and education is critical to our College of Engineering's leadership in solving global challenges.

One of those is our world's need for more protein sources. NC State University is one of three universities worldwide awarded \$30 million to establish a **Bezos Center for Sustainable Protein**. As a land-grant university with a long history in innovative engineering and agricultural advancements, NC State is among the best places in the world to lead the way in developing alternative proteins.

Another challenge is the need to prepare for an increasingly AI-driven future, and I have a vision for our college to be a preeminent center for applied AI in engineering and computer science. Last fall, we launched the **Applied AI in Engineering and Computer Science Initiative** during a college-wide symposium, and we hosted the inaugural **Dean's Distinguished Seminar Series on Applied AI Futures**. I am excited for the way our college will be transformed and to see our students emerge as future leaders as we integrate AI across the full breadth of our teaching and research.

I am grateful to the faculty, staff and alumni who built our college's strong foundation — and proud of the people who are leading us forward. ■



W.G. Pfaendtner

Jim Pfaendtner, Ph.D.
Louis Martin-Vega Dean of Engineering



Manufacturing Rubber at Home

NC STATE UNIVERSITY is one of five universities to be part of a new National Science Foundation Engineering Research Center — Transformation of American Rubber through Domestic Innovation for Supply Security (TARDISS) — to establish a domestic, alternative source of natural rubber.

The research at NC State is led by **Greg McKenna**, research full professor in the Department of Chemical and Biomolecular Engineering (CBE), and his co-PIs **Sindee Simon**, department head, and **Saad Khan**, INVISTA Professor, both in CBE.

“Our industrial society couldn’t work without rubber,” McKenna said. “You couldn’t have an engine,

as the oil would leak out. We use rubber for a lot of different things, from surgical gloves to belts and conveyor belts and aircraft and automobile tires.”

Along with Ohio State University as the lead, the other core institutions involved in the project are Texas Tech University, the California Institute of Technology and the University of California, Merced.

NC State will receive \$2 million in grant money over the next five years, with the possibility of a second funding period for an additional five years. The university is matching that amount with \$407,095.

“We plan to measure the properties of the rubber latex particles with



atomic force microscopy, because the properties of latex particles depend on the protein content of the particles,” said McKenna. “We’re also going to study how rubber crystallizes, and that’s where the thermal analysis comes in.” ■

Engineering LHPs for Next-Gen LEDs

A NEW TECHNIQUE developed at NC State allows researchers to engineer layered hybrid perovskites (LHPs) down to the atomic level, opening up the door to creating materials tailored for use in next-generation printed LEDs and lasers.

LHPs can efficiently convert electrical charge to light and light into electricity. They consist of thin sheets of perovskite semiconductor material that are separated by thin organic “spacer” layers. But researchers could not figure out how to engineer these materials to control their performance.

The NC State team discovered that nanoplatelets, which are individual

sheets of the perovskite material, form spontaneously at the surface of solutions and can play a key role in the properties of the LHP films — if they can be controlled.

Within LHPs are quantum wells, which are sheets of semiconductor material sandwiched between spacer layers. Nanoplatelets serve as LEGO pieces of different thickness, where the thickness determines the quantum confinement and the energy. If the series of nanoplatelets have a thickness of two, three and four atoms in ascending order, the LHP can form efficient energy cascades.

“What’s exciting is that we found we can essentially control the growth of several nanoplatelets at once, essentially tuning the size and location of quantum wells in LHP films in a reproducible manner,” said **Aram Amassian**, professor in the Department of Materials Science and Engineering. “And because we can control their arrangement, energy can cascade more efficiently between the quantum wells and undergo recombination — which means the material is highly efficient at converting this energy into light in laser and LED applications.” ■

To Heal, Just Add Water

MILLIONS OF AMERICANS live with chronic wounds, which can take months or more to heal — if they ever do. Researchers at NC State University have helped develop a new battery-powered bandage that speeds up the healing process.

The disposable wound dressings have electrodes on one side and a small, “biocompatible” battery on the other. Simply apply a drop of water to activate it, and the bandage will produce an electric field for several hours.

“Anybody, without any training, should be able to use these bandages,” said **Amay Bandodkar**, an assistant professor in the Department of Electrical and Computer Engineering at NC State.

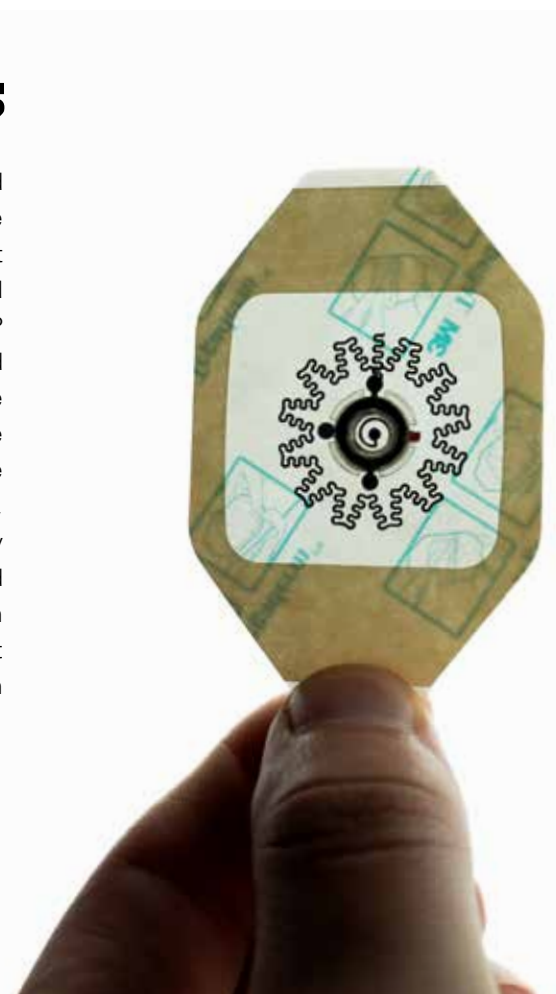
In animal testing, wounds that were

treated with these electric bandages healed 30% faster than wounds treated with conventional bandages. But existing electric wound dressings are costly and complex.

“That electric field is critical, because it’s well established that electric fields accelerate healing in chronic wounds,” said **Rajaram Kaveti**, a postdoctoral researcher at NC State.

The work was funded by the Defense Advanced Research Projects Agency and the ASSIST Center (Center for Advanced Self-Powered Systems of Integrated Sensors and Technologies) at NC State.

Last fall, NC State’s Office of Research Commercialization filed a patent on Bandodkar’s behalf for the electric bandage technology. ■



Glassy Gels: Best of Both Worlds

SIMPLE TO PRODUCE. Hard to break. Yet stretchable and over 50% liquid. Those are a few of the qualities of a completely new class of materials created by researchers at NC State University.

They're calling the materials "glassy gels." Essentially, glassy gels represent a combination of two classes of materials — gels and glassy polymers — that have historically been considered distinct from one another.

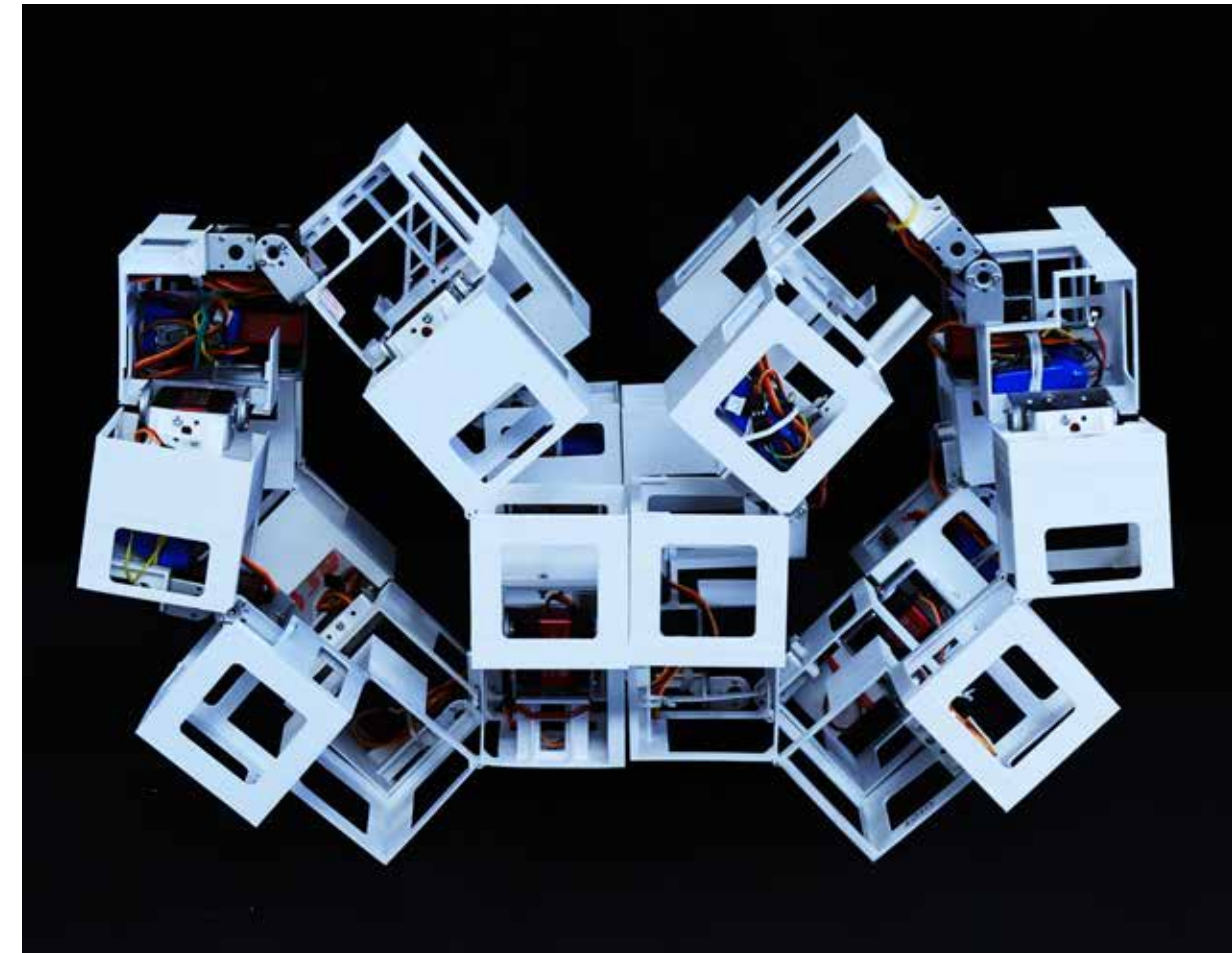
Glassy gels bring the best of both worlds, simultaneously exhibiting some of glassy polymers' and gels' most attractive properties.

"We've created a class of materials that we've termed glassy gels, which are as hard as glassy polymers but — if you apply enough force — can stretch up to five times their original length, rather than breaking," said **Michael Dickey**, corresponding author of a paper on the work and the Camille and Henry Dreyfus

Professor of Chemical and Biomolecular Engineering at NC State.

Glassy gels have many potential applications. They conduct electricity more efficiently than comparable plastics. They are also easy to make through curing in molds or 3D printing.

"We're excited to see how glassy gels can be used and are open to working with collaborators on identifying applications for these materials," Dickey said. ■



Origami Inspires 'Transformer Bots'

WITH ONLY THREE active motors, a single cubed structure made of plastic can be transformed into over 1,000 configurations, according to NC State University research.

Using a 3D printer, engineers at NC State have found a way to assemble up to 36 hollow, plastic cubes into what they've dubbed "transformer bots."

It might sound like something out of science fiction, but the bots weren't inspired by characters like Optimus Prime and Bumblebee from the popular film and comic book series *Transformers*. Instead, the

idea behind this real-life technology came from the paper-folding art of origami.

Rotating hinges — some fixed with metal pins, others activated wirelessly with a motor — allow the cubes to transform into many different shapes.

"The question we're asking is how to achieve a number of versatile shapes with the fewest number of actuators powering the shapeshifting," said **Jie Yin**, associate professor in the Department of Mechanical and Aerospace Engineering. "Here we

use a hierarchical concept observed in nature — like layered muscle fibers — but with plastic cubes to create a transforming robot."

The untethered transformer bots, created by the research teams of Yin and fellow associate professor **Hao Su**, can move forward, backward and sideways merely by controlling how the shape of the structure changes. The bots can transform relatively quickly from flat — or fully open — to a boxlike, fully closed larger cube. They can carry loads of up to roughly three times their weight. ■



Tractor Team Takes Top Spot

AFTER 20 YEARS, and a previous highest ranking of third place, the Pack Pullers won Overall Champion at the annual American Society of Agricultural and Biological Engineers (ASABE) International Quarter-Scale Tractor Competition.

Over the summer, the team headed to Peoria, Illinois, to compete in the 2024 competition. Junior **Silver Hyatt**, who studies biological engineering with an agricultural concentration, captained the team.

"I originally wanted to join the team to make connections with students and faculty within the department," said Hyatt, who is in the Department of Biological and Agricultural Engineering (BAE). "Then, I fell in love with the team and the design process."

The Pack Pullers are the only team that does all of their tractor fabrication in house. The BAE Research Shop helps make this possible.

"Many other teams send off parts to be made, but our members do 90% of the fabrication, and

our research shop takes care of the rest," said Hyatt.

The team spends an average of 15-20 hours a week working on the tractor throughout the year. The month before the competition, that bumped up to around 10 hours a day.

"We have been very close in the past, but soft skills are approximately 40% of the scorable events, and you have to do well in all phases to finish first overall," said **Grant Ellington**, Pack Pullers team advisor and BAE extension associate professor.

During the competition, each team completes a technical inspection, submits a written design, defends their design, gives a team presentation and competes in several tractor pulls. The competition ends with the durability and maneuverability courses. In Peoria, there are many early mornings and late nights.

Hyatt says this year the team worked on improving their soft skills by a few points and getting a few

more feet in the tractor pulls. They added more gears to go the distance and worked on the report and presentation to gain extra points that would make a world of difference.

"This competition is indescribably competitive," said Hyatt. "Being one of three schools from the Southeast, it's our goal to outperform the power schools from the Midwest."

This year the team adopted the Dale Earnhardt mindset.

"We named this year's tractor 'Intimidator' because we were number three and Dale Earnhardt had a car with the number three named Intimidator," said Hyatt.

The Pack Pullers won the Overall Champion title as well as first place in the Team Presentation category.

"The Intimidator took 20 years to win the Daytona 500, the biggest race in NASCAR," said Hyatt. "Our team has been competing consecutively for 20 years, and our Intimidator won after 20 years of trying just like Earnhardt's." ■

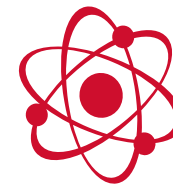


QUESTIONS FOR **SANSKRITI DEVA**

*As a computer engineering major, leader and founder of several student organizations across NC State's College of Engineering, the United Nations' National Council's youngest elected official, and more, **Sanskriti Deva** had a lot on her plate, but she wouldn't give up any of it. Deva graduated in December.*

What brought you to the Department of Electrical and Computer Engineering (ECE) at NC State?

I really loved the facilities here when I came to visit, and it just seemed like a very collaborative environment as well. I visited other schools and they were super competitive. Here, it felt like it was a Wolf-pack, like it wasn't just a gimmick or some sort of marketing thing, like everyone really had each other's backs.



You mentioned in an interview with *Inside Quantum Technology* that you learned a lot about quantum computing via YouTube. Were you mostly self-taught before undergrad?

A lot of it was self learning, but I did have a lot of wonderful physics teachers growing up. Dr. Charles Payne was my physics teacher at the North Carolina School of Science and Mathematics in Durham, North Carolina. He would roll you around in a chair just to show Newton's motions and stuff like that. For me, quantum computing is a mix of the two things I really liked about learning: the technology aspect, and then also the wonder part that teachers like Dr. Payne instilled in me.

How did you come to be the UN National Council's youngest elected official?

I got connected to someone at the UN who told me, "We have these elections, and you should run because we need more young people to run." My initial answer was actually no because while I have an interest in policy, I'm going to be a computer engineering major. To my surprise, they told me, "We really want a diversity of thought and ideas in our represented government, and then even if you run and you lose, other young people are going to see that you ran, and it's going to make a difference still." The last part really meant a lot to me, and somehow I ended up running and winning.

How did you set yourself up for success and find a community for yourself in ECE?

I really sought out a community of other women who were going through the same thing. I refounded a club at NC State called Women in Electrical and Computer Engineering, so that club was a huge way that I found my community. Now, it's actually one of the biggest clubs in the Department of Electrical and Computer Engineering.



How did you balance your schoolwork, extracurricular activities and mental health?

That's something I definitely learned how to do in college, because before that, I think I would just work, work, work. When I got to college, I was like, I really need to figure out what I want to do with my life and what the work is for. I really like to center myself on a why, so that way I don't burn out and I can remember, OK, this is my end goal. ■



"Our partners were really instrumental in making sure that we understood the local context and also in introducing the U.S. students to life in Malawi."

AYSE ERCUMEN



Hands-on Research in Malawi Influences Student Perspectives and Learning

BEN CLARK didn't anticipate spending eight weeks of the summer in Malawi, but when he found a grant-sponsored trip involving environmental and health-based research, he applied immediately.

"My actual research advisor was like, 'I don't know if that's like the best idea,'" said Clark, who is a Ph.D. student studying civil engineering. "Especially if I want to graduate on time. But I don't really care about the timeline. I wanted to spend two months in Malawi."

The trip, which was funded by the National Science Foundation, allowed students to get hands-on research experience on water, sanitation and hygiene needs of underserved populations.

NC State University students worked on one of four projects: to understand linkages between

household water, food and energy insecurity and how these affect contamination with E. coli and antibiotic-resistant E. coli in drinking water and food; to do a survey on household access to and sources of potable water; to design soak pits for grey-water in a refugee camp; and to do wastewater testing and research on pathogen transmission.

Clark and six other NC State students partnered with academics and fellow students from Malawi, including at Mzuzu University and Malawi University of Science and Technology, as well as students from the University of Louisville. Students ranged from undergraduates to Ph.D. students.

"When you do these studies, a lot of times you don't want Westerners or people who don't belong in the area to go out into the field," he said. "That could definitely bias your survey, so I would sit in a van and wait for one of my Malawian student partners to call me and say that they obtained consent from the community members. Then myself and a partner would go and we would take samples."

This will not be the last time NC State students have the opportunity to do similar research in Malawi. **Ayse Ercumen**, an associate professor and epidemiologist in NC State's Department of Forestry and Environmental Resources and the faculty lead on the 2024 trip, said that the team plans to lead two more cohorts on eight-week-long summer trips in 2025 and 2026.

Along with Ercumen, the trip was led by **Francis de los Reyes**, Glenn E. and Phyllis J. Futrell Distinguished

Professor in the Department of Civil, Construction, and Environmental Engineering (CCEE); **Angela Harris**, associate professor in CCEE; **Raymond Guiteras**, associate professor in the Department of Agricultural and Resource Economics; and **Cassandra Workman**, an associate professor of medical anthropology at the University of North Carolina at Greensboro.

Other faculty partners included **Rochelle Holm**, associate professor at the University of Louisville; **Brighton Chunga**, head of the Department of Water and Sanitation at Mzuzu University; and **Petros Chigwechokha**, head of the Biological Sciences Department at Malawi University of Science and Technology.

"In order to be truly innovative, our job was to think about what the gaps are that remain in the existing literature," Ercumen said. "Some of the messaging around water treatment and hand washing has been around for a long time, but there's other types of exposures that sort of fall through the cracks when you're delivering programs."

Ercumen credits NC State's in-country partners for such a positive experience.

"You can well imagine that without an established partnership, you can't very well parachute students into another part of the world and then expect them to thrive," she said. "So it was really important to just work through channels where we had formed trusting work relationships with researchers in Malawi, and those were built on a long-standing collaboration."

While there was a lab component of the research, much of it involved

population-based research and going into communities.

"In each project team, U.S. students partnered with Malawian students, who were wonderful," Ercumen said. "So our partners were really instrumental in making sure that we understood the local context and also in introducing the U.S. students to life in Malawi. We relied on them really heavily."

Back on campus, students incorporated their new experiences into their work and studies.

"I had to develop the math for the refugee camp on ArcGIS," said **Gabby Vertreese**, referring to the geographic information systems software. "Before I went, I didn't know any ArcGIS, so I taught myself. For what I want to do, for environmental and ecological engineering, they use a lot of GIS modeling and mapping. Now I know how to put the points in ArcGIS, so I definitely will be using that a lot." Vertreese is a senior biological and agricultural engineering student.

Chinmay Talikoti, a junior in computer science and economics, plans to keep working on analyzing the data and possibly develop something more. Talikoti worked on the drinkable water survey, in which he and the others on his team cataloged what sort of treated water locals were drinking and how they got access.

"It was a really valuable thing for me to be able to see," he said. "Now, I feel like I understand a little bit more about what these models represent and why they're useful on the ground to actually understand how to solve a problem." ■



Marshall becomes First Black Woman President of ANS

Lisa Marshall, inaugural assistant extension professor and director of outreach, retention and engagement in the Department of Nuclear Engineering (NE) at NC State, started her term as president of the American Nuclear Society (ANS) in June 2024. Marshall has been a member of ANS since 2005.



Horn receives DARPA Director's Fellowship

Tim Horn, associate professor in the Department of Mechanical and Aerospace Engineering, became the second faculty member at NC State to be awarded the Defense Advanced Research Projects Agency (DARPA) Director's Fellowship. Horn previously received the DARPA Young Faculty Award in 2022, an honor that only seven NC State faculty have ever received.



Lietz wins DOE award for plasma research

Amanda Lietz, assistant professor in NE, won an award from the Department of Energy Office of Science Early Career Research Program for her project "Incorporating Kinetic Effects in Fluid Models of Low Temperature Plasmas via Machine Learning." Lietz will receive \$900,000 over five years. She and her research team aim to develop a new computational method for low temperature plasmas modeling to better inform engineering for applications that use plasmas.



Two faculty members win NSF CAREER Awards

John-Paul Ore, assistant professor in the Department of Computer Science, received a Faculty Early Career Development award, also known as the CAREER Award, from the National Science Foundation (NSF). Ore has received \$594,739 for his project, "Robust and Lightweight Formal Methods for Mobile Robot System Development." Ore and his team aim to reduce the cost and improve the scalability of lightweight

formal methods for robotic software systems, laying the foundation for the next generation of automated testing and analysis of robotic systems.

Chau-Wai Wong, assistant professor in the Department of Electrical and Computer Engineering (ECE), received a CAREER Award for \$598,752. His project, "Fighting Against Data Reconstruction Attacks in Federated Learning," focuses on enhancing privacy

in federated learning and addresses vulnerable federated learning schemes that may leak sensitive information through improper privacy definitions or malicious attacks. Expected contributions include a deeper understanding of privacy risks and more robust defense mechanisms that can be applied to enhance the privacy of federated learning systems.



Three COE faculty members named Fulbright Scholars

Three COE faculty members have joined the 2024-25 class of Fulbright Scholars: **Fernando Garcia Menendez**, associate professor in the Department of Civil, Construction, and Environmental Engineering, is at Carleton University in Ottawa, Canada, studying the impacts of pollution from wildfires.

Jason Hou, associate professor in NE, is working with Politecnico di Milano

in Italy to promote nuclear energy by advancing understanding of advanced nuclear reactor technologies.

Adriana San Miguel Delgado, associate professor in the Department of Chemical and Biomolecular Engineering, is at the Universidade do Algarve in Faro, Portugal, studying C. elegans as a novel model for studying aberrant stress granule formation.

Oralkan and Augustyn win Alcoa Foundation Awards

Ömer Oralkan, professor in ECE, won the 2024 Alcoa Foundation Distinguished Engineering Research Award, which is given to senior faculty members for research accomplishments made over a five-year period at NC State. Oralkan researches the intersection of electrical engineering and the life sciences, particularly as they pertain to supporting systems for diagnostics and therapy.

Veronica Augustyn, associate professor and Jake and Jennifer Hooks

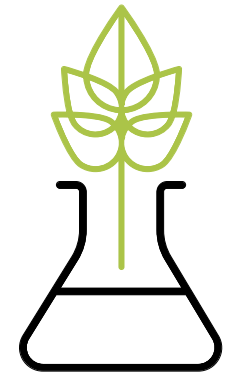
Distinguished Scholar in the Department of Materials Science and Engineering, received the 2024 Alcoa Foundation Engineering Research Award, which recognizes early-career faculty members for research achievements over three years. Augustyn's research group focuses on the synthesis and characterization of materials for electrochemical energy and environmental technologies, including batteries, electrochemical capacitors, electrolyzers and fuel cells. ■



PIECING TOGETHER THE PROTEIN PUZZLE



The Bezos Center for Sustainable Protein will build on alternative meat development work done in the NC Food Innovation Lab. Pictured above is a mushroom-based burger made in the lab.



As the global population increases, so does the demand for food. To address this growing need, engineers, scientists, farmers, chefs and other stakeholders are investing more resources into alternative proteins, an emerging sector that shows promise as a supplement to traditional agriculture.

But while companies like Beyond Meat and Impossible Foods have received significant private venture capital, leading to advancements for specific technologies and products, public research on the fundamentals of alternative proteins has not received the same level of investment.

“There is a lot of opportunity for researchers at universities to look at some of the basic science and engineering behind creating these types of products,” said **Rohan Shirwaiker**, James T. Ryan Professor in the Edward P. Fitts Department of Industrial and Systems Engineering.

At NC State University, that opportunity recently received a major investment. The Bezos Earth Fund awarded the university \$30 million to establish the **Bezos Center for Sustainable Protein at NC State** — one of three in the world, and the only one based in North America.

The goal? Create a biomanufacturing hub for dietary proteins. The center’s research will investigate the proteins’ environmental sustainability, nutrition, affordability and taste.



ABOVE: A hybrid fish nugget pairs well with fries and tartar sauce.



In the Food Innovation Lab, the Bühler extruder creates a texture in plant-based protein similar to that in meat.

NC State has tremendous expertise in advanced manufacturing, biotechnology and food sciences — and leads agricultural and extension work in support of North Carolina’s agriculture industry, which generates more than \$110 billion in annual economic impact. The university is well positioned to lead the center, which will support new research and technology development projects, develop education and training programs and offer community engagement events.

“If the alternative meats are plant-based, we must rely on farmers to grow and harvest crops used for protein extraction,” said **Bill Aimutis**, co-director and chief operating officer of the center. “As new areas emerge to biomanufacture proteins, such as precision fermentation and cell cultivation, traditional crops and by-products will supply the carbon and nitrogen-containing compounds essential for growth of microbial and mammalian cells.”

Aimutis co-leads the center — which is based in Fitts-Woolard Hall on Centennial Campus — with Shirwaiker, who also serves as chief science officer. Aimutis came to NC State from industry to serve as executive director of the NC Food Innovation Lab in the College of Agriculture and Life Sciences.

Located in Kannapolis, North Carolina, the lab accelerates food research, product development and commercialization, particularly for plant-based food innovation.

“North Carolina is one of very few states that is seeing investments in this area,” Shirwaiker said.

Shirwaiker has spent most of his career working on biomanufacturing processes related to biological products, including 3D-printing human tissue for organ and tissue transplants.

A few years ago, he started to explore how the basic techniques and fundamentals of medical tissue engineering could be applied to manufacturing alternative proteins such as cell-cultivated meats — and found that there are significant synergies.

“I’ve started looking at the development of new manufacturing technologies to process plant-based and cellular materials for emerging food products with the vision to achieve price parity with more traditional sources of meat and proteins,” he said.

His work pairs well with Aimutis’ research, which includes characterizing proteins’ physical functionalities and using their physiological bioactivities to prevent high blood pressure, gastrointestinal disorders and dental cavities. Aimutis also worked on twin screw extrusion, a critical processing technique for adding a meat-like texture into plant-based proteins.

“When I began working more with plant-based materials, the industry was beginning to formulate and promote plant-based meat alternatives,” he said. “Many of the functional properties

I studied were important to the formulations.”

The two are leading academic partners — including North Carolina Agricultural and Technical State University, University of North Carolina at Pembroke, Duke University and Forsyth Technical Community College — as well as industry partners and community stakeholders from across North Carolina and the U.S. to work toward the center’s goal of developing sustainable alternative proteins.

Together, the center’s stakeholders will work to make these proteins tasty and something people will want to eat.

“Ultimately, we must educate consumers about proper eating habits of the varieties and amounts of proteins from all sources, animal, plant, microbial and cell-cultivated,” Aimutis said. “Accomplishing these many objectives and goals will provide food security in a sustainable manner for future generations.” ■

“MEAT” THE TEAM

- **THE RESEARCH AND DEVELOPMENT TEAM** is improving existing and finding new materials to extract proteins or to use for fermentation and cell cultivation. Using advanced biotechnology, researchers are reducing costs and increasing the efficiency of the manufacturing process. They are working alongside other scientists and practitioners in the alternative protein domain to advance science and innovation and are cultivating strategies to facilitate technology transfer to industry.
- **THE WORKFORCE DEVELOPMENT TEAM** is developing a diverse portfolio of education and training activities for students and professionals, while implementing programs that extend NC State’s Biomanufacturing Training and Education Center’s groundwork in pharmaceuticals to advanced food technologies.
- **THE CAPACITY BUILDING TEAM** is reaching out to community stakeholders such as consumers, farmers and chefs to understand their expectations. They will conduct workshops with industry members and create a sustainable protein boot camp for countries that will benefit the most from the environmental benefits of alternative protein technology.

MENU

The center focuses on three types of sustainable proteins: plant-based, fermentation-made and cell-cultivated meat products. Crops and agricultural sidestreams will be the source of various key ingredients required to make all three product types, which generate fewer greenhouse gas emissions than traditional meat products.

PLANT-BASED PROTEINS

Mimicked oils, carbohydrates and organoleptic properties of restructured meat, made from soybeans, yellow peas, wheat and other grains.

FERMENTATION-MADE PRODUCTS

Organic, sustainable protein and food ingredients identical to animal proteins, but produced using microbial cells with unique properties and nutritional benefits.

CULTIVATED MEAT

Grown from animal cells with the help of nutrient broths. Option of cells from eggs, biopsies or feathers, among other things.

On the Move with AI



Experiment-free approach for autonomous robotic exoskeleton captures national attention

Inside the Biomechanics and Intelligent Robotics Lab on the third floor of Engineering Building III, at least a half-dozen robotic exoskeletons are on display alongside a stair climber and a treadmill.

Some are designed for knees and hips, others for shoulders and elbows. The newest versions are lighter and more compact.

What they have in common is what sets them apart from other robotic exoskeletons. They were trained by an AI-based method to assist human movement. The AI framework lets people start using the exoskeleton without extensive physical tests and can be adapted for different robotic devices. Users are able to walk, run or use the stairs with the exoskeleton immediately, rather than spending an hour or more on a treadmill to customize the exoskeleton to work with their gait.

“We call this experiment-free,” said **Hao Su**, head of the lab and associate professor in the Department of Mechanical and Aerospace Engineering. “We don’t need any physical experiments. We can do everything in the computer simulation, which saves time and resources. That’s why it’s so powerful.”

His research team developed a simulated environment with a virtual human and a virtual exoskeleton that can interact. In the simulation, the virtual human learns how to walk while the exoskeleton learns how to provide the right amount of assistance, resulting in a synchronized and effective human-robot interaction.

The simulation is able to run many iterations with different gaits — running vs. walking, for example — to generate more data for the robotic exoskeleton. Once a person is wearing the exoskeleton, a sensor gathers

even more data on human gait kinematics.

“The key challenge is figuring out how to ensure this AI simulation works for all the people who wear this kind of robotic exoskeleton,” Su said.

Ivan Lopez-Sanchez, a postdoctoral researcher in the lab who has previous experience using AI in mechanical and aerospace applications, is working on improving the reinforcement learning-based control and the data transfer and interfaces between the electronic components of the exoskeleton.

“I actually recently injured my knee,” he said. “I’d never thought about it, but... we are developing something that in the future could make the rehabilitation time shorter and improve the final outcome.”

The research generated interest this summer when it was published in the prestigious journal *Nature*.

Su heard from potential academic and industry partners from around the world. Researchers see potential uses for the AI framework beyond exoskeletons, including for prosthetic devices and even in autonomous vehicles. Industry partners see a potential to use the exoskeleton to help reduce musculoskeletal load on workers. The outdoor equipment company Arc’teryx and startup Skip expressed an interest in the framework for their robotic pants that the creators call an “ebike for hiking.”

Already, Su’s team is working with medical clinics to test the AI framework. Researchers are partnering with the Johns Hopkins School of Nursing to use the framework on robotic hip exoskeletons for elderly people who have muscular weaknesses. This could help delay the need for hip replacement surgery for some people.

At a National Institutes of Health clinic in Bethesda,

Maryland, the framework is being tested on a robotic knee exoskeleton for children with cerebral palsy. **Sainan (Selena) Zhang**, another postdoctoral researcher in the lab, wants to use the AI-based method to help reduce the children’s crouch gait, which causes excessive knee bending while walking.

“Our framework may offer a generalizable and scalable strategy for the rapid development and widespread adoption of a variety of assistive robots for both able-bodied and mobility-impaired individuals,” Zhang said. “We have already achieved outstanding results with healthy subjects, and our next step is to validate its effectiveness for children with cerebral palsy using pediatric knee exoskeletons.”

Those who are already able to use the robotic exoskeleton are excited about its potential and are already asking about its availability. Researchers are factoring in expenses and using materials that will lower production costs to make the technology more accessible.

“We want to get a lot of feedback,” Su said. “Some people say, ‘I want this to be cheap, cost-effective, affordable.’ So, there’s a lot of expectation from people.” ■

A LIGHTER LOAD

Human subjects reduced their metabolic energy use (meaning less fatigue and more endurance) when wearing the robotic hip exoskeleton by:



24.3% WHILE WALKING



15.4% WHILE CLIMBING STAIRS



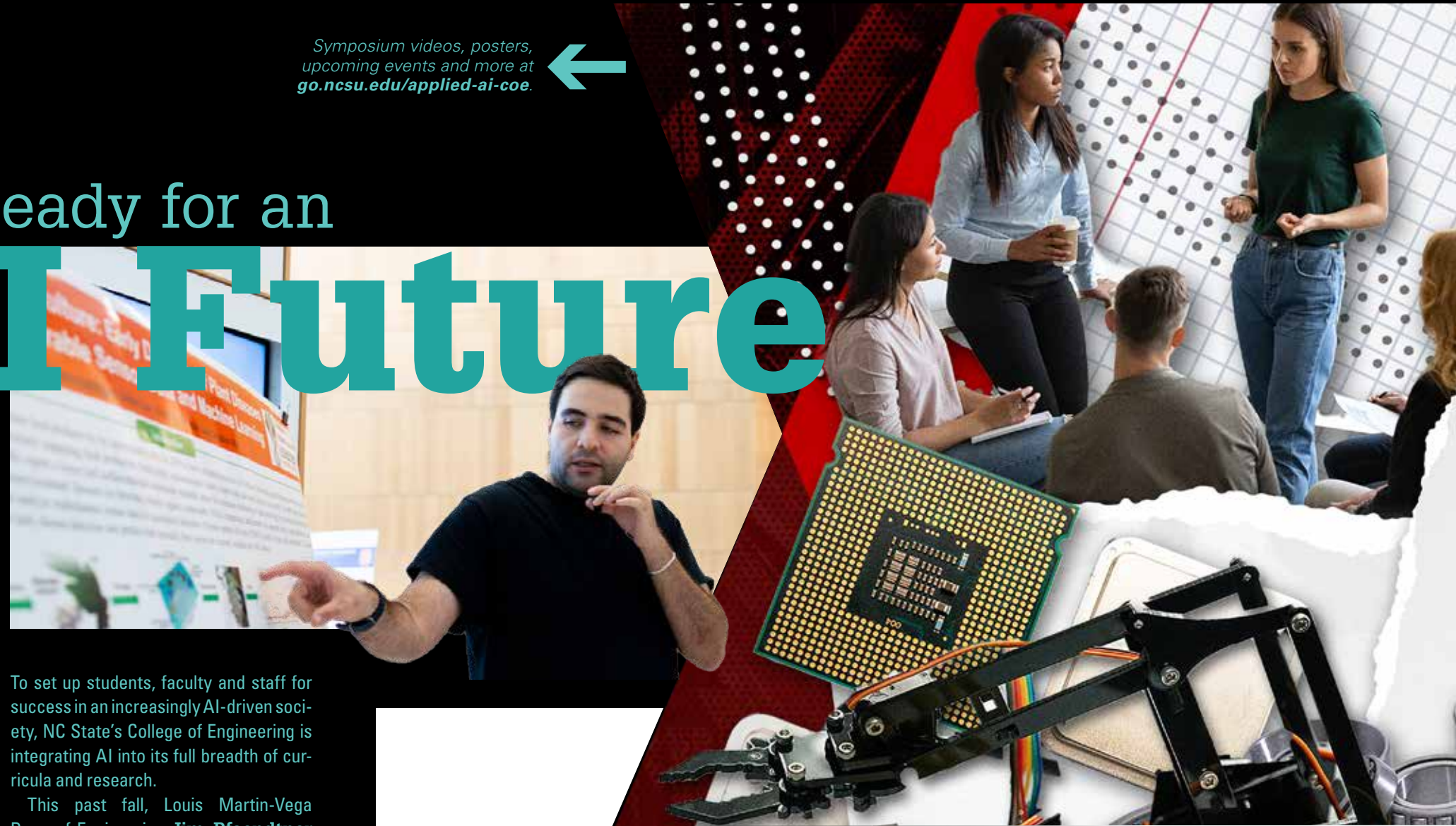
13.1% WHILE RUNNING

The newest version of the hip exoskeleton is **1.5 inches thick** and **weighs 2.5 kilograms**. It runs for **1.5 hours** on a single battery charge.

Symposium videos, posters, upcoming events and more at go.ncsu.edu/applied-ai-coe.



Ready for an AI Future



To set up students, faculty and staff for success in an increasingly AI-driven society, NC State's College of Engineering is integrating AI into its full breadth of curricula and research.

This past fall, Louis Martin-Vega Dean of Engineering **Jim Pfaendtner** launched the College of Engineering's Applied AI Initiative. With a cross-disciplinary approach, the initiative aims to ensure that all NC State engineering and computer science faculty, staff and students understand AI's potential for contributing to the advancement of their fields. The initiative builds on the college's thematic research strengths, including fundamental AI algorithms and theories, robotics and automation, smart systems, sensors and materials and macromolecules.

"We want to equip our students with a foundational understanding of how to most effectively apply AI to problem-solving so that they leave NC State fully prepared as leaders in a rapidly changing workforce," Pfaendtner said.

APPLIED AI SYMPOSIUM LAUNCHES VISION FOR FUTURE

In September, the college brought together industry leaders and faculty, staff and students to discuss where the college is headed with using AI in classrooms, research and work.

An applied AI committee composed of faculty members from all of the college's departments is helping to advise curriculum changes, faculty hiring and planning for future labs and classrooms.

Several common themes emerged from the talks and discussions, including data-driven engineering, communication and collaboration, scaling up infrastructure and personalized learning.

On the Cutting Edge

Graduate students presented 90 posters demonstrating their work applying AI to a wide range of disciplines. Posters mentioned guide dogs, agriculture, robotic limbs, historical Arabic documents, yams, autonomous vehicles, materials discovery and more.

Improving Efficiency of DNA-Based Storage

Gunavaran Brihadiswaran, a third-year electrical engineering Ph.D. student, talked about his research to use machine learning algorithms to attempt to predict DNA bindings in a large-scale system.

"Let's say you want to store one exabyte of data, which is [one billion gigabytes]," he said. "We need two conventional data centers' worth of space with the current technology, but with DNA, we only need one cubic inch."

Dean's Distinguished Seminar Series: Applied AI Futures

The Dean's Distinguished Seminar series is bringing AI leaders to campus for talks on relevant areas of applied AI, including process control, supply chain and manufacturing, agriculture and food safety, and health and biomedical applications.

On November 4, 2024, the college welcomed **Markus J. Buehler**, Professor of Civil and Environmental Engineering at MIT, as the keynote speaker for the inaugural Applied AI Futures Seminar Series. His seminar focused on the exciting ways applied AI can enhance discovery and solve complex, multiscale problems in advanced materials. In one example, he talked about using AI to find common structural similarities between music and materials science.

Upcoming seminars:

March 18: Maria Gini

Distinguished Professor of Computer Science and Engineering, University of Minnesota

April 21: Sergei Kalinin

Weston Fulton Professor of Materials Science and Engineering, University of Tennessee, Knoxville Chief Scientist, AI/ML for Physical Sciences, Pacific Northwest National Laboratory

While more work needs to be done, Brihadiswaran and his fellow researchers found the convolutional neural network (CNN) classifier, which is often used for image classification, to be a promising option.

Predicting Guide Dog Aptitude

Guide dogs help thousands of people with visual disabilities in their daily lives, but training them is a costly and time-consuming process. Researchers at NC State are using a smart collar to collect behavioral and physiological data to study gait patterns from puppies, and AI can help speed up and improve data analysis.

Yifan Wu, a fourth-year Ph.D. student in electrical engineering, has a very close research partner for this work: his dog, Happy. "She's in almost all of our alpha testing phases," he said.

Working in collaboration with Guiding Eyes for the Blind, this ongoing study has assessed more than 500 candidate puppies. ■

Lucas Bauer, left, holds the standard sensor device for photosynthesis measurements. Joshua Larsen, a graduate research assistant in Professor Michael Kudenov's lab, uses the prototype of the light polarization sensor. This sensor may detect starch and sugar in plants, and the team's goal is to develop more scalable sensors.

SENSORS, CENTERED

The Institute for Connected Sensor-Systems (IConS) ties together NC State's strengths in sensor development and application-driven solutions.



In 2021, **Shevaun Neupert** wrote a proposal for the National Institutes of Health on integrating off-the-shelf wearable devices, such as a smartwatch, into her research on detecting patterns of cognitive impairment.

When proposal reviewers suggested she look into using more innovative wearable devices for her research, she only had to look across NC State University's campus.

Neupert, a Distinguished Professor in the Department of Psychology, was connected with the Advanced Self-Powered Systems of Integrated Sensors and Technologies (ASSIST) Center and tapped into the wide range of research happening in the College of Engineering on sensor-systems, including wearable devices.

She is now working with **Edgar Lobaton**, professor in the Department of Electrical and Computer Engineering (ECE), on a project to identify psychophysiology, attention and cognition patterns that can help determine the appropriate sensors for tracking progression of mild cognitive impairment (MCI).

Their project is funded by a seed grant from the Institute for

Connected Sensor-Systems (IConS), a new university initiative under the Office of Research and Innovation with a mission to lead, integrate and deliver sensors, sensing and systems solutions for and by the research community at NC State. With interdisciplinary support and funding from all the NC State colleges, the institute's goal is to link sensor developers and users by emphasizing an applications- and systems-driven approach.

"If you look across NC State, it's like, OK, what's the application area? And what do we need sensors developed for? And also, who needs to use them and who can create them?" said **Michael Daniele**, professor in ECE and the Joint Department of Biomedical Engineering. "So IConS is trying to take an approach where there's sensor developers and sensor users participating in the work."

Daniele is an executive co-director of IConS, along with **Alper Bozkurt**, McPherson Family Distinguished Professor in Engineering Entrepreneurship in ECE, and advisory co-director **Veena Misra**, head of the ECE department and M.C. Dean Distinguished University Professor.

The three IConS co-directors have all been involved with ASSIST, the National Science Foundation Engineering Research Center founded at NC State in 2012. Misra and Bozkurt are the current co-directors, and Daniele is a key faculty member with the center. ASSIST's model and its partnerships with industry and device users served as inspiration for IConS.

"We try to come up with that innovation, starting from the problem and then finding the solution, rather than having a solution and

looking for a problem to solve it," Bozkurt said. "This is I think the main spirit of IConS, that it is a conversation."

That ongoing conversation has led to a long list of projects that could incorporate sensors.

So far IConS has released three requests for proposals — including one in partnership with the NC Plant Sciences Initiative — and announced seven seed grant projects. College of Engineering researchers are working with faculty members and students in the College of Humanities and Social Sciences, College of Agriculture and Life Sciences and Wilson College of Textiles. IConS is expanding to work with all of NC State's academic units as more faculty members and students recognize the value of sensors and data collection.

IConS' leaders see the potential for sensors in a broad range of fields: education, zoology, biology, military, social sciences and more. Bozkurt and IConS teams connected with the North Carolina Zoo to discuss using sensors for enriching exhibits for polar bears and protecting red wolves.

"Sensors have been becoming increasingly vital as the influence of artificial intelligence (AI) continues to grow," Bozkurt said. "AI thrives on data, and sensors are critical sources of this information. However, many of these sensors have yet to be developed or deployed, presenting vast opportunities for innovation and exploration."

Learn more at go.ncsu.edu/connectedsensors. ■



PROJECT SPOTLIGHT:

What sensors are best for detecting cognitive impairment?

Neupert and Lobaton's project, titled "Tracking the Impact of Physically Active and Sedentary States on Cognition," is working toward identifying the best types of sensors for early detection of MCI so that people can take action to reduce or prevent further decline.

The study involves multi-modal sensing of facial expressions, audio and physiological responses such as heart rate and blood pressure. Researchers want to identify which of these are most likely to be potential indicators of MCI.

Researchers are bringing in a control group and a group of people experiencing MCI to campus for two separate visits. During both visits, they will take two sets of cognitive tests while connected to sensing devices. On one visit, patients remain sedentary the entire time. During the other, they ride a stationary bike between tests, then walk on a treadmill after the second set of tests.

"It'll be great if there's one particular biomarker that gets accentuated more depending on what we're looking for," Lobaton explained. "It'll take some exploratory data analysis to find out. It won't be a conclusive answer either, but it will be a first step."

Neupert hopes that one day, their research can go beyond the lab and that sensor systems will collect real-life data to achieve real-time data analytics.

"I would like people to do real things in their real environments and see if we can get strong, robust, impactful findings that will improve people's lives," she said. "And that would be a future step of work like this, to have people go home with these sensors and be wearing them in their day-to-day lives."

PROJECT SPOTLIGHT:

What does polarized light tell us about a plant?

Polarized light may enlighten researchers on how stress impacts a plant's ability to use starch, generated by the plant through photosynthesis, which could help them better understand a plant's energy dynamics and predict yield.

With support from IConS and the NC Plant Sciences Initiative, researchers at NC State are using sensors to gather data on what polarization — which can detect structural and chemical changes, as well as the orientation of molecules over time — can indicate about a plant.

"I think there is a lot of opportunity there that hasn't been exploited with polarized light," said **Michael Kudenov**, professor in ECE. "And I think it's primarily because the expertise isn't there. People don't really know why it can be useful. So I think that's the exciting part of the project. It's a very understudied space, and then we have the expertise, the tools and the positioning to do it."

The team is working on the development of organic photo electronics to optimize the sensor's flexibility and breathability to create as little disturbance to the plant as possible. Their long-term goal is to create a micro ellipsometer, which measures changes in polarization in reflected light.

This project, titled "Intrinsic Polarization Transceivers for On-Plant Polarimetric Sensing," is led by Kudenov; **Brendan O'Connor**, professor in the Department of Mechanical and Aerospace Engineering; and **Anna Locke**, a USDA-Agricultural Research Service scientist and adjunct professor in the Department of Crop and Soil Sciences.

By encouraging faculty members to form interdisciplinary teams, IConS helps keep momentum going and build camaraderie for projects that haven't yet received higher-level funding, such as from the National Science Foundation.

"AI thrives on data, and sensors are critical sources of this information."

- ALPER BOZKURT

They're Yelling Timber

“The internet will not stand for a video featuring two guys simply chopping down a tree. They demand something new, something sensational. Hence a peanut butter axe.”

The drive to do something that’s never been done before is evident throughout alumni **Rhett McLaughlin** and **Link Neal**’s careers. Best friends since first grade, they both attended NC State. McLaughlin graduated in 2000 with a degree in civil engineering, and Neal earned a degree in industrial engineering in 2001.

Better known as Rhett and Link, the internet duo own Mythical Entertainment and star in two award-winning daily YouTube shows, *Good Mythical Morning* and *Good Mythical More*. They recently launched a new show, *Rhett & Link’s Wonderhole*.

For the series’ fourth episode, they visited the Center for Additive Manufacturing and Logistics (CAMAL) on Centennial Campus to make their third childhood best friend laugh from the beyond. They enlisted students from the Department of Civil, Construction, and Environmental Engineering and the Edward P. Fitts Department of Industrial and Systems Engineering to build three different experimental axes to cut down a tree, an activity the three did together as children.

Students came up with three versions: a frozen axe, an axe made of a polymer that was 55% peanut butter and a titanium axe.

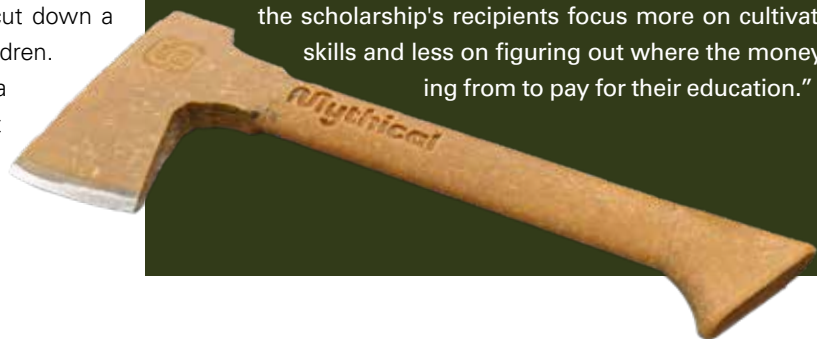
To see how the axes fared, check out go.ncsu.edu/peanutbutteraxe.



A Mythical Scholarship

In 2024, the alumni, via their company Mythical, established a full-ride, two-year scholarship, The Rhett and Link Engineering Innovation Scholarship Fund. Available to third- and fourth-year engineering students, the award will support students who demonstrate commitment to innovation and creativity in engineering, sciences, the arts, entertainment or a mixture of these disciplines.

“We hope it can provide meaningful help to students who are interested in the technical aspects of engineering but also have a desire to express themselves creatively, whether that be in direct innovative engineering applications or simply creative endeavors that require problem solving,” said McLaughlin and Neal. “Balancing both technical and creative pursuits can require significant time commitments, and we think financial assistance will help the scholarship’s recipients focus more on cultivating their skills and less on figuring out where the money is coming from to pay for their education.” ■



A ‘Dream Come True’ Supported by Day of Giving



Meredith Martinez left NC State in 2017 as a proud alumna of the Department of Civil, Construction, and Environmental Engineering (CCEE), but she always knew she wasn’t saying goodbye forever.

Martinez, who is an assistant teaching professor and the coordinator of undergraduate advising for CCEE, was hired this past year thanks to donations from the annual fundraising event Day of Giving. The next one is March 26, 2025.

“As an undergraduate scholarship recipient myself, it’s really impactful to see that alumni and donors want to give back and want to see students be successful,” Martinez said.

Even before Martinez came to NC State for her undergraduate degree, she knew she was destined to be a member of the Wolfpack. She’s a fourth-generation NC State student, and both of her parents are engineers.

“Growing up, I had the NC State onesie and the NC State cheerleading outfits,” she said. “When I was looking at colleges, it was the one that made sense, but it was also the one that when I visited, it felt like home.”

Before Martinez graduated, she approached her mentor, **Tarek Aziz**, who is currently an associate professor in CCEE and was the coordinator of advising for the department before Martinez.

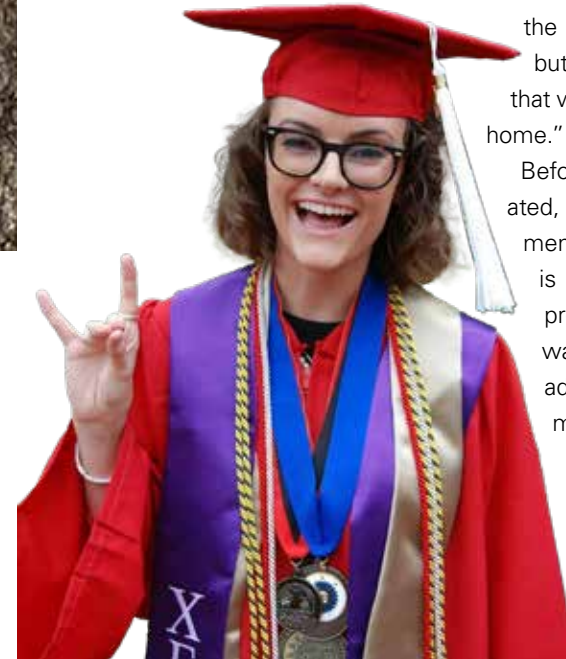
She told him, “I want your job one day. How do I get your job?”

“He said, you know, go to graduate school and do good work, and hopefully at some point, something will work out to where you can come back,” Martinez said. “And I’m really fortunate to have been able to make that dream come true seven years later.”

Martinez’s job now is a mix of teaching and advising, and she especially loves the intersection of the two.

“I really love getting in the classroom, getting students involved and helping them see how the natural world is connected,” she said. “I also get to advise students and hear about their goals and what they’re looking to do in a career. Being able to support them in that and help guide them and find a path that works best for them is just really exciting to see.”

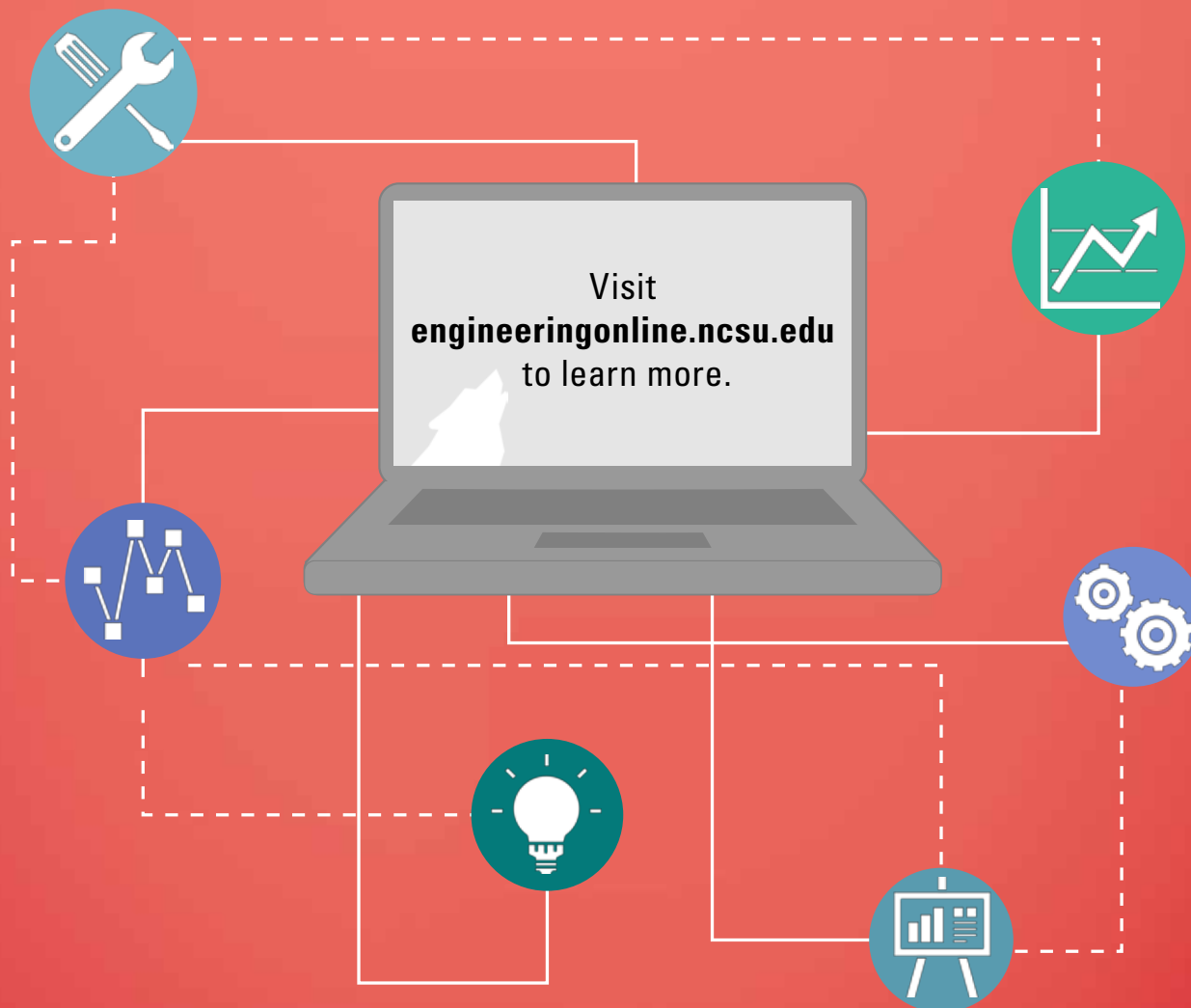
“Opportunities are out there for students if they’re willing to pursue them,” she continued. “It’s an amazing generation coming through, so I’m excited to see what they’ll continue to do.” ■



NC STATE

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Dan Pleasant '72, '73 and **Braydon Boaz** both grew up on tobacco farms in Caswell County before graduating from Bartlett Yancey Senior High School and leaving their home county to pursue an engineering degree at NC State University.

Both remember being encouraged by teachers to consider engineering because of their aptitude for math. Pleasant's high school math teacher, Nellie Strader, told him he should be an engineer. Boaz's mother, who is a teacher, signed him up for STEM activities when he was younger. Boaz also dual-enrolled at Piedmont Community College in high school to earn an associate degree.

Both were one of just a handful of students from their graduating class to enroll at NC State in engineering.

Their shared experiences from growing up in the same rural area helped develop their empathy for those around them.

"I think if you grow up in a rural area, you're more likely to have that," Pleasant said. "You quickly put yourself in the other person's shoes, and you want to understand their situation."

Dan Pleasant and his wife, Barbara Pleasant, who is from the neighboring Person County, prioritized giving back to their communities throughout

their lives by volunteering and serving in leadership roles for numerous nonprofit and civic organizations. Recently, they established the Dan and Barbara Pleasant Scholarship Endowment. The full-tuition scholarship is for engineering students from rural North Carolina counties, with a preference for Caswell and Person counties. The counties are both about an hour-and-a-half from NC State's campus.

Boaz is the first recipient of the scholarship, and he shares the Pleasants' drive to give back. A sophomore construction engineering student, he volunteers every Tuesday at his local food parish in Caswell County to reduce food insecurity.

"It's where my roots are," Boaz said. "The people and experiences

from Caswell County have shaped me into who I am today."

Boaz's long-term goal is to open his own construction company.

The Dan and Barbara Pleasant Scholarship makes that easier for him. Boaz can spend more time on research and extracurricular activities when he'd otherwise be working a part-time job.

"Being able to graduate from school without having large debt is a possibility that I didn't think I'd ever get," he said. "In the long-term, to be able to have financial flexibility or freedom after I graduate to start my career how I want to is also something I never thought I'd be able to do."

Read the full article at go.ncsu.edu/pleasantscholarship.

Giving Back to the Places That Shaped Them

Dan and Barbara Pleasant established a scholarship for students from Caswell and Person counties. Braydon Boaz of Caswell County is its first recipient.



“...to be able to have financial flexibility or freedom after I graduate to start my career how I want to is also something I never thought I'd be able to do.”



BRAYDON BOAZ

FROM THE ENGINEERING FOUNDATION BOARD

The NC State Engineering Foundation (NCSEF) was established in 1944 to aid and promote, by financial assistance and otherwise, engineering education and research at NC State. A board of directors made up of alumni and friends of the College of Engineering works with the college advancement staff and dean of engineering to set the Foundation's agenda. The board is led by President Scott Stabler and Vice-President Helene Lollis.

Board President Reflects on COE Significance to Alumni

Last September, James Earl Jones, the iconic screen and voice actor, passed away. His distinctive voice introduced us to CNN, made *Star Wars'* Darth Vader even more menacing and gave *The Lion King's* Mufasa gravitas. While he had memorable roles in the *Hunt for Red October* and *Coming to America*, he was also known for his part in one of my favorite baseball movies, *Field of Dreams*.

Jones played the reclusive author, Terrence Mann, seeking to leave his "60s" past behind him. He gets pulled into Ray Kinsella's (Kevin Costner) quest to uncover the meaning of the mysterious cornfield whisper quotes. Ask the line that everyone remembers from that movie and you'll hear "Build it and they will come."

The line that resonated with me, however, came from Dr. Moonlight Graham, Burt Lancaster's character. When asked about his one-game career in the major leagues — one which unfortunately didn't include an at-bat — Moonlight wistfully remarks that *"You know we just don't recognize the most significant moments of our lives while they're happening..."*

If you're reading this, you care enough to keep up with the latest from the

College of Engineering, and clearly something "significant" happened during your time in Raleigh. It may have been an inspirational professor who shaped your interest and career journey. Perhaps a classmate who became a lifelong friend, business partner or spouse. It may simply be the priceless benefit and recognition that an engineering degree from NC State represents. Whatever the hook, your desire to stay connected years, and even decades, later is borne of your pride in being a Wolfpacker and in the significance of your time in the College of Engineering.

On behalf of Dean Pfaendtner and the Engineering Foundation, I invite you to become even more connected. Come back for a tour of Centennial Campus, attend one of the dean's events in a town or business near you and/or consider a contribution to the College of Engineering. The momentum enjoyed by NC State Engineering today with the rapid expansion of the college, the dean's signature focus on Applied AI and the breadth of research associated with the award-winning faculty is truly unprecedented. Our students are having the most significant times of their lives whether they recognize it or not!

Come see for yourself.

Scott Stabler
BSME '82
President, NC State Engineering Foundation Board of Directors ■

YOUNG ALUMNI

THREE YOUNG ALUMNI EXCEL AT WORK AND BEYOND

Three Young Alumni Advisory Board (YAAB) members were honored for achievements inside and outside the office in 2024:

CHARLIE TOWNSEND

Charlie Townsend received the Young Professional Award from the National Society of Professional Engineers (NSPE). The award recognizes a young NSPE member who has made outstanding contributions to the engineering profession and community. Townsend was recognized at the 2024 Professional Engineers Conference in Raleigh, North Carolina. Townsend earned his B.S. in civil engineering in 2015 and MBA in 2019, both from NC State. He is the land development team leader for VHB in Raleigh.



CHRISTOPHER BAILEY

Christopher Bailey was awarded the Outstanding Young Alumni Award for his exceptional achievements in engineering and biotech and extensive volunteer work. This is awarded by the NC State Alumni Association to honor an alumnus who has graduated in the last 10 years who has made outstanding contributions in their profession, community and to NC State. Bailey earned his M.S. in mechanical engineering from NC State in 2016. He is a senior proposal manager at MilliporeSigma in St. Louis.



ABBY LAMPE

Abby Lampe proved the first time she won the Cooper's Hill Cheese-Rolling and Wake was no fluke as she captured the title for the second time in May. She again brought international recognition to her alma mater. Lampe is a fourth-generation NC State alum, and her grandfather is a former dean of the College of Engineering. She earned a B.S. in industrial engineering in 2022. She is a financial services consultant at PwC in Charlotte. ■



ABOUT YAAB: Formed in 2018 by the NC State Engineering Foundation, YAAB consists of NC State alumni who are less than 15 years post-graduation from their last degree earned. The program was created to encourage support from the growing population of COE young alumni who want to stay connected to the Wolfpack. The board started with 12 members. Currently, there are 28 members on the board representing a wide range of engineering and computer science disciplines.

Foundation Year in Review

The NC State Engineering Foundation, Inc., established in 1944, is the fundraising arm of the College of Engineering. For more information on the Foundation, including financial statements, audits and tax identification number, please visit aeoperations.ofo.ncsu.edu/nc-state-engineering-foundation-inc.

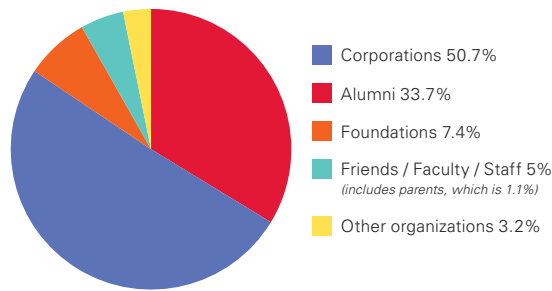
The **NC State Engineering Foundation, Inc.** led another successful fundraising year for the College of Engineering.

Fundraising totals to the College were **\$40,437,188** during the 2024 fiscal year. The College has invested in projects like Day of Giving, raising **\$4.8 million** from a **record-setting 2,172 gifts** in March. These donations are critical to the growth and development of the College's programs that round out and enhance students' experiences while at NC State.

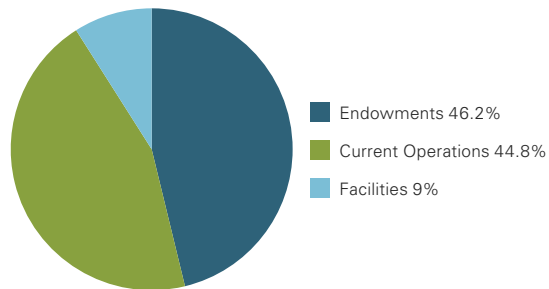
Endowments to the College generally fall into one of three categories: scholarships, named professorships and fellowships. There are now **66** permanently endowed named professorships and **\$88.2 million** in total endowed scholarships. Total endowment support for the College is **\$258.7 million** as of June 30, 2024, including directly owned assets as well as endowments held outside of the Engineering Foundation.

The annual giving program raised a total of **\$529,193.48** for the College of Engineering Leadership Fund. The Dean's Circle, the College's leadership annual giving society, has **512** members. There were **5,653** Annual Giving donors for the 2024 fiscal year. ■

GIFTS AND NEW COMMITMENTS BY GIFT SOURCE, FISCAL YEAR 2024



GIFTS AND NEW COMMITMENTS BY GIFT USE, FISCAL YEAR 2024



Jenni Mangala

LIGHTS ON

Atop a mountain on an island in Rwanda's Lake Burera, 60 K-6 Birwa Primary School students are able to study until the evening hours and their teachers are using digital education tools regularly thanks to seven new solar panels generating electricity for the school.

Accessible by a 20-minute boat ride, the school is not connected to the area's power grid. When **Jenni Mangala** learned about a potential project to install solar panels at the school, she said yes.

Mangala's family is from Congo, and she speaks French, which is one of Rwanda's official languages. This is the first undergraduate-led project of its kind in the College of Engineering.

Passionate about renewable energy and expanding access to electricity, Mangala coordinated the planning, fundraising and installation from 7,000 miles away and across a 6-hour time difference. A Park Scholar, Mangala earned her B.S. in electrical engineering in May and her M.S. in December 2024 through the Department of Electrical and Computer Engineering's accelerated bachelor's/master's program.

The panels were installed in August by MySol, which is part of the larger Rwandan company ENGIE Energy Access Rwanda.

The project took nearly two years. Mangala first visited the school in 2022 on a summer study abroad trip, and she returned in 2023. That year, she started a fundraising campaign for the solar panels with assistance from College of Engineering advancement staff.

Her efforts inspired NC State alumni and students to donate to the project, and Hitachi Energy contributed \$12,000. She raised just under \$19,000.

Mangala found it challenging to coordinate the project while balancing her classes, presidency of NC State's chapter of the National Society of Black Engineers and other commitments.

"But what's been fun has been being able to talk about the project with other people and share the work that I've been doing," she said. "And having an opportunity to inspire others to do more, like really impactful service or international work." ■

Board of Directors

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