NC DEPARTMENT of COMMERCE
SCIENCE, TECHNOLOGY & INNOVATION

Dr. John Hardin
EXECUTIVE DIRECTOR

June 2, 2022

It is my honor to introduce this issue of *Research North Carolina*, a forum for North Carolina institutions and companies to showcase their research programs, innovations, and achievements.

Innovation is key to North Carolina's economic development strategy. Forging new tools, technologies, and processes creates measurable value in the way we live and work, raising the standard of living of our citizens. Innovation creates new industries, keeps existing ones globally competitive, advances national security, and drives future economic growth and well-being. Innovative regions are better equipped to resist and recover from economic shocks, such as those caused by the COVID-19 pandemic. North Carolina's ability to thrive in an increasingly dynamic, global economy depends, fundamentally, on fostering regions of innovation across this great state to the benefit of all North Carolinians.

One of our state's strongest innovation assets remains its research universities. North Carolina's academic R&D expenditures relative to the size of its economy rank fifth nationally, according to the North Carolina Board of Science, Technology & Innovation's recent *Tracking Innovation 2021* report. The transfer of technology and knowledge from universities is key to realizing their economic potential. The state has made impressive gains in technology commercialization, through deliberate initiatives at universities to generate intellectual property and foster business start-ups.

Additionally, since 2000, business R&D as a share of gross domestic product increased at more than twice the rate of the U.S. Continued collaboration between academic institutions and companies through development of new technologies and supplying much needed skilled talent will position North Carolina well amid uncertain economic conditions. North Carolina also has a clear opportunity to become a leader in defense innovation, given the size of its economy, academic and business R&D capabilities, and miliary footprint. Biotechnology, pharmaceuticals, and information technology are sectors in which North Carolina already leads and develops products and services to strengthen our national security.

This special section, *Research North Carolina*, is a great way to learn in more detail about the types of research and innovation-based activities that underlie these statistics and are helping to grow our economy in North Carolina. A high-productivity, high-employment, high-income, growing economy must be a high-technology economy driven by research and innovation.

The Office of Science, Technology & Innovation commends *Business North Carolina* on this important initiative to spotlight the state's critically important research activities. I invite you to read *Research North Carolina* and to join in these efforts.

Sincerely,

John W. Hardin

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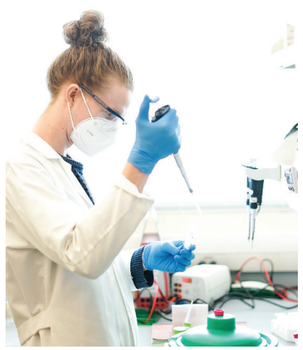



RESEARCH NORTH CAROLINA

Preparing the problem-solvers of tomorrow

Appalachian State University serves NC by advancing research, knowledge and innovation

Dr. Baker Perry, National Geographic Explorer and professor in App State's Department of Geography and Planning, led a successful return expedition to Mount Everest in April and May 2022, coordinating the maintenance of weather stations at the top of the world. The expedition built upon the record-breaking National Geographic and Rolex Perpetual Planet Everest Expedition in 2019. Photo by Dawa Yangzum Sherpa/National Geographic

Under the leadership of Chancellor Sheri Everts, Appalachian State University's research enterprise has grown substantially since 2014. Last year, the university set a record for external funding from grants and contracts, and plans for future growth in research and creative activities continue.

One of the hallmarks of App State is its emphasis on undergraduate research, which gives students the opportunity to work side by side with faculty and present their findings at regional, national and international conferences.

"The advancement of knowledge through scholarly and creative activities is fundamental to our teaching mission," said Provost and Executive Vice Chancellor Heather Hulburt Norris, who added that such pursuits keep faculty current in their fields, leading to valuable classroom experiences for students, and also provide significant benefits to society through the generation of new knowledge, innovations, discoveries and processes.

App State is home to multiple research institutes and centers, including the Appalachian Energy Center, Center for Appalachian Studies, Center for Economic Research and Policy Analysis, Transportation Insight Center for Entrepreneurship, Research Institute for Environment, Energy and Economics, Blue Cross and Blue Shield of North Carolina Institute for Health and Human Services and Center for Judaic, Holocaust and Peace Studies.

With funding from the North Carolina General Assembly and Governor Roy Cooper, App State broke ground on the first phase of its future Innovation District in March 2022. The first academic building in the Innovation District will be the Conservatory for Biodiversity Education and Research. Proposed additional facilities include renewable energy labs and spaces for research, multidisciplinary projects, teaching and demonstration.

Read more about recent research endeavors at App State:

Dr. Baker Perry leads climate science expedition to the world's highest mountain

Dr. Baker Perry, National Geographic Explorer and professor in App State's Department of Geography and Planning, led a successful return expedition to Mount Everest this spring, coordinating the maintenance of weather stations on the world's highest mountain.

On May 9, the National Geographic Society expedition team, in collaboration with a group of elite climbing Sherpas, installed a new weather station at Bishop Rock, located just below the summit of Mount Everest, at an elevation of 8,810 meters (28,904 feet).

The installation, along with essential maintenance of four other automatic weather stations at various points on the mountain, builds upon the record-breaking National Geographic and Rolex Perpetual Planet Everest Expedition in 2019.

The Bishop Rock installation replaces the Balcony station (elevation 8,430 meters, or 27,657 feet) installed in 2019. The Balcony station, which was impacted by severe weather, was the world's highest automatic weather station at the time of installation.

This weather station network on Everest provides unparalleled and critical data on how climate change impacts the planet. Data from the stations — managed by Perry at App State in collaboration with other partners — can help communities respond to climate risks that threaten the lives and livelihoods of more than 53 million people who live in the Himalayan Mountains region.

Real-time wind, temperature and precipitation measures from the stations are also improving climber safety on the main Mount Everest climbing routes. Worldwide, the data are enabling scientists to learn more about climate at high altitudes and its impact on glacier health and water supply, Perry said.

App State team researches treatments for aggressive breast cancer

An App State research team is investigating effective treatments for one of the most aggressive types of breast cancer — with the goal of reducing adverse side effects.

Dr. Michael Reddish, assistant professor in App State's A.R. Smith Department of Chemistry and Fermentation Sciences, was awarded a grant from the North Carolina Biotechnology Center to study medications proposed to treat triple-negative breast cancers, which he said have "the least number of and least effective treatment options available."

Assistant professor Dr. Michael Reddish, left, and Ethan Harris '22 test samples in the lab in fall 2021 to investigate treatments for triple-negative breast cancer. Photo by Chase Reynolds

According to the National Breast Cancer Foundation Inc., a diagnosis of triple-negative breast cancer means the three receptors that fuel most breast cancer growth — estrogen, progesterone and the HER-2 gene — are not present in the tumor, and common treatments like hormone therapy are ineffective. Approximately 10% to 20% of breast cancers are triple negative.

Examining ancient evidence in mass extinctions

App State's Dr. Sarah Carmichael describes her job as similar to that of a crime scene investigator — and the evidence she examines is more than 350 million years old.

Carmichael — a geochemist, a National Geographic Explorer and a professor in App State's Department of Geological and Environmental Sciences — specializes in Devonian period research, studying the causes and effects of mass extinction events that occurred 350–417 million years ago.

"The Devonian period contains pulses of extinctions that, taken together, constitute one of the top five most severe mass extinction events in Earth's history," Carmichael said. "The events decimated coral reefs and marine ecosystems and changed the evolutionary trajectory of fish."

Many scientists have studied these extinctions — thought to be caused by anoxia (oxygen loss) — but the reasons behind the change in oxygen levels remain a mystery, Carmichael said. For clues, scientists study fossils and chemical compositions preserved in rocks.

By studying extinction events from the past, Carmichael said scientists can look for similar trends in sediments today — and better understand and predict potential outcomes.

Dr. Sarah Carmichael is pictured during a field expedition in Mongolia in 2018, where she and her team evaluated specimens preserved in volcanic rocks. Photo by Felix Kunze

BUILDING PARTNERSHIPS FOR PROGRESS

ECU CONNECTS RESEARCH, ECONOMIC DEVELOPMENT AND COMMUNITY ENGAGEMENT ACTIVITIES TO BENEFIT THE REGION AND BEYOND

East Carolina University continues to deliver on its motto, ***Servire*** -- "To Serve" -- through partnerships that catalyze regional transformation. Faculty, students and staff collaborate with industry, health care and other community organizations to find solutions that improve health, educational outcomes, economic prosperity, workforce and community assets. Campus and community stakeholders use shared knowledge, expertise and resources to build a better tomorrow for our region, state and communities across the globe.

FROM THE CLASSROOM TO THE WORKFORCE

The coupling of expert faculty researchers with cutting-edge technology and innovative approaches means that ECU can produce top-notch scientists, innovators, educators, health care professionals, entrepreneurs and other employees that meet the workforce needs of employers.

The new Life Sciences and Biotechnology Building is home to the Eastern Region Pharma Center, a partnership joining the university with 15 pharmaceutical companies and five community colleges to build a workforce that answers industry demand.

Through partnerships with the military and industry, ECU makes higher education affordable and accessible for both traditional and non-traditional students. Military service members can find educational opportunities that support career advancement through ECU's Bachelor of Science in Industrial Technology and Industrial Distribution & Logistics programs. Both programs are part of the initial in-person offerings onboard Marine Corps Air Station Cherry Point. ECU can provide Department of Defense personnel in and out of uniform with pathway options that enhance their current career progression or support transition to new careers in the growing pharmaceutical, aerospace or equipment manufacturing sectors in eastern North Carolina.

Both ECU's College of Nursing and the School of Dental Medicine put the university's mission into action – reaching into underserved areas to deliver needed care to community members. Providing students in health professions with these real-world experiences allows them to be prepared for the challenges and opportunities they will face after graduation.

Breaking ground on Intersect East, a hub where industry and businesses can tie into ECU's research and talent. More information at intersecteast.com/leasing

FROM COLLABORATIONS TO ADVANCEMENT

Similarly, ECU's College of Education founded the Rural Education Institute as a response to community need. The Institute supports rural scholars to return to their home regions armed with tools to address the opportunities for growth in rural communities and families. By tailoring programming to focus on issues specific to the rural education system, ECU is helping to give young students and educators a leg up when compared to those who receive education from establishments with access to more resources.

ECU facilities and partnerships also offer opportunities for businesses and organizations to collaborate. The Bureau of Business Research, housed in the College of Business, provides business leaders, communities and policymakers with insightful research to transform eastern North Carolina into a stronger, sustainable and more resilient region. The Small Business and Technology Development Center provides management counseling to help business owners make better business decisions and offers specialized assistance in exporting, technology commercialization, and government contracting. Additionally, the RISE29 internship program partners emerging student entrepreneurs with businesses located in rural communities to support business plans, marketing strategies, expansion opportunities and succession planning to create or retain jobs in those communities.

Opening soon on ECU's Research and Innovation Campus is Intersect East, a center of innovation located within Greenville's National Register Historic Tobacco District adjacent to downtown amenities and ECU's main campus. With this new facility, industry and business partners will enjoy additional access to university research capabilities that foster advancement, collaboration, innovation and job growth.

FROM RESEARCH TO READINESS

As a public research university with a mission to bring about positive change and transformation, faculty and student researchers consistently reach across departments and across county lines to help ready eastern North Carolina and its neighbors for tomorrow.

Set on the beautiful Outer Banks is the Coastal Studies Institute, a multi-institutional research and educational partnership led by ECU. The program uses an interdisciplinary approach and scientific advances to provide effective solutions to coastal problems. Student and faculty researchers focus their studies and data collection on subjects like coastal erosion, sea level rise, fisheries, resource management and marine renewable energy. These researchers are working each day to better understand and find answers to the complex issues that affect not only coastal North Carolina, but coastal systems around the globe.

Researchers in the College of Health and Human Performance are working on a study funded by the Office of Naval Research to enhance the readiness and resilience of our service members. The two focus areas of the study address improving recovery from mild traumatic brain injury and prevention of musculoskeletal injuries. Advancing the understanding of these injuries will enable improved medical care for our service members, strengthening our forces and setting them up for a better future after service.

ECU is focused on providing the expertise and resources that support practical solutions for a stronger, more prosperous North Carolina. Contact ECU Research, Economic Development and Engagement to learn about potential partnership and research opportunities for your business or community.

To learn more about ECU's research, economic development and engagement, visit rede.ecu.edu

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Rescue training in a swift water tank

SERVING THE COMMUNITY

A NEW COMPLEX WILL PROVIDE STATE-OF-THE-ART RESCUE TRAINING FOR FLOODS, FIRES AND OTHER HAZARDS

Fayetteville Technical Community College is building a facility that will revolutionize opportunities for emergency personnel to train for swift-water and flood-water rescues.

FTCC's **Swift Water Rescue Training Center** will be a state-of-the-art indoor facility at the College's new **Regional Fire & Rescue Training Center**.

The 8,400-square-foot Swift Water Rescue Training Center will house an 88,000-gallon tank with eight pumps that can blast water up to 7 knots per hour to simulate realistic flood situations. The center will be able to operate daily and offer a wide variety of rescue scenarios, including submerged vehicles and enclosed areas, different weather situations, water temperatures, current flow, obstacles, night rescues and other challenges.

FTCC moved to create the Swift Water Rescue Training Center because of the need to provide specialized swift-water and flood-water rescue training to emergency personnel in a world that is increasingly flood-prone. It can be difficult and dangerous to arrange such training on a regular basis in natural, outdoor settings. Meanwhile, certified swift water rescue personnel are required to undergo regular retraining to maintain their credentials. There are more than 40 certified swift water rescue teams in North Carolina.

"This facility will serve a critical training need for emergency personnel in Cumberland County, eastern North Carolina and beyond," said FTCC President Dr. J. Larry Keen. "Dangerous flood and swift-water situations can happen almost anywhere," Keen said. "It is vitally important that emergency responders have specialized training in these instances. With this new facility, FTCC will be able to provide that training."

FTCC's Swift Water Rescue Training Center will be the only indoor facility of its kind on the East Coast of the United States. The center's tank and technology are being provided by Fathom Tanks of Georgetown, Texas, which operates its own indoor swift-water facility. The FTCC facility is expected to open in late 2022.

The facility is part of a Regional Fire & Rescue Training Center now under construction by FTCC. The regional training center, located on Tom Starling Road in Cumberland County, will provide much expanded and state-of-the-art fire and rescue training programs for fire and emergency personnel from Cumberland County and beyond. The first phase of the regional center includes a 24,000-square-foot building with classrooms, apparatus bays, simulation labs and offices; a technical rescue complex with a 4-story training tower; and a 3-story "burn building" where live burning exercises can be conducted. It is expected to be completed by the end of August. FTCC's Corporate and Continuing Education division plans to begin offering classes at the new Regional Fire and Rescue Training Center this fall.

The second phase of the project includes the Swift Water Rescue Training Center, as well as an Aircraft Burn Simulator and two additional burn buildings. Other specialized training opportunities will include Technical Rescuer certification, vehicle extrication, trench rescuer, confined space rescuer, farm rescuer, and communications tower rescuer.

FTCC is the only college in North Carolina to offer sophisticated, high-level training which includes multiple burn buildings, an aircraft trainer, rappelling tower with high zip line capability, and trench collapse training. The full project is expected to be completed by June 2023.

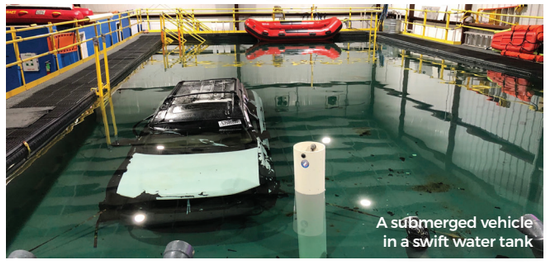
The Regional Fire and Rescue Training Center and Swift Water Rescue Training Center are expected to boost the local economy, as individuals from well beyond Cumberland County seek out the specialized training and visit local hotels, restaurants and businesses.

"This Center will provide hands-on specialized training in a wide variety of emergency situations," Keen said. "Firefighters and first responders will be able to do their jobs more effectively and safely, and their training will pay dividends to the people they are able to help."

Keen said the Fire & Rescue Training Center and the Swift Water Rescue Training Center are the result of hard work by many, including Cumberland County's legislative delegation, the County's Board of Commissioners, the Cumberland County Fire Chiefs Association, the North Carolina Community College System and the College's Board of Trustees.

He said FTCC is honored to be able to serve firefighters and other emergency personnel. "FTCC is thrilled to be able to provide training in this state-of-the-art Center for the courageous men and women who step up through their professional calling to serve the emergency needs of citizens throughout our communities, states, and our nation," Keen said. "This Center represents the culmination of the strong value and deep appreciation shared by many in our community and across our state who recognize why the work of our emergency service workers is critical."


Rendering of FTCC's new Regional Fire & Rescue Training Center


A submerged vehicle in a swift water tank

For over sixty years, Fayetteville Technical Community College has been a pillar of Fayetteville and Cumberland County, providing members of the community opportunities to pursue a high-quality education offered conveniently and affordably. The mission of FTCC is to serve its community as a learning-centered institution to build a globally competitive workforce that supports economic development. FTCC offers over 286 academic programs of study leading to the award of associate degree, certificate, or diploma. FTCC's Corporate and Continuing Education division provides a broad range of classes including courses in high school equivalency, personal interest, and career and job training. The Small Business Center, which operates under the umbrella of Corporate and Continuing Education, provides training to meet the needs of new or existing businesses and industries. As members of a North Carolina community college, FTCC's faculty, staff, and leadership are honored to provide training to meet the needs of employers and the community and help individuals pursue a better quality of life through the pathway of education.

RENDERING OF THE TRAINING CENTER PROVIDED BY HH ARCHITECTURE

Interested in learning more about FTCC and the new training center? Visit faytechcc.edu

@faytech

FTCC

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GAME-CHANGING

GTCC FUELS INNOVATION IN LOCAL AND NATIONAL AVIATION SCENE

Since it began in 1970, the aviation program at Guilford Technical Community College has soared. And now, given the "boom" in aviation, GTCC is poised to offer a new pipeline of skilled labor in the field.

A bit of background: In January 2022, Boom Supersonic announced that it will build the world's fastest, most sustainable aircraft, the Overture, in Greensboro, North Carolina. The supersonic jet will fly at twice the speed of most passenger airplanes, and it will utilize sustainable aviation fuel (SAF). Boom's state-of-the-art manufacturing facility, slated to be 400,000 square feet on a 65-acre lot, will create more than 1,750 jobs with an average salary of $69,000 per year. Boom's Overture Superfactory will also grow North Carolina's economy by about $32 billion over 20 years.

In large part, Boom chose North Carolina for its ability to produce trained workers. Blake Scholl, founder and CEO of Boom Supersonic, told Spectrum News, "With some of the country's best and brightest aviation talent, key suppliers, and the state of North Carolina's continued support, Boom is confident that Greensboro will emerge as the world's supersonic manufacturing hub."

Naturally, GTCC responded to the opportunity, developing plans to build an expansive 100,000-square-foot aviation center on its Cameron Campus. This new facility will complement the existing T.H. Davis Aviation Center, located adjacent to the runways at Piedmont Triad International Airport, and will allow for expansion of GTCC's aviation programs. And the cost? It's well worth it, given the impact of Boom's investment in the area. GTCC is firmly on its way to securing $37.4 million for its new aviation center, and college leaders may take bids for the initial construction as soon as May or June 2023, with the hope of completing construction by 2027.

Leaders in education and economic development agree that Boom's presence in Greensboro will create vital new opportunities for area and state students. GTCC is uniquely positioned to meet the specialized demand, already offering cutting-edge programs in aerospace manufacturing, aviation systems, aviation electronics (avionics), and aviation management. Students can also enroll in the Aviation Manufacturing Quick Careers Program (AMQCP) in areas such as composite technology and aircraft structural repair. They later have the option to enroll in additional programs,

earning stackable credentials that will make them highly desirable in the growing field of aviation.

In fact, all students at GTCC can earn a wide variety of credentials. They can pursue certificates, diplomas, and associate degrees, with program lengths ranging from a few weeks to two years. Aviation students can even earn a bachelor's or master's degree on-site at GTCC, thanks to an articulation agreement between the college and Embry-Riddle Aeronautical University.

In addition, GTCC's aviation program is deeply rooted in the local business community, including collaborative partnerships with entities such as HondaJet and HAECO. Business partners provide crucial work-based learning for students seeking apprenticeships, internships, and mentorships. Through 2032, Boom expects to create 200 additional opportunities via internships for students who attend publicly funded North Carolina universities, community colleges, or technical schools. This type of on-site education allows students to immerse themselves in the field of aviation, learning by doing, all with the support of experts. Day and evening classes are available to GTCC's aviation students, allowing them the flexibility to take advantage of experiential learning.

The potential for expanding business relationships, particularly via landmark companies like Boom, is beyond promising. According to Nick Yale, GTCC's director of aviation programs and industry veteran with 25 years of field experience, local companies already request classroom time with aviation students, sending recruiters to get in front of them. Representatives from Boom Supersonic have also begun visiting GTCC to discuss possibilities for collaboration.

And what about tuition? Financial aid and scholarships are available to all GTCC students, and many are able to attend at minimal or no cost, breaking down financial barriers to lucrative careers. Even outside of the classroom, GTCC offers students innovative solutions for their non-academic needs. The Titan Link program at GTCC provides above-and-beyond support for challenges related to housing, transportation, food insecurity, and more. GTCC's Food Nutrition Services Employment and Training (FNS E&T) program offers additional support to area students and community members who receive food stamps. These additional services include specialized job search support, skills and interest assessment, and connections to workforce training and continuing education opportunities.

Community-focused innovators like GTCC are essential to providing accessible, equitable access to cutting-edge training. Think of the college tagline: Make Amazing Happen. GTCC's aviation program is taking it to a brand new elevation.

ABOUT GTCC

Guilford Technical Community College is the fourth largest of 58 institutions in the North Carolina Community College System. Serving 27,000 students annually from five campuses and a Small Business Center, GTCC offers more than 80 programs of study, including flexible, low-cost options for earning associate degrees, diplomas, and certificates. GTCC is rooted in innovative education, training, and partnerships.

Make amazing happen. Visit us online at www.gtcc.edu

GTCC GUILFORD TECHNICAL COMMUNITY COLLEGE make amazing happen

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WORLD-CLASS FACILITY

A NORTH CAROLINA RESEARCH GEM ATTRACTS THE BEST AND BRIGHTEST FROM ACADEMIA, GOVERNMENT AND INDUSTRY

Housed inside the **Joint School of Nanoscience and Nanoengineering (JSNN)**, a 105,000-square-foot, LEED Gold Certified research facility, is the Joint School's Institute for Research Technologies (JSIRT). It holds more than 100 state-of-the-art pieces of equipment for use in micro and nanofabrication, imaging, analytical characterization, synthetic biology, advanced materials design, and computational research. JSNN is a unique academic collaboration between **North Carolina Agricultural and Technical State University** and the **University of North Carolina at Greensboro**. It builds on the strengths of both institutions to offer innovative, cross-disciplinary graduate programs in research areas where nanoscience and nanoengineering play a key role, including synthetic biology, materials science, computational nanotechnology, and environmental science and sustainability. JSNN offers master's and doctorate degrees in nanoscience and nanoengineering as well as graduate certificates in advanced materials, micro and nano devices, systems and synthetic biology, STEM entrepreneurship, medical sciences, instrumentation, and nanoscience. In collaboration with Georgia Tech, JSNN is a partner in the Southeastern Nanotechnology Infrastructure Corridor, funded by the National Science Foundation's National Nanotechnology Coordinated Infrastructure program.

JSNN has received outstanding research contributions from faculty and students. Under the leadership of Dr. Sherine Obare, who in 2019 took the helm of leading JSNN as its second dean, enrollment at the school has increased by 35%, external funding has grown by 54%, and the school was recognized in 2021 by Insights into Diversity for novel initiatives that increase women's careers in nanotechnology. Talented faculty from various disciplinary backgrounds have fostered significant innovation at JSNN.

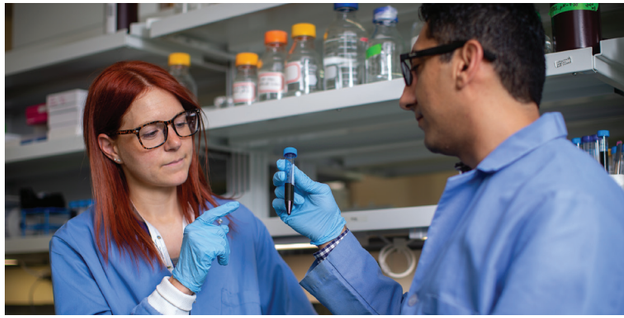
The fee-for-use-based resources and equipment are available to academic, government, and industry users. In addition to the equipment, users have access to highly skilled staff and world-class specialized training. JSNN serves academic, industrial, and governmental researchers across the U.S. and around the globe. The advanced microscopy instrumentation includes the only Helium Ion Microscope in the Southeast. A brand-new micro-computed tomography (micro-CT) scanner, installed in March 2022, produces high-resolution 3D images of a variety of artifacts and organisms.

Dr. Shyam Aravamudhan, director of JSNN core facilities, said, "We provide 24/7 open access to laboratories, equipment, tools, and support for nano and microscale lithography, fabrication, synthesis, characterization, design, and computation, as well as hands-on training in a shared user environment. There is no other place in Piedmont that offers access to such a stellar facility with world-class equipment and access to our expert staff."

JSNN's world class facility has also led to exciting research innovations. A recent patent titled Amphiphilic Hybrid Nanomaterials by Drs. Daniel Herr, Hemali Rathnayake, and Kristen Dellinger would enable the tech industry to manufacture high performance computer chips at reduced cost. It also creates a potential path for dissolvable prosthetic devices and promises to help address the global computer chip shortage of computer chips. This shortage, creating a deficiency not seen in decades, stalls the production of millions of products, including cars, smartphones, household appliances, computers, and much more. Current production of computer chips relies 'top-down' manufacturing, in which designed structures are etched into a functional substrate, creating a significant amount of material waste. This invention represents a 'bottom-up' approach that builds functional nanostructures as needed, in a way that is similar to how our bodies create cells, with very little wasted material."

Furthermore, JSNN researchers use bio-based and bioinspired tools to help usher in a new era of information processing. A new convergent technology called Semiconductor Synthetic Biology promises to transform semiconductor manufacturing and information processing technologies and achieve this twenty-year vision. Several JSNN faculty co-authored and contributed to the first SemiSynBio roadmap in 2018. The JSNN faculty, whose collaborative team addresses the roadmap's key information storage challenges, are becoming world leaders in this emerging field, with support from an NSF grant, "DNA Mutational Overwriting Storage."

The memory industry realizes the critical need to explore alternative storage materials. Due to the absence of alternatives, an information storage crisis is imminent. With the demand for memory growing exponentially, the JSNN DMOS team's environmentally sustainable DNA-based data storage system does not require resource-intensive de novo DNA synthesis. This breakthrough system exhibits the potential to augment or replace state-of-the-art digital memory platforms, which are rapidly approaching their physical limits. This collaborative DMOS team,



led by Dr. Reza Zadegan, includes the following JSNN researchers: Drs. Shyam Aravamudhan, Daniel Herr, Eric Josephs, and Dennis LaJeunesse, accompanying a number of leading industrial and academic stakeholders engaged through the SemiSynBio Roadmap. Thus far, the team has demonstrated the enormous potential of DNA-based information storage. They also suggest and are working to verify that DNA digital memory provides far superior spatial capacity, energy efficiency, and information durability compared to other sophisticated memory materials.

In a recent patent, Lithium Recovery from Wastewater, Dr. Hemali Rathnayake and Dr. Sheeba Dawood (a JSNN alumna) are co-founders of Minerva Lithium, a JSNN spin-off. Together they developed a method to capture lithium from water. By 2030, half of all vehicles sold in the U.S. will be electric, fueling increased demand for lithium batteries. But mining this relatively rare element is detrimental to the environment, and lithium is not common in the U.S. This technology can also be tailored to remove toxic substances like lead and heavy metals from water. Their newly patented technology removes valuable chemical elements from wastewater in 24-48 hours. Focusing on lithium because of high demand, the technology can trap lithium from water with a yield of 90% in less than 24 hours, a tremendous improvement over traditional lithium recovery, which can take more than one year with a success rate of 30-65%.

JSNN is a place for talent and innovation. The facility, the equipment, and the brilliant faculty make it one of the state's points of pride and a place for research advancement.

If you are interested in learning more about accessing research equipment, enrolling in graduate programs, or fostering collaborations, please visit jsnn.ncat.uncg.edu.

Visit us online at www.jsnn.ncat.uncg.edu

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Professor Beatrice Dingha shows students how hemp benefits from intercropping.

HEMP RESEARCH

HELPING FARMERS NAVIGATE A NEW FIELD

For some farmers, hemp sounds like the cash crop of their dreams. Since Congress made hemp farming legal in 2018, it has been the hot new topic in agriculture, bringing hope to North Carolina farmers still recovering financially from the decline of the tobacco industry. The fast-growing plant can yield seeds, flowers, fibers and oil, all of which can theoretically fetch high prices on the hemp market — enticing thousands to try growing it.

But there's one problem for current and future hemp farmers: it's a new field, with little long-term research to guide eager farmers on their journey.

Enter the College of Agriculture and Environmental Sciences, which is performing research that ultimately will educate farmers on commercial hemp production. Researchers are studying a variety of aspects of hemp farming — from pests and pollination to production and profits — to help growers maximize the crop's potential and minimize the risks associated with growing it.

As they reach conclusions, the researchers will share their findings with farmers and agricultural Extension agents through symposia, seminars, pamphlets, websites and other means — all with the goal of painting a full picture of the realities of hemp production.

Abolghasem Shahbazi, Ph.D. is working on methods of extracting CBD oil from hemp plants.

"The plant has a lot of potential, but people are jumping into something without considering what they need to do first," said Obed Quaicoe, Ph.D., an assistant professor in the Department of Agribusiness, Applied Economics and Agriscience Education. His team is using a $500,000 grant from the USDA's Agriculture and Food Research Initiative to examine the financial risks of growing hemp.

Hemp is one of the oldest cultivated plants in the world, once grown in fields owned by George Washington and Thomas Jefferson. But there's not a wide body of research on the best conditions for growing hemp, the pests it attracts or the economic ramifications for farmers growing it.

With good reason. For most of the last 100 years, it was illegal to grow hemp, which made it impossible to study the plant's biology or its potential as a crop. Hemp comes from cannabis, the same plant that produces marijuana. And though it's legal once again to grow hemp in North Carolina, marijuana is a different story. State officials regularly test hemp farmers' plants for tetrahydrocannabinol, or THC. If a cannabis plant contains more than .3 percent THC, then it's marijuana and must be destroyed.

That's just one of the risks of hemp farming. Others include pests, mold and market saturation, which is where Quaicoe's interests lie. Too many farmers are investing time and money into growing a crop they know little about, he said. As of August 2021, there are 1,500 hemp growers licensed through the state's Industrial Hemp Commission; however, according to Quaicoe, many of those farmers have been so excited about the potential that they failed to line up buyers, which has been financially devastating for some.

"You have all these output from farmers and literally not enough people to buy the flowers or the fiber from them to process," he said. "When that happens, it chokes the market. And if you don't get a good price, you get your head underwater."

THE BENEFITS OF INTERCROPPING

Beatrice Dingha, Ph.D., often finds herself walking through rows of hemp at the N.C. A&T Farm, inspecting the plants, monitoring the soil, keeping an eye out for bees and bugs, her specialty.

Dingha, a research associate professor in the Department of Natural Resources and Environmental Design, is examining how hemp benefits from intercropping — growing two or more other crops so close together that they interact biologically. The research is being funded in part by a $230,000 grant from the Southern Sustainable Agriculture Research and Education, which promotes sustainable farming practices.

Dingha and her team are using three crops for this grant-funded research: hemp, cowpeas (black-eyed peas) and either okra, squash or watermelon, which are dependent on bees for pollination.

The bees are an important part of Dingha's research, and not just because she's an entomologist. Bees seek out cowpeas for nectar. The more pollinators there are in the fields, the greater the yield of cowpeas. And that means more nitrogen in the soil, something needed to produce a healthy hemp crop. Dingha is experimenting with four varieties of cannabis plants to see which one reacts best.

"If we can have cowpeas that produce nitrogen, then we might be able to cut down on the amount of fertilizer that we use," she said.

Her team's research has another important implication for hemp farmers: it demonstrates the importance of farmers having a second or third crop to sell income if something happens to the hemp.

"They should not rely only on hemp, because we all know that hemp is a delicate crop," she said.

PERFECTING PRODUCTION

A delicate crop, indeed. It needs the right temperature, the appropriate amount of fertilizer, the correct irrigation, the proper protection from pests and weeds. Any variations, and the crop could fail, costing farmers their livelihoods until next season.

Ghasem Shahbazi, Ph.D., a professor in the Department of Natural Resources and Environmental Design, has spent the last four years investigating the optimal growing conditions for hemp — specifically what varieties produce the best CBD oil. The agricultural and biological engineer, who specializes in bioenergy research and product development, is a member of the N.C. A&T Industrial Hemp Team, which is now in the second phase of research funded in part by a grant from the USDA Evans-Allen Research Program.

Like the other researchers in the college, Shahbazi's goal is helping farmers remove the guesswork from planting, cultivating and selling this often-misunderstood plant.

"Some people by nature only look at the positive side," he said. "They only look at the price and potential and income and say, 'Wow. I need to jump in there with both feet.' But a lot of people couldn't sell their hemp in years past because of the lower quality, or because of a lack of connection with a buyer."

The first phase of the team's work began with Arnab Bhowmik, Ph.D., the assistant professor of soil science and soil microbiology who is responsible for the part of the research that takes place on the farm. He planted two varieties known for their production of buds that produce high quality CBD oil to assess what grows best under what circumstances.

With grown plants in hand, Shahbazi extracted and purified the CBD oil, running it again and again through the university's small-scale biorefinery machine. The second phase, which began in 2020, is focusing on how the quality of the soil impacts the quality of the CBD oil.

Results from both phases will help farmers choose their varieties more wisely — and temper their expectations.

"We tell them that they need to be careful," Shahbazi said. "Usually in these situations, there are people who have a lot of money that they can throw at risky things. Farmers don't have unlimited money to throw at risky things."

To learn more about hemp research at N.C. A&T, visit us online at www.ncat.edu/caes

NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY
AGRICULTURE AND ENVIRONMENTAL SCIENCES

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TOGETHER WE CONNECT

TRAINING DEVELOPMENT AND TALENT ACQUISITION

Our state continues to need scientific, engineering, and technical talent to support rapid industry growth. High-technology sectors continue to add jobs that pay above national averages. From 2020 through 2022 the North Carolina Community College System (NCCCS) announced nearly 15,000 new jobs totaling a $19.3B economic impact. The biopharma sector alone needs nearly 5,000 jobs in the next 3-5 years. Now is the best time to transition or advance in your career, but how does one get to make this dream a reality? BioNetwork, the life science training initiative of the NCCCS, works with colleges, companies, and students to connect talent development and talent acquisition needs of the life science industry. BioWork is a great place to start.

Sarah Cote shows us that a career path can have many chapters. After working in several distinct professions, Cote landed a career in the biopharma industry that brought together all of her skill sets. She is a graduate of the single-semester BioWork course which is designed to give students the foundational skills for a career in biopharma manufacturing.

COMMON THREAD

On a "whim," she decided to sign up for classes at Central Carolina Community College and found that she loved the work. Cote got an associate degree in machining technology and worked at a local manufacturing company. "I started as a machine operator, and four months later, I was promoted into the machine shop, becoming the only female who had ever worked in that department," she says. "My grandfather was a master tool-and-die maker, but I didn't know that until after I was already in the industry. Learning that was neat – sometimes you don't know where your interests stem from."

Eventually she went back to school and got a second associates degree, this time in respiratory therapy.

"I really loved that work," Cote says. "When you're caring for people, you are paying it forward in a way. One day, you or somebody in your family might be in that same situation, and you want them to receive the best care possible. So, when you become a medical professional, you strive every day to do that."

After working as a respiratory therapist for five years, it was time for a change. Cote explored the biopharmaceutical industry.

LEARNING THE ROPES

Cote first heard about the BioWork course through connections on LinkedIn.

"I communicated via LinkedIn with people who worked at Pfizer and other companies," she recalls. "They said, 'The BioWork class is only one semester, and it will give you a good baseline to see if you'll like pharma.' So I took the class with Dr. Lisa Smelser at Central Carolina Community College and realized that pharma was exactly where I wanted to be and what I'd been missing this whole time."

While BioWork sets out to provide students with science education, that is not the only goal of the course, Smelser says.

"We do focus on hands-on technical skills to give students confidence, especially if they are making a transition like Sarah's from a different field," she says. "But we also spend a lot of time making sure that students understand things like shift work and contract positions. That career development piece is a permanent and important part of the experience. We want to make sure that we're setting them up for success so they can articulate their transferable skills, walk out the door with a very strong resume, and be confident when talking with potential employers."

LANDING THE JOB

Cote's early work experience in pharma brought great opportunities and tough choices.

"After I finished in August 2020, Dr. Smelser would hook us up with these virtual career fairs through BioNetwork," she says.

"I work on the CDA/Fill Team," says Cote, who is pursuing a bachelor's degree in biology on the side. "We weigh out raw material to the entire site. We are the start and finish to everything – the process starts with the raw materials being distributed and finishes with the fills being completed.

"Pfizer is a great place to start out and grow your career over time, and I enjoy being a part of a growing industry with a main focus of patient care."

Cote believes her earlier work experiences helped prepare her for her new career.

"If you take the machines and the medical background and the people work, that's everything that a pharmaceutical job is," she says. "I'd love to be an inspiration for young girls who really don't know what direction to take. Pharma is a great career path with a lot of good benefits, so if they take a chance, try it out, and they end up making a career out of it, that would be great to see."

Learn more online at ncbionetwork.org/biowork

NC COMMUNITY COLLEGES | BIONETWORK

BIOWORK

FRONTLINE OF THE FUTURE

PROMOTING DEFENSE TECHNOLOGIES IN NORTH CAROLINA

North Carolina – the Frontline of the Future - is home to a highly capable and diverse innovation ecosystem, fully capable of supporting America's warfighters worldwide. Fortunately, North Carolina is also home to the best infrastructure in the country to help industry- and academia-based innovators to win and successfully execute research and development opportunities with the Department of Defense (DoD).

The North Carolina Defense Technology Transition Office (DEFTECH) is a statewide resource of the North Carolina Military Business Center (NCMBC). Focused on technology transition, DEFTECH scours the state for business and university researchers who are developing new technologies with defense applications. These technologies may fit in one of many research and development (R&D) categories, including human performance, medical and biomedical, advanced textiles, autonomous systems, artificial intelligence and machine learning, cybersecurity and many more. Once identified, DEFTECH helps these innovators to introduce their advanced technologies to DoD, and assists them in navigating DoD agencies and R&D acquisition processes.

In addition to seeking out researchers developing defense-related technologies, DEFTECH also develops market intelligence and sources future DoD and Homeland Security technology requirements to the innovation ecosystem statewide. DEFTECH builds relationships with DoD and military service agencies that develop requirements and acquire technologies - including the Defense Innovation Unit (DIU), Army Futures Command, Marine Corps Systems Command, US Special Operations Command and the military services' rapid fielding organizations - and leverages these relationships to identify, distribute and help innovators to compete for federally-funded research and development opportunities. DEFTECH particularly targets and helps businesses to compete for and win defense-related Small Business Innovation Research (SBIR), Small Business Technology Transfer (STTR) and various Other Transaction Authority (OTA) R&D acquisitions.

DEFTECH employs various methods to engage and communicate with the innovation ecosystem in our state. Innovators can explore the DEFTECH website at www.DEFTECH.nc.gov, review current and anticipated SBIR, STTR and other federally-funded R&D opportunities, and contact DEFTECH by email or phone to register in the DEFTECH network. Once connected, innovators can engage in DEFTECH's Mobilize community (https://nc-defense-technology-transition-office.mobilize.io/network-groups) to network with other businesses and receive updates and teaming opportunities. Finally, businesses can contact DEFTECH to attend the weekly, virtual Coffee Call series and other DEFTECH webinars and in-person events - such as the Defense Technology Symposium in Fayetteville on July 26 - that regularly connect innovators in North Carolina with technology acquisition agencies in DoD and other federal agencies. DEFTECH works daily to ensure that North Carolina remains the Frontline of the Future.

DEFTECH is one component of the North Carolina Military Business Center (NCMBC), a statewide business development and tech transition entity of the State of North Carolina embedded in our community colleges and headquartered at Fayetteville Technical Community College. Charged by the General Assembly with growing the defense economy – the second largest sector of our state's economy ($66 billion annual impact) – the NCMBC business development, DEFTECH and strategic industry staff members serve businesses in all 100 counties from 15 offices across the state. For more information about the NCMBC, visit www.ncmbc.us, and register for free daily federal contract notices at www.MatchForce.org.

Left: An 82nd Airborne paratrooper using a tactical robotic controller for an expeditionary modular autonomous vehicle during a field exercise.

Below: Special Forces conduct a high-altitude, low-opening jump from an Air Force MC-130J Commando II.

PHOTO CREDIT: AIR FORCE MASTER SGT. LEKENDRICK STALLWORT; ARMY SGT. MARITA SCHWAB

PHOTO CREDIT: AIR FORCE SENIOR AIRMAN ALEXANDER COOK

Visit us online at ncmbc.us | deftech.nc.gov | matchforce.org | cybernc.us

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As part of TreeCo's forestry research, the inner stem of a Poplar tree has been gene-edited to appear NC State red.

RESEARCH COMMERCIALIZATION

FOSTERS ENTREPRENEURIAL, ECONOMIC AND INNOVATION EXCELLENCE

NC State is a powerhouse in research commercialization. We've established a streamlined process that connects our faculty with industry partners in order to bring new, innovative technology to the marketplace. NC State research has sparked more than 190 startups and spinoffs, which, alongside our students and alumni, generate $6.5 billion of North Carolina income each year. It's not surprising that the George W. Bush Institute listed us as one of the top 20 universities for innovation impact.

NC State promotes a culture of entrepreneurial and innovation excellence. As the leader of a National Science Foundation I-Corps, we teach teams of researchers how to shepherd their discoveries and inventions into the marketplace. Training includes customer discovery and market research. Teams are also connected to mentors as they decide how best to enter markets.

Since 2010, NC State has been executing a unique seed-funding program that supports short-term, commercially-focused research projects. Supported by Chancellor Randy Woodson, the Chancellor's Innovation Fund awards university innovators up to $50,000 to strengthen the commercial potential of our researchers' intellectual property. The fund helps bridge the gap between public and private funding and encourages products and technology that tackle some of society's most pressing problems.

In the past 12 years, the Chancellor's Innovation Fund has awarded $3.9 million and generated $74.9 million in follow-on funding. Awards aren't limited to a single discipline. Sponsored projects have turned sawdust into packaging materials, created coatings to protect stealth aircraft, accelerated the industrial purification of biotherapeutics and developed microgel-based materials that mimic blood platelets.

PhotoCide Protection, Inc., is just one of the 32 startups launched thanks to the Chancellor's Innovation Fund. Founded in 2018, PhotoCide Protection's technology combines cellulose with photosensitizers to fight various pathogens on surfaces. The company has developed fabrics, plastics and coatings that disinfect themselves. This mitigates the spread of infectious diseases that are transmitted via high-touch surfaces.

LEADING THE PACK

#2
in tech transfer among public universities
Heartland Forward

#4
in startups launched among universities without medical schools
AUTM FY20

CHANCELLOR'S INNOVATION FUND

32
Startups formed by CIF

42
Project technologies licensed

$3.9M
Total awards funded

$74.9M
Follow-on funding generated

Another startup, TreeCo, edits genes to breed healthier forests and, in turn, a more sustainable future. Using CRISPR, TreeCo can shorten the growing cycle of trees and implement other enhancements, like better drought or frost tolerance. Not only does this technology help grow more resilient trees faster — it can also help meet the rising demand for biofuels, plastic alternatives, and sustainably manufactured textiles and paper.

These successful projects are fostered by NC State's Office of Research Commercialization. The office helps our faculty members evaluate, protect and license their technology. By facilitating commercialization of research discoveries, the office helps drive economic growth. For fiscal year 2021, NC State reported $547 million in research expenditures. On Centennial Campus, a premier research park right on campus and the Office of Research Commercialization's homebase, more than 70 corporate, government and nonprofit partners work alongside faculty members and students. NC State research has led to more than 1,500 patents and 600 products reaching the market total so far.

National organizations have taken note of our success. After analyzing universities' invention disclosures, issued licenses and options, gross licensing income, formed startups, cited patents and graduates in STEM fields, the nonprofit Heartland Forward ranked NC State University second among all U.S. public universities, and seventh among all universities, in research technology transfer and commercialization. The Association of University Technology Managers listed NC State as first in active licenses and options and fourth in startups launched among universities without a medical school for fiscal year 2020. The Milken Institute, an economic think tank, labeled Raleigh one of the top 10 best-performing large cities in the United States and cited the collaboration and innovation fostered by NC State — especially Centennial Campus.

Research commercialization is key to NC State's mission of "Think and Do." From laboratory to industry, NC State research has the power to solve global challenges. Innovative ideas are transformed into measurable, tangible benefits. Embodying "Think and Do," our researchers are improving the world, one discovery at a time.


Jack Wang, left, and Rodolphe Barrangou founded TreeCo.

For more details, visit research.ncsu.edu

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INTERNATIONAL INNOVATION

REACHING AROUND THE WORLD FROM NORTH CAROLINA

For more than six decades, RTI International's commitment to innovation has led to landmark scientific discoveries, game-changing research, and life-saving program implementation. Our impact is felt in countries around the world, from the Philippines to Guatemala, Tanzania to Indonesia.

But you don't have to travel far from RTI headquarters in Research Triangle Park to see how we're improving lives and serving clients. Founded in 1958 by Triangle-area universities and government and business leaders in North Carolina, we are motivated by a deeply felt responsibility to serve the people of North Carolina, from Murphy to Manteo, and to deliver on behalf of private- and public-sector clients in our state.

We view innovation as a strategic imperative for success. Our clients choose us because we bring innovative solutions to bear on complex problems. Client-centricity drives us to take an outside-in view of innovation and trains our sights on producing high-quality research and delivering technical services solutions that maximize resources.

Whether individual citizen, policymaker, or government or private partner, we want you to thrive. For example, we know North Carolinians worry about their healthcare. We apply our expertise in health across a span of focus areas, including commercial healthcare. We recently established RTI Health Advance to deliver evidence-based, practical solutions for business and clinical leaders that advance healthcare in North Carolina and across the United States.

Working on behalf of clients, our researchers analyze and evaluate issues and trends that impact health policy and care delivery worldwide. We bridge boundaries through technology, using expertise in areas such as telehealth to customize solutions for federal and state health agencies and improve access to care right here in North Carolina.

We recognize the importance of the military community to our state. Nationally, North Carolina has the fourth-largest active-duty presence and the eighth-largest veteran population. To serve those who have served, we helped determine the effectiveness of Stellate Ganglion Block injections in the treatment of post-traumatic stress disorder. With support from our internal commercialization team, RTI scientists developed the Wearables Research and Analytics Platform (WRAP) to test wearable sensors to monitor military health through longitudinal studies.

RTI is also part of the North Carolina Center for Optimizing Military Performance (NC-COMP), bringing together expertise in research, medicine, health, fitness, engineering, materials, and manufacturing to allow for accelerated creation and deployment of solutions that fill critical military personnel performance gaps. Through NC-COMP, we help prevent injury and improve recovery times for our military members, help soldiers better function in multi-stressor environments and enhance baseline physical and mental performance.

North Carolina, like other states, has been hit hard by the opioid crisis. RTI partners with federal, state, and local government agencies, community-based organizations, and foundations to develop and evaluate strategies to prevent substance use and misuse. Our research benefits not only the populations we study but those served by the practitioners and policymakers who apply our findings in their own communities.

In 2021, we launched the Idea Lab for Equitable Economic Development. Through this collaboration, we are exploring ways to reduce extreme wealth inequality and create resilient economies. Our research into small southern cities shows the importance of reinvention and innovation in places like Boone and Wilmington.

We recently analyzed the costs and benefits of Triangle Residential Options for Substance Abusers (TROSA), an innovative, North Carolina-based, multiyear residential program providing care and education to people with substance use disorder. The program results are compelling: TROSA saves the state $7.5 million annually by preventing arrests, incarceration, and emergency hospital visits.

Our innovative spirit drives us to take on the world's greatest challenges, including climate change and protecting our environment. Last year our scientists received federal funding to develop a cost-effective CO_2 capture system and commercially viable CO_2 utilization solutions for the cement industry. We are also investing in the study and removal of harmful "forever chemicals" present in our air, rivers, groundwater, and landfills, and disposed of at our military bases and manufacturing facilities. Our groundbreaking work to help identify lead in drinking water in childcare facilities in North Carolina—and around the nation—has made children safer.

A highly skilled team of scientists and engineers in our Center for Water Resources has designed, developed, and implemented integrated services and solutions for complex water issues, helping clients respond to water resource challenges using cutting-edge technologies, advanced analytics, and actionable information. The team's state-of-the-art approaches and analysis tools help build understanding and planning around climate resiliency, mapping and modeling, and risk assessment, preparing communities for natural disasters and weather events. We conduct this work here at home and in countries across the globe.

Our mission to improve the human condition globally starts at home. Innovation is a key enabler for the realization of our mission, the strength of our impact, and the reach of our contributions to a better future. We continually grow our partnerships in North Carolina to address the challenges of today and unlock the possibilities of tomorrow.

RTI International is an independent nonprofit research institute dedicated to improving the human condition.

RTI INTERNATIONAL

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SBIR/STTR Specialist John Ujvari presenting at The Chesterfield / LaunchBio in Durham

FUNDING INNOVATION

SBTDC HELPS SMALL BUSINESSES UTILIZE SBIR FUNDING TO DEVELOP NEW TECHNOLOGIES

The higher the risk, the less funding that is available. Such is the quandary of every entrepreneurial, innovation-driven small business that is seeking R&D funding to develop a technology. Triangle Environmental Health Initiative (TE) in Durham and OpiAID in Wilmington are two companies that have faced this challenge.

Enter the Small Business Innovation Research (SBIR) program, a highly competitive three-phase award system that rewards technological innovation of small businesses in critical needs of the federal government. Enacted in 1982, federal agencies with more than $100 million in extramural R&D are required to set-aside 3.2% of their budget for the SBIR program.

SBIR has played a significant role in funding early-stage innovations that are deemed too risky for other entities, such as equity investors and banks. Over $1.4 billion has been awarded to innovation-driven small businesses in North Carolina since the program was launched.

Small businesses that earn Phase I awards can obtain a maximum of $256,000 over six months to fund concept development and feasibility studies. Phase II awardees can receive up to $1.5 million to work on protype development of their technology. Eleven federal agencies currently participate in the SBIR program.

The North Carolina SBTDC is equipped to help small businesses tap into the opportunity that the SBIR program provides. Founded in 1984, the SBTDC was the first Small Business Development Center in the nation to be officially recognized as providing specialized technology commercialization services. The SBTDC is a business and technology extension program of the UNC System, administered by NC State University and operated in partnership with the U.S. Small Business Administration.

The SBTDC's Technology Development and Commercialization program assists eligible small businesses with incorporating SBIR into their funding strategies, identifying appropriate agencies and topics, and providing proposal reviews. The SBTDC also regularly offers SBIR workshops across the state and online.

"We take a holistic approach towards serving our clients," said John Ujvari, SBIR/STTR Specialist at the SBTDC. "We see businesses as a whole and provide education and counseling when specific needs arise. Thousands of innovators have attended our trainings and utilized our one-on-one counseling services."

Resources available to North Carolina small businesses through the SBIR program have grown in recent years, as funding has ballooned from $53.3 million in 2012 to $96.6 million in 2021. Clients of the SBTDC have been taking advantage of the opportunity, receiving 88 percent of all SBIR/STTR funding awarded to North Carolina small businesses.

Between 2012 and 2021, North Carolina's small businesses were awarded 939 Phase I and 452 Phase II awards, worth a total of $718 million. Of the 389 unique awardees, 64 percent were SBTDC clients.

The SBTDC's expert counsel has helped startup Triangle Environmental Health Initiative (TE) leverage funding from the SBIR program to develop its technologies. TE was founded in 2016 to transform the way we think about and use our waste. TE develops water and sanitation technologies with a focus on resource recovery, including non-potable water for flushing toilets.

TE has earned three Phase I and two Phase II awards from the U.S. Environmental Protection Agency. As a result of this funding, TE was able to prove the technology concepts of their wastewater treatment products, pilot and commercialize the products, and establish valuable connections to commercial partners.

"As a small business with limited finances, the SBTDC was a great, free resource to strengthen our early SBIR proposals. We received key insights into reviewer approaches and why many companies struggle to receive SBIR funding," said Tate Rogers, Founder/Principal of TE.

Tate Rogers

Conducting research at Triangle Environmental Health Initiative

Founded in 2019, OpiAID is developing technology to personalize treatment for opioid use disorder (OUD) to make it safer and more effective. Their 14 team members are developing a decision support tool that collects and collates data from a patient's health record to provide timely and actionable data to support clinical decision-making. This allows for just-in-time interventions that can save a life.

OpiAID won a SBIR Phase I grant from the NIH to develop a biometric algorithm capable of detecting withdrawal and relapse with a wrist worn device. OpiAID has applied for a Phase II grant to commercialize this technology.

"SBTDC's one-on-one counseling and workshops have been great. We are excited for the opportunity to help clinicians provide even better care for our neighbors in recovery," said OpiAID founder David Reeser.

In 2021, the SBTDC's Tech Team worked with 362 clients and helped them obtain over $50 million in funding, including SBIR/STTR, angel investment, and venture capital. Given these results, the SBTDC continues to be recognized as an important part of North Carolina's ecosystem for technology-based small businesses.

LEADERS IN THE MAKING

RESEARCH-FOCUSED STUDENTS GAIN FIRST-HAND EXPERIENCE IN THEIR FUTURE CAREERS

At the University of North Carolina Asheville, students across more than 30 majors take their learning outside of the classroom and into the real world through undergraduate research projects, closely mentored by faculty who are experts in their fields. With about 3,300 students, UNC Asheville is known for its dynamic, leadership-focused, relationship-driven education. As the original home of the Council on Undergraduate Research (CUR), the site of the first National Conference on Undergraduate Research (NCUR), UNC Asheville continues to set a high bar with research projects that address pressing issues, merge technology and social commentary, and support the local economy.

CHEMISTRY STUDENTS DRIVE RESEARCH FOR DEVELOPING A CUTTING-EDGE ANTIBIOTIC

GlaxoSmithKline Distinguished Professor in Molecular and Chemical Biology Amanda Wolfe and Assistant Professor of Chemistry Ryan Steed are combining their research specialties of Medicinal Chemistry and Biomolecular Chemistry, respectively, to develop a new antibiotic that treats Pseudomonas aeruginosa, a form of bacteria that is currently antibiotic treatment-resistant.

Their initial research, conducted entirely with UNC Asheville undergraduate research students, has been promising. "This new antibiotic would be able to eliminate drug-resistant strains of Pseudomonas aeruginosa because it works in a novel way," explains Wolfe regarding the new antibiotic that her student-driven team is developing.

The project, which recently received a National Institutes of Health Academic Research Enhancement Award of over $380,000 to support six students with stipends to continue developing their research over the next three summers (2022-2024), was piloted in an upper-level laboratory course with chemistry undergraduates collecting data over multiple semesters. "This aspect is pretty unique and demonstrates the applied and cutting-edge education-focused research that we provide our chemistry majors at UNC Asheville." Adds Steed, "The student involvement and impact that our undergraduates experience aligns UNC Asheville in the prestigious company of other elite research-active undergraduate institutions."

NEW MEDIA STUDENTS WITH "EPIC" OPPORTUNITIES

UNC Asheville Assistant Professor of New Media Victoria Bradbury integrates gaming skills and technology at the service of art and social commentary.

With the assistance of student research assistants, including a music technology major who designed the score, Bradbury recently created Blue Boar VR - a virtual reality game developed on the Unreal Engine featuring her 10th-great grandmother, who was tried and convicted in the Salem Witch Trials.

"I have taught physical computing in my advanced interactive class, and being able to interface that with Unreal [is] really exciting," says Bradbury. She surmises her students will also enjoy "employment possibilities" stemming from learning "a variety of software applications in addition to VR." She continues, "There is a lot of interest in Unreal because of the broad applications – not only as a game engine. Unreal is being used in industry, and Epic Games is headquartered right here in North Carolina – in Raleigh."

After completing Blue Boar VR, Bradbury was awarded a $44,000 Epic MegaGrant from Epic Games so she and her students could work on tying together Epic's Unreal Engine – the software used in games like Fortnite – with physical computing using microcontrollers.

The award was applied to two 2021 grant-funded projects with three students hired on for roles including games programming and sharing the web and social media work. Bradbury hopes that disseminating this grant-funded work online and through conference presentations will bring attention to new possibilities in new media art and design, interactive design, and new media pedagogy.

MANAGEMENT STUDENTS IN REAL-WORLD BUSINESS

Students rarely get the opportunity to gain substantive experiences with real businesses outside of an internship, yet, Susan Clark, associate professor of management at UNC Asheville, provides students the chance to do just that. Each year, approximately 12 top management students are selected to be part of a consulting practicum that offers direct support to a local Western North Carolina business. In spring 2022, Clark and her students, through an ongoing relationship with the Asheville Area Chamber of Commerce, partnered with local business Darë Vegan Cheese.

In this student-led consulting practicum course, undergraduates apply theoretical knowledge to develop a strategic business plan and identify teams to contribute innovative deliverables to help a business scale up production, sales, and success.

While working with Darë Vegan Cheese, the students conducted extensive market research and determined an ideal target customer. They also identified strategic business partners and initiated national distribution pathways to sell more products. From their experience, students gained concrete expertise to add to their resumes and portfolios and received real-world job market preparation.

"We completed multiple projects, including legal analysis, certification feasibility studies, and real-time business development strategies [to develop] a living business plan that the CEO can use to maximize her potential for success," said Darden Smith, a student in the business development team. She feels her most valuable takeaway from the project which will be "applicable to success after graduation" was "working with the teams to produce exceptional content with academic rigor and professional excellence, all within budget and on a precise timeline."

At UNC Asheville, these are just a few examples of students engaging in undergraduate research projects at the frontiers of their fields. Through real-world research projects, students gain invaluable experience in collaborative project design, data analysis, and communication, and are applying in-demand skills at the forefront of their communities and workforce.

To learn more about UNC Asheville visit us online at www.unca.edu

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POWERING THE ECONOMY

THROUGH A STRONG INFRASTRUCTURE AND WORKFORCE

Since its founding in 1789, UNC-Chapel Hill has served as an engine to drive North Carolina's economy. Over two hundred years later, Carolina continues to invest in critical infrastructure to grow and attract new industries to the state and generate the workforce needed to staff them.

NEW SCHOOL FOR DATA SCIENCE & SOCIETY

Recent announcements by Google and Apple to locate major operations within the state will create great demand on its workforce of data scientists, software engineers, and machine learning and AI innovators. To support the needs of our data-intensive industries, the university will establish the new **UNC School for Data Science and Society** in the fall of 2022.

UNC's Data Science School will foster the region's next generation of data science leaders. Beyond teaching the elements of managing and interpreting data, it will train students to apply data science to solve complex problems that achieve public good. Built on a cross-cutting model, the new school will feature faculty with joint appointments in other schools to ensure the expertise required to apply data science skills. Both graduate and undergraduate programs will be offered, as will training opportunities for campus and industry partners.

TAPPING DIGITAL HEALTH'S BUSINESS POTENTIAL

The oceans of data generated by today's digital society, especially within the health care industry, offer transformative business opportunities.

A case in point – the unique collaboration of **Dr. Eric Weimer** in the UNC School of Medicine and **Katherine Newhall, PhD** in the UNC College of Arts & Sciences' Department of Mathematics. Their work intersected after Weimer, an organ transplant specialist, wondered if mathematical modeling could enhance the precision of matching patients in need of organ transplants to donated organs compatible with their immune systems.

Enhancing a process that had previously been conducted in labs using tests and the best judgment of doctors, the two collaborated on a predictive mathematical model to better refine compatibility determinations. Ultimately, they enlisted experts from Microsoft to develop a machine learning process that trains computers to amplify the accuracy of these multifaceted risk assessments.

Weimer and Newhall's process was supported by **UNC's Digital Health Venture Studio**, a novel program which rapidly advances promising digital health technologies. The team completed an intensive and competitive venture development process that culminated with **Epulate**, a startup currently pursuing venture capital for an AI model and workflow tool that taps a national database and helps match patients to immunologically compatible donor organs.

NEW INNOVATION AND ENTREPRENEURIAL SPACES

Since the late 1950s, UNC-Chapel Hill has launched over 844 new businesses for the State of North Carolina, creating over 89,000 jobs. Building on that legacy, Chancellor Kevin Guskiewicz has committed the university to a new chapter of catalyzing regional economic growth.

An **innovation district** in downtown Chapel Hill is sparking business and industry growth along the Franklin and Rosemary Street corridor. A central feature of the plan is a 20,000-square-foot **UNC Innovation Hub** housed within a newly renovated Grubb Properties commercial building across the street from campus. The Grubb building will feature wet labs to provide much needed co-working space for UNC life sciences startup ventures. **BioLabs North Carolina** will be one of the first tenants. Announced last fall, BioLabs and the university are developing a strategic partnership to increase the number of startups established through UNC-Chapel Hill faculty research.

NC INVESTMENTS IN ANTIVIRAL RESEARCH PAY OFF

Carolina's status as a top-ranked global research institution for virology and infectious disease is paying major dividends for the state of North Carolina. UNC's **Rapidly Emerging Antiviral Drug Development Initiative (READDI)** links the university's virology experts with researchers and industries worldwide. Founded with internal seed funding from the UNC **Vice Chancellor for Research**, and supported by the **Eshelman Innovation Institute**, READDI has attracted funding from **RTI International**, the **NC General Assembly** and **NC Collaboratory**. These investments recently paid off for North Carolina in the form of a $65 million award from **NIH** to establish a new **Antiviral Drug Discovery Center** at UNC. While READDI is built solidly on the back of UNC's scientific expertise, it has been developed with a critical eye to the role it can play in regional economic development – creating opportunities for other North Carolina research universities and for industry.

PARTNERSHIP WITH COMMUNITY COLLEGES

As part of a commitment to forge new connections to North Carolina's community colleges, UNC has partnered with **Central Carolina Community College** to help launch **NEXT LEVEL**, a new comprehensive business startup program funded by **NC IDEA** that targets entrepreneurs building scalable businesses with potential national or worldwide reach. The **CCCC Small Business Center** and **Innovate Carolina** will work together to develop programming for these prospective high-growth business owners.

The **UNC Innovation Hub**, located in the heart of Chapel Hill, is home to **Innovate Carolina**, the university's launch pad for innovation and entrepreneurship.

To partner with us or to join our growing footprint of innovation space, please visit innovationhub.unc.edu.

UNC | INNOVATE CAROLINA

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TRANSFORMING POWER

WHAT'S NEXT FOR ENERGY IN NORTH CAROLINA

UNC Charlotte's Energy Production & Infrastructure Center (EPIC) is helping North Carolina meet its goal to reduce carbon emissions by 70% by 2030 and reach net zero by 2050. Groundbreaking research and preparing students as leaders in dynamic, evolving fields are driving this effort.

"EPIC's founding mission prioritizes its role as a workforce developer," said Mike Mazzola, Duke Energy Distinguished Professor and director of EPIC for The William States Lee College of Engineering. "Knowledge transitions when our students graduate and start their careers, deepening our impact on the field of transformational energy."

A recent $41.2 million investment from the N.C. General Assembly for "Engineering North Carolina's Future" allows UNC Charlotte to recruit an additional 2,000 students over the next five years in engineering, computer science and data science – as well as hire additional world-class faculty and expand facilities and academic programs.

With support from the U.S. Department of Energy and more than 250 regional partners, here are four ways UNC Charlotte is driving unparalleled advancements in critical areas of need for North Carolina.

MICROGRID RESILIENCE

Microgrids – networks of electricity users with a central supply source – attach to a centralized energy grid; their design allows them to function autonomously if the primary grid becomes inoperable. Across North Carolina, microgrids provide essential backup – and keep communities operating – during major power outages.

In EPIC's Duke Energy Smart Grid Laboratory, researchers are developing ways to strengthen microgrids to improve their resilience. A $3.5 million grant from the DOE is supporting development and testing of control strategies to enhance the reliability of microgrids state- and nationwide.

"Through our partnership with DOE, we are demonstrating how microgrid technology helps communities better prepare for and mitigate the costs associated with power disruptions — more equitably and safely than today," said Robert Cox, EPIC's associate director. "EPIC is on the leading edge of a solution to a problem that will improve lives throughout North Carolina."

NUCLEAR CONSTRUCTION

Nuclear energy, the world's second-largest source of low-carbon electricity behind hydropower, is a clean energy option. However, energy companies have shied away from it due to a combination of factors, such as permitting issues, construction of infrastructure that houses the reactor, and the cost and time to complete projects.

With support from the DOE's National Reactor Innovation Center, EPIC is showing how "digital twins" help reduce overruns, making nuclear energy more affordable and attainable. Most used in advanced manufacturing, a digital replica of the as-built infrastructure is used by inspectors, designers and constructors to answer questions that arise during construction and reduce downtime.

Currently part of the DOE's Advanced Construction Technology Initiative led by GE Hitachi, the approach is solidifying EPIC as part of the nation's go-to research team for bringing digital techniques to nuclear construction, according to Cox.

"Our work is getting the U.S. back on track to complete nuclear projects on cost and on time," he said.

SECURING ENERGY INFRASTRUCTURE

Critical energy infrastructures are constantly vulnerable to intentional disruptions by hackers and cyber criminals, whose interference damages supply chains and other business operations – such as last year's attack on the Colonial Pipeline.

A solution lies in the development of security features integrated into a system's hardware in addition to its software, eliminating the need for passwords – widely considered any system's weakest link. Fareena Saqib, associate professor of electrical and computer engineering, who leads UNC Charlotte's Hardware and Embedded Security Lab, is researching ways to make hardware security an intrinsic feature of any device. "Any device should — and can — be responsible for keeping itself secure," she said.

As part of the federal government's priority to fill thousands of cybersecurity jobs that require specialized training, Saqib is leading a consortium of universities that is developing certification programs in cybersecurity and artificial intelligence. These programs, supported by the

U.S. Department of Defense and National Security Agency, are available to transitioning military personnel and first responders through UNC Charlotte and its three consortium partners across the country.

ELECTRIC VEHICLE SOLUTIONS

As North Carolina emerges as a key hub for electric vehicle manufacturing with more than $1 billion in recent investments by Toyota and VinFast, and Arrival announcing its North American headquarters in Charlotte, EPIC is developing ways to support the state's leadership in this growing industry. Last winter, EPIC unveiled PoleVolt™ , an innovation with potential to benefit car owners who live in multifamily housing or urban areas without a dedicated charging source.

Harnessing energy from existing infrastructure and street lights, this technology – currently in a pilot phase – is supported by the U.S. Department of Energy's Vehicle Technology Office and was developed in partnership with Duke Energy, the city of Charlotte and the Centralina Regional Council.

"PoleVolt™ is a great example of what can be accomplished through a productive public-private partnership," said Cox. "It shows how researchers and students – working collaboratively with industry experts – apply research to real problems and develop cost-effective solutions that support people as well as regional industries."

For more details, visit epic.charlotte.edu

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PRECISION NUTRITION

RESEARCHING HOW EACH OF US CAN EAT UNIQUELY FOR OPTIMAL HEALTH

An internationally recognized center, the UNC Nutrition Research Institute (NRI) conducts innovative basic and translational science to establish how individual differences in nutrient requirements and responses to diet affect our nutritional needs.

The NRI is a unit of the University of North Carolina at Chapel Hill and is located on the North Carolina Research Campus in Kannapolis, NC. NRI principal investigators hold faculty appointments in the departments of Nutrition and Psychology and the School of Social Work at UNC-Chapel Hill. Their research questions nutrient roles in disease prevention and risk with an emphasis on some of the most urgent nutrition-related, chronic health concerns facing our society today—brain health, cancer, and cardiometabolic diseases—across the lifespan from periconception through aging.

Our scientists have demonstrated, in specific populations, the need for certain essential nutrients, the high-risk nature of some diets, the link between obesity and cancer, and the prevalence of fetal alcohol spectrum disorders. This work explores the impact of gene-environment and gene-nutrient interactions by using advanced approaches including nutrigenetics, epigenetics, nutrigenomics, metabolomics and microbiomics.

The NRI houses research cores that offer a wide range of services to researchers. Cores offer shared resources including cutting-edge technologies, high-end instrumentation, technical support, and education. NRI cores enhance and expand the collaborative capabilities of research at the institute, at the North Carolina Research Campus, across the UNC-Chapel Hill campus, and throughout the worldwide research community.

NRI Research Cores

Animal Metabolism Phenotyping

Human Research

Metabolism and Metabolomics

Precision Nutrition

The Human Research Core features one of the few whole-room human calorimeters in the United States. This advanced research suite uses indirect calorimetry to evaluate a research participant's 24-hour energy intake and expenditure. The suite is equipped with a bed, treadmill, bathroom, airlock chamber for food delivery, ports for blood draws, and entertainment options. Data can be collected without interruption during meals, sleep, and light activity. The whole-room calorimeter is essential for studies on energy balance and fuel use.

MISSION: To understand how nutrition affects personal health through our leadership in precision nutrition research, finding how differences in our genes, gut bacteria, metabolism, and environment shape our individual disease risk.

VISION: To use scientific discovery to ensure optimal health through individualized nutrition.

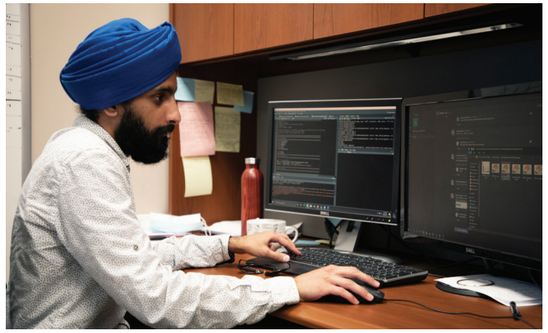
Located in the greater Charlotte region, Kannapolis is a blossoming community, steeped in history, full of charm, and currently experiencing a remarkable renaissance in its downtown. The people who make up the NRI have wide-ranging expertise and skills—professors of nutrition, psychology, and social work and psychiatry, postdocs, laboratory technicians, doctoral students, interns, administrators, and administrative support staff—and have come to Kannapolis from all parts of the world. As diverse as this community is, they have agreed on a set of values to which they commit themselves while conducting their work in service of the NRI mission and vision: Integrity; Innovation; Collaboration; Dedication; Research Excellence; and Diversity, Equity, and Inclusion.

A 501(c)(3) nonprofit organization, the NRI was launched in 2008 as a primary partner of the North Carolina Research Campus. The institute is housed in a 125,000-square-foot building featuring state-of-the-art laboratory and research spaces, clinical facilities, and offices and meeting areas.

With this advanced facility and technology, NRI research scientists are making important discoveries for worldwide health. In turn, this intellectual capital is fueling an economic engine to attract business opportunities and create new jobs for North Carolinians. The NRI is training a skilled biotechnology workforce that serves life sciences and nutrition companies located in the Piedmont.

As a nonprofit research center at UNC-Chapel Hill, part of the state university system, the NRI receives an annual state appropriation, and is additionally funded by federal and other research grants, and private donor gifts to explore new scientific ideas, recruit the world's best scientists, and provide hands-on education and mentoring of students. The NRI embraces the University's mission, which includes public service, by producing annual training workshops, symposia, and seminars for scientific researchers, and a full slate of free programming to translate the good works of the NRI for the public.

The NRI welcomes inquiries for collaborative opportunities and its service cores and encourages everyone to learn about precision nutrition in order to Eat Uniquely.



For more information, visit us online at uncnri.org

UNC | NUTRITION RESEARCH INSTITUTE

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OUT OF THE LAB AND INTO THE WORLD

UNCW'S NEW COASTAL AND OCEAN SCIENCES DOCTORAL DEGREE INTEGRATES ENTREPRENEURSHIP WITH THE AQUATIC ECOSYSTEM

by Venita Jenkins

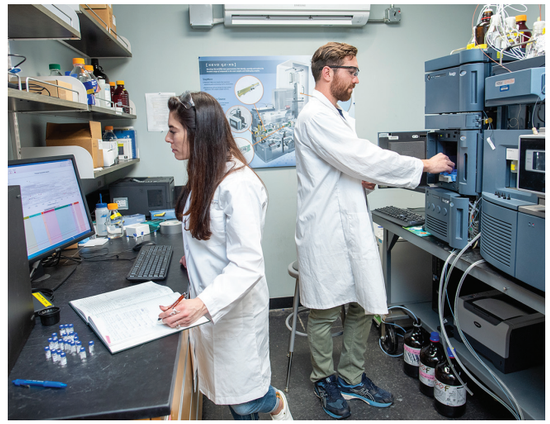
UNC Wilmington's new Ph.D. in Applied Coastal and Ocean Sciences builds on the university's 50-year history of marine sciences research and education by providing students with a robust marine science degree alongside additional learning and training and opportunities to develop dynamic entrepreneurship and technology development skills.

The new doctoral program, set to begin in fall 2022, leverages UNCW's unique coastal location and has the potential to contribute to the regional and national blue economy. The blue economy encompasses a broad range of economic and sustainable uses and benefits of the ocean, including fisheries, aquaculture, biotechnology, maritime transport, tourism and recreation, energy and mineral resources, waste management and impacts of climate change. The Organization for Economic Cooperation and Development estimates that oceans contribute $1.5 trillion annually to the global economy.

"The Applied Coastal and Ocean Sciences program formally integrates entrepreneurship topics to help students envision new applications for their ideas in business, policymaking, and other areas of targeted problem solving," said Dr. Steve Skrabal, graduate program director and chemistry and biochemistry professor. "Our graduates will not only be prepared for the academic job market but also well-qualified to enter the workforce in the private and policy sectors or as entrepreneurs starting their businesses."

UNCW has deep experience in marine natural products chemistry and drug discovery through its Marine Biotechnology in North Carolina (MARBIONC) program, a research and development program located at the university's Center for Marine Science. Dr. Jennifer McCall, assistant professor in the Clinical Research Program, and her husband, Sam McCall, founded SeaTox Research Inc., which focuses on drug discovery and developing natural products into new bio-actives, as well as developing faster, easier-to-use testing for toxins that might contaminate commercial seafood. SeaTox Research is one of a number of commercial tenants in MARBIONC. Science also meets innovation in the development of an instrument to measure coral health indicators called CISME, "Coral In Situ Metabolism," by Dr. Alina Szmant, coral reef ecologist and former marine biology professor, and Dr. Rob Whitehead, a Center for Marine Science research specialist.

"With the ACOS degree, we will educate and train scientists who can think about how to get their discoveries out of the laboratory and into the world, making a positive impact," said Dr. Stuart Borrett, associate provost for research. "UNCW has a strong history of preparing stellar scientists skilled at working on basic, curiosity-driven research questions. With this program, we will position them to collaborate effectively with entrepreneurs or become professional innovators themselves. Most importantly, we will encourage them to ask research questions and pursue discoveries that seek solutions to critical problems and address the needs of society."



The blue economy is critical for North Carolina, which possesses the seventh-longest coastline in the U.S. – the longest along the Atlantic seaboard, and the second-largest East Coast estuary, Skrabal said.

"Given growing societal dependence on coastal and marine systems in the face of daunting marine environmental challenges, partnerships between communities, businesses, non-governmental organizations, and UNCW – as the state's coastal university – are critical for building deep understanding in marine sciences," said CMS Executive Director Ken Halanych.

Research at CMS encompasses 108 faculty members from within all UNCW colleges. CMS researchers work around the world to address societal issues and understand environmental change. Such research includes:

- Development and deployment of the Seahawk-1 nano-satellite for remote sensing of ocean properties from space
- Development of potential pharmaceuticals from marine organisms
- Development of coral protection and spawning techniques
- Development and application of ocean sensors, including one for monitoring carbon dioxide in the ocean
- Maintenance and study of marine algae species, including those involved in harmful blooms
- Studies of perfluorinated compounds, including Gen-X and other contaminants in surface waters, rainwater and groundwater in the Cape Fear region
- Marine aquaculture of economically important fish and shellfish species
- Studies of sea-level rise and shoreline changes
- Coastal Ocean Research and Monitoring Program (CORMP) provides data for improving maritime safety, weather and ocean conditions, climate change forecasting, and underwater autonomous vehicles for ocean sensing

"Our faculty expertise related to emerging coastal issues, our excellent infrastructure with a growing entrepreneurial emphasis, coastal location, and connections with coastal constituents create a synergy that allows Ph.D. students a distinctive opportunity for understanding and pursuing applied research relevant to coastal communities in the state and across the globe," said Skrabal.

For more details, visit uncw.edu/cms

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LEADING THE WAY TO AGING WELL

Aging affects everyone, so keeping ourselves and senior loved ones healthy is vitally important. What does it take to age well? A team of physician-researchers at Atrium Health Wake Forest Baptist and Wake Forest University School of Medicine – the academic core of the Atrium Health enterprise – are leading the way to ensure that we age well.

Ranked among the top 15 national centers in aging research funding from the National Institutes of Health, these regional institutions are having national impact. The School of Medicine has one of the largest geriatrics and gerontology faculties in the country and is the coordinating center for many nationally prominent aging research trials and NIH research centers focused on improving health in older adults. Wake Forest University School of Medicine has the longest designation, since 1990, as a National Institutes of Health-funded Claude Pepper Older Americans Independence Center in the United States.

Wake Forest University School of Medicine is a recognized leader in geroscience, the study of approaches to slow the rate of the aging process.

Further, the School of Medicine is the only National Institutes of Health Alzheimer's Disease Research Center in the nation co-located with a Claude Pepper Center in the Department of Internal Medicine. This fosters a focus on common lifestyle changes – controlling blood pressure, diabetes treatment and obesity – to provide the best care options for reducing the risk of Alzheimer's disease and physical disability at any age.

Wake Forest University School of Medicine is also a leader in research on the best diets that maintain the correct balance of proteins, carbohydrates and fats to promote healthy aging. The impact of the ratio of these dietary components changes as we age and we study approaches to adjust these components to the level that is safest.

The School of Medicine and Atrium Health's Pepper Center has the largest repository of muscle biopsies in the country, assisting efforts to determine which types of exercise and diets are most suitable for healthy aging.

The unique emphasis of the Alzheimer's Disease Research Center is illustrated in the nationally and internationally recognized research that supports:

- the largest study in the United States looking at how the combination of healthy diet, exercise and cardiovascular risk factor control can preserve memory and thinking and other cognitive skills.
- one of four centers in the nation testing ways to better help caregivers of persons with Alzheimer's disease and other dementias during their Alzheimer's journey.
- 300+ families receiving counseling in everything from how to transfer a loved one to the next level of care, how to achieve better sleep habits, how to calm anxiety experienced when a person recognizes increases in memory lapse, the impact of losing a driver's license and how to find and use the resources available where they live. Almost no other aging center in the country has this level of connection to the families of persons dealing with the disabling effects of Alzheimer's disease.

Wake Forest University School of Medicine is a recognized leader in geroscience, the study of approaches to slow the rate of the aging process. Wake Forest researchers are exploring why some individuals seem to age and develop aging related diseases earlier, perhaps linked to why some people at age 85 look their age, while others look much younger. The current research focuses on how to remove specific types of cells that seem to accelerate the aging process.

Wake Forest Baptist Health's combination with Atrium Health has substantially fostered the use of electronic medical records to proactively check-in with patients who are most in need of care due to their frailty of memory difficulty.

This is a defining moment for innovation in health care and the treatment of patients across the world. By cultivating excellence at the nexus of patient care, medical research, and education, Atrium Health Wake Forest Baptist and Wake Forest University School of Medicine continue to foster an environment that benefits patients and families while advancing health care for the nation and the world.

Investing in research means more treatments, cures and care for both patient and caregiver. Philanthropic support of the research mission is key in seeking to recruit top-tier faculty, and these commitments allow for faster movement and building of translational bridges which will allow research and discoveries to be more seamlessly and quickly integrated into clinical care.

For more information on how to support research, contact the Office of Philanthropy and Alumni Relations at Atrium Health Wake Forest Baptist and Wake Forest University School of Medicine. Giving.WakeHealth.edu or 336-716-4589.

For more details, visit School.WakeHealth.edu

Wake Forest University
School of Medicine

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