

DECEMBER 1, 2024

COLLABORATORY.UNC.EDU

NORTH CAROLINA COLLABORATORY

ANNUAL REPORT



Background image is a photomicrograph of a thinly cut section of lithium-containing pegmatite from western North Carolina

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DIRECTOR'S LETTER

When I teach my class "Science for Hyperpartisan Times," here at UNC, I invariably quote Daniel Sarewitz, a leading author on science policy issues.

"Technology is what links us to human experience; it is what makes science real for us." What Sarewitz is talking about is innovation. As it's defined, innovation is simply a new idea, method, or device.

Home to some of our nation's best academic research faculty and infrastructure, there is no shortage of big ideas right here in North Carolina. However, without focused research funding and project oversight, innovation would never leave the lab. So, perhaps another way to look at innovation is the support structure necessary to both fuel and progress the development of new ideas, methods, or devices.

Created by the North Carolina General Assembly in 2016, the Collaboratory was established to facilitate the dissemination of the policy and research expertise found throughout our colleges and universities for practical use by State and local government. A unique model, unparalleled in scope and magnitude, the Collaboratory provides a front porch to the University of North Carolina System and beyond for our elected leaders. This year alone, the results of the legislative investments in academic R&D through the Collaboratory have led to the creation of three startup companies.

Sorbenta, an NC Pure offshoot, will manufacture resins that remove Per- and Polyfluoroalkyl Substances (PFAS) from water four times more effectively than currently available filtration technology. Using AI, PatientReady, a partnership between Winston-Salem State University and UNC School of the Arts, will enable virtual training for nursing students and medical professionals. And, Goldie will offer life-saving resources for people overcoming the challenges of opioid use disorder through a partnership with Eshelman Innovation at UNC-Chapel Hill.



With a current research portfolio consisting of more than 230 active projects – far too many to include in the pages of this annual report – the Collaboratory is a key component of the State's R&D landscape. Through our work in both the field and the lab, the Collaboratory is making science real for the ten-million plus North Carolinians on whose behalf we work to provide new knowledge, technologies, and understanding to address some of the State's most pressing challenges.

If it's innovation you seek, welcome to the Collaboratory.

A handwritten signature in black ink, reading "Jeffrey Warren".

Jeffrey Warren, PhD
Executive Director, NC Collaboratory



Megan Mendenhall/UNC Research

WHAT WE DO

EST. 2016

SCIENCE. POLICY. SOLUTIONS.

The North Carolina Collaboratory is a research funding agency that partners with academic institutions and government entities to transform research into practical information and technologies for use by State and local governments and the communities they serve.

Since its authorization in 2016 by the General Assembly (see 31a N.C.G.S. §116-255), the Collaboratory has stewarded approximately \$225 million in appropriations from the legislature, investing in over 600 research projects that have the potential to develop innovative, evidence-based solutions that benefit our State and its residents.

Initially focused on environmental and natural resources, the scope of the Collaboratory's portfolio has expanded to include projects focused on public health, education, technology, and infrastructure.

Given the Collaboratory's history, our mission has always been clear: To serve the State.

"The Collaboratory is a shining example of our mission of service to the people of North Carolina. The Collaboratory team ensures that our expert researchers have the resources they need to be impactful in practical ways across our great state. I'm grateful indeed that we can provide a platform to tackle the challenges of today and address the problems of tomorrow."

— **Lee H. Roberts**

Chancellor, UNC-Chapel Hill

OUR MISSION

To address pressing environmental, economic, education, public health, and medical issues faced by North Carolinians through academic research that:



**Advances
Knowledge**



**Informs Policy &
Practice**



**Accelerates
Innovation**

The Collaboratory funds and facilitates research in service to the people of the State by supporting mutually beneficial partnerships that bridge the gap between academia, government, industry, and community. The Collaboratory seeks to achieve a more prosperous future for North Carolinians through efficiently stewarding taxpayer dollars for impactful academic research.



SUSTAINED SUCCESS

Megan Mendenhall/UNC Research

2016

COLLABORATORY BEGINNINGS

The North Carolina General Assembly (NCGA) approved Session Law 2016-94 which established the North Carolina Collaboratory with funding of \$1 million annually.

The Collaboratory was directed to utilize the research expertise of the UNC System for the benefit of State and local governments. The legislation charged the Collaboratory with focusing on environmental and natural resource issues.

1ST FUNDED PROJECTS

- Recovery efforts and resiliency planning following Hurricane Matthew
- A multi-year study of Jordan Lake nutrient issues
- An evaluation of the aquaculture industry in North Carolina

2018

NC PFAS TESTING NETWORK

The Water Safety Act provision in Session Law 2018-5 directed the Collaboratory to work with multiple academic institutions to address the impacts of forever chemicals, known as PFAS, in North Carolina. The legislation included an appropriation of over \$5 million and led to the creation of the PFAS Testing Network.

2020

COVID-19 RECOVERY

Session Law 2020-4 included \$29 million in funding for the development of a research portfolio related to aspects of COVID-19 and the pandemic. The Collaboratory funded projects focused on vaccine research, economic development issues, and a myriad of public health topics.



Dan Sears/UNC-Chapel Hill

2021

CODIFICATION

In the 2021 budget bill, Session Law 2021-180, the Collaboratory was codified into statute in Article 31A. The Collaboratory's mandates from the NCGA were expanded beyond environmental to all fields of research that might be of interest to policymakers or citizens of the State.

2023

ADDITIONAL FUNDING

The NCGA's October budget bill included new funding and additional directives for Collaboratory projects, including:

- Recurring funding for PFAS to ensure that forever chemicals have forever funding.
- \$15 million in funding to support a research portfolio focused on Next-Gen Energy.
- A new partnership between the Collaboratory and NC Innovation to strengthen the State's innovation economy.

2024

OFFICE OF LEARNING RESEARCH

In November 2024, the NCGA approved Senate Bill 382 to establish the Office of Learning Research within the Collaboratory. The legislation provides \$1.5 million annually to contribute data for evidence-based decisions, implement programs to accelerate learning, and evaluate ROI.

SIGNATURE PROGRAMS

This year also included a large increase in funding for Collaboratory projects, which led to the creation of some of the Collaboratory's foundational programs:

HISTORICALLY MINORITY-SERVING INSTITUTIONS

Providing research funding and capacity building.

LEARNING RECOVERY NETWORK

Assessing educational policies in a post-pandemic setting.

OPIOID ABATEMENT & RECOVERY PROGRAM

Research to support recovery and community efforts.

2022

OPERATIONAL COSTS

UNC-Chapel Hill, the headquarters of the Collaboratory, more formally solidified its longstanding support of the Collaboratory by agreeing to cover all of the Collaboratory's operational costs with non-State funds, ensuring that every State dollar from the NCGA to the Collaboratory is harnessed for the power of research.

LOOKING FORWARD

Since 2016, the North Carolina Collaboratory has grown into a dynamic force for impactful research across the State. As we look ahead, we remain committed to forging new partnerships and leveraging cutting-edge research to solve the challenges of tomorrow, ensuring North Carolina remains a leader in innovation for years to come.



Courtesy of Fayetteville State University

FUNDED INSTITUTIONS

To date, the Collaboratory has funded projects across all 17 University of North Carolina System institutions, as well as at numerous private colleges, schools, and academic centers.



2023-2025 BIENNIAL FUNDING

In October 2023, the North Carolina General Assembly passed its biennial budget, appropriating over \$67 million in new dollars to the Collaboratory for the upcoming fiscal biennium, and tasking the organization with managing the distribution of up to \$140 million for NC Innovation. Funding amounts and brief project descriptions of these legislative provisions and directives are below:



\$28 MILLION PFAS

This directive includes implementing an aqueous film-forming foam buyback program, evaluating PFAS destruction technologies, a human exposure study, water-related research on emerging compounds and more.



\$3.5 MILLION ARTIFICIAL INTELLIGENCE

The budget provides funding to study the use of AI in improving non-confidential patient information.



\$15 MILLION NEXT-GEN ENERGY

Next-generation energy research & development will focus on building business-academia partnerships within the State.



\$3 MILLION HISTORICALLY MINORITY- SERVING INSTITUTIONS

The research grant program is specified for institutions in the UNC System identified as historically minority-serving, and includes ECSU, FSU, NCA&T, NCCU, UNC-Pembroke, and WSSU.



\$10.7 MILLION OPIOID ABATEMENT

This appropriation is designed to fund research to assist with opioid mitigation and recovery efforts across the State.



\$1.5 MILLION ENDOMETRIOSIS

The Collaboratory received funds for targeted research on endometriosis.



\$300,000 RECOVERY COURTS

This appropriation is for conducting a study of existing, judicially managed accountability and recovery courts (JMARC)s, including drug treatment courts.



\$660,000 FERRYMON & MODMON

The ongoing FerryMon and ModMon programs collect and assess water quality data in the Albemarle-Pamlico and Neuse River Estuaries.



\$4 MILLION DIGITAL ENGINEERING

These funds will support grants across the UNC System focused on providing cloud-based, high-performance computing resources, which leverage data and technology to produce improvements to applications—or even entirely new solutions.

The Collaboratory is grateful to the North Carolina General Assembly for providing the funding that makes our work possible and UNC-Chapel Hill for supporting our operational costs through non-State funds.



ENVIRONMENT & NATURAL RESOURCES

STRENGTHENING NC'S FLOOD RESILIENCY EFFORTS

Since its creation in 2016, by the NCGA, the Collaboratory has been a leader in supporting research to reduce flooding from storm events. In response to Hurricane Matthew, which occurred in October 2016, the Collaboratory's first major research projects focused on assisting in recovery efforts. The Collaboratory's research team supported planning efforts in six eastern North Carolina towns to enhance the rebuilding efforts in these communities.

Following that work and after Hurricane Florence in 2018, the NCGA directed the Collaboratory to conduct a comprehensive Flood Resiliency Study. The Collaboratory's multi-year research study culminated in a final legislative report in 2021, which included several priority policy and funding recommendations.

NORTH CAROLINA FLOOD RESILIENCY HUB

Since the submittal of the 2021 legislative report, the Collaboratory has been active in flood resiliency research by creating the North Carolina Flood Resiliency Hub – a clearinghouse for the latest research about flooding in the State. The Flood Resiliency Hub features research on various flooding issues, including flood mapping, mitigation actions, resiliency planning efforts, natural infrastructure, and community impacts. It is designed to serve as a resource for policymakers, emergency management officials, university researchers, and stakeholders interested in the latest information about flood research and efforts to mitigate the impacts of large storm events.

2024 FLOOD RESILIENCY PROJECTS

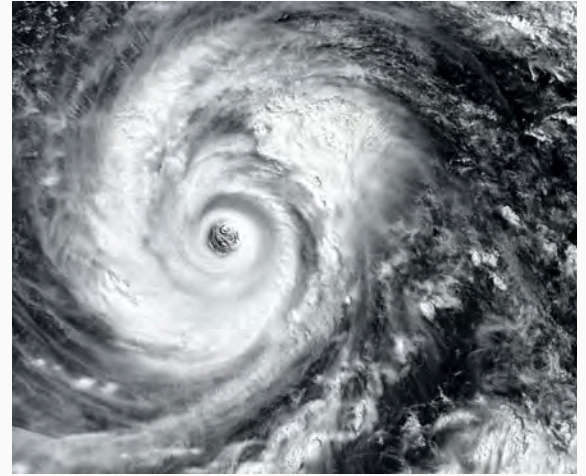
ASSESSING HEALTH RISKS FROM CONTAMINATED TIDAL
FLOODWATER IN COASTAL NC COMMUNITIES – NC STATE
UNIVERSITY

LEVERAGING MODELS TO OPTIMIZE EASTERN NC'S COMMUNITY-
LEVEL FLOOD RESILIENCE – NC STATE UNIVERSITY

STRATEGIES FOR REDUCING MORTGAGE DEFAULT AND HOME
ABANDONMENT AFTER FLOODING IN EASTERN NC – UNC-
CHAPEL HILL

ENABLING EQUITABLE AND EFFICIENT INVESTMENTS IN FLOOD
RISK MANAGEMENT – UNC-CHAPEL HILL

ANALYZING SOURCES AND SINKS OF ESTUARINE NUTRIENTS –
UNC-CHAPEL HILL



HURRICANE HELENE

Following the impacts of Hurricane Helene on western North Carolina, the Collaboratory is working with partners in state agencies, academic institutions, and communities to identify efforts in which research and assessments are needed in the region as part of the response and recovery efforts.

Part of this process involves working with its flood resiliency research team to identify priority projects that should be initiated in the coming months that could strengthen the State's recovery and future planning actions.

In addition, the Collaboratory is deploying numerous rapid grants to faculty members at Appalachian State University, Western Carolina University, and UNC-Asheville, and their partners. The grants are targeted to faculty members interested in partnering with local, State, and federal agencies, and various community partners.

The Collaboratory remains committed to leveraging research for the continued support of the longer-term efforts needed in western North Carolina for the foreseeable future.



POWERING NC'S ENERGY TRANSITION

In the 2023 legislative session (Session Law 2023-134) the North Carolina General Assembly invested \$15 million for Next-Generation Energy research. The Collaboratory is using these funds to identify and support research that will assist industry efforts in the energy transition as well as take advantage of the economic development opportunities that come with this transition.

The legislation directs the Collaboratory to leverage its academic partnerships with businesses to research technologies, including lithium batteries, computer chip manufacturing, small modular or micro-nuclear technologies, hydrogen storage, production, and transportation, and grid modeling for power generation, storage, and distribution.

BUILDING A BATTERY SUPPLY CHAIN ECONOMY

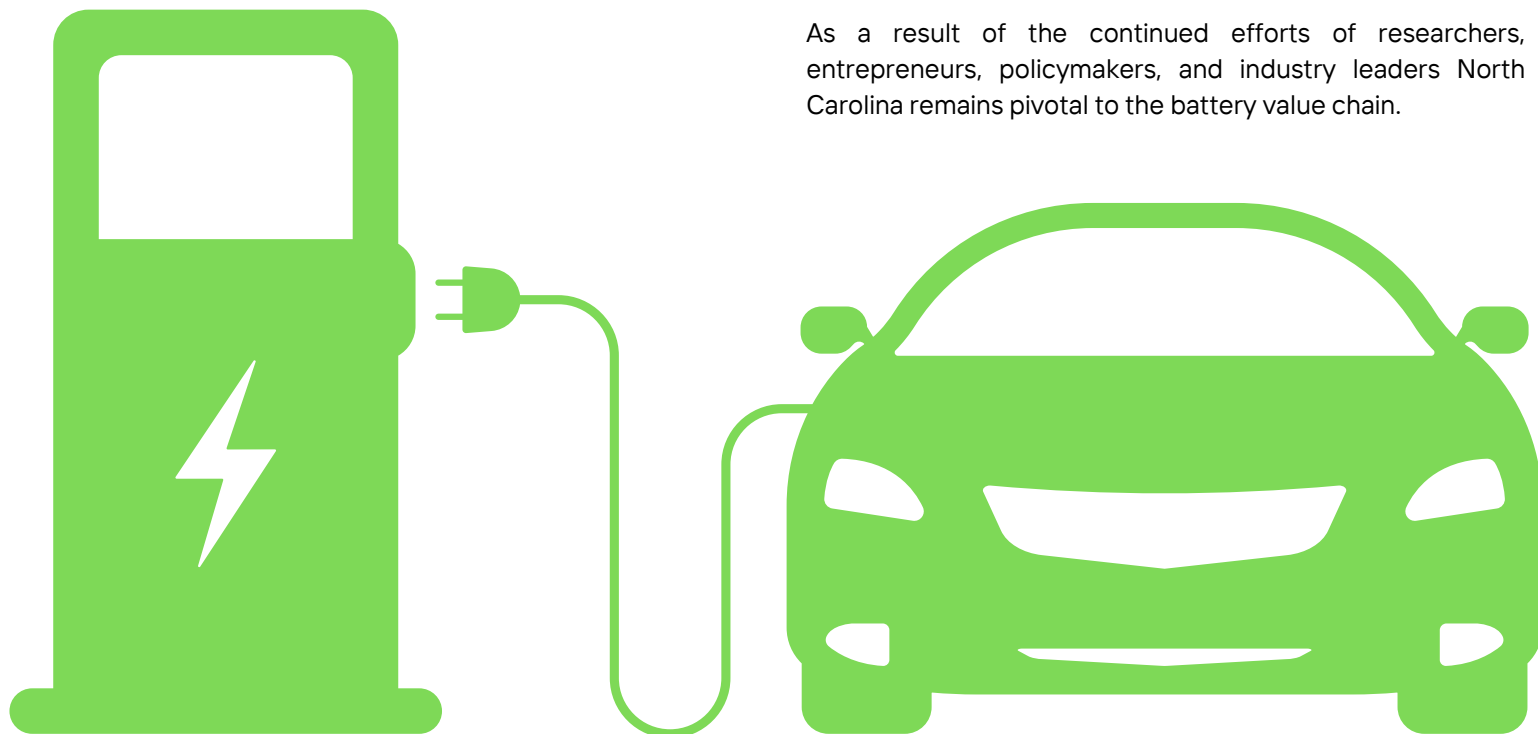
North Carolina's abundance of mineral resources has attracted many companies throughout the battery value chain to this area. Examples include:

- The proposed mines of Piedmont Lithium and Albemarle Corporation have a potential economic impact of almost \$2 billion annually.
- Toyota constructed its first North American EV battery facility in Randolph County, which has the potential to generate approximately 5000 jobs.
- Natron Energy, the sole commercial manufacturer of sodium-ion batteries in the US, plans to invest \$1.4 billion in establishing a giga-factory in Edgecombe County that is expected to generate over 1000 jobs.

The Collaboratory aims to encourage North Carolina's battery supply chain market by supporting innovative research to strengthen this emerging sector with projects:

- Research at UNC-Chapel Hill is using the new technology Laser-Induced Breakdown Spectroscopy (LIBS) to assess ore quality through advanced aging techniques.
- Projects at North Carolina State and Duke are developing methods to better distinguish between lithium-rich and -poor pegmatites.
- Research at UNC-Greensboro tests the new Nano Mosaic SPE, boosting extraction efficiency by up to 87% and reducing acquisition time to 48 hours.

As a result of the continued efforts of researchers, entrepreneurs, policymakers, and industry leaders North Carolina remains pivotal to the battery value chain.



STRENGTHENING THE ELECTRIC GRID

North Carolina's demand for electricity is projected to significantly increase in the coming years. As such, the Collaboratory is supporting research to ensure a resilient electric grid.

Researchers at UNC-Charlotte and NC State are working to streamline the planning and processes of generation, transmission, and distribution within an increasingly distributed network of renewable energy resources by leveraging computational advances to develop a co-simulation tool for the future carbon-neutral grid. In collaboration with the Energy Production and Infrastructure Center (EPIC) as well as Duke Energy's Center for Advanced Engineering Research (CAPER), the research team will design this co-simulation tool that incorporates complex scenarios and dynamics of the future grid across the entire Eastern Interconnect to ensure both efficiency and reliability.

The Collaboratory is also supporting projects at UNC-Chapel Hill to explore emerging vehicle-to-grid technologies within North Carolina's municipal fleets and a State-wide assessment of the economic landscape, and technological and resource availability, related to energy storage projects in North Carolina.

EXPLORING THE FUTURE OF ADVANCED NUCLEAR REACTORS

North Carolina's need for low-carbon, baseload sources of energy has led to renewed interest in understanding the opportunities and efficacy of expanding advanced nuclear fleets as fossil fuel resources are phased out. Two newly launched projects at NC State focus on expanding the skilled nuclear workforce and using digital simulation techniques to effectively communicate the capabilities and complexities of small modular nuclear reactors (SMRs) to the public and other stakeholders.



Electric car lithium battery pack and power connections.

LEVERAGING PARTNERSHIPS TO ADVANCE THE SUCCESS OF NC'S ENERGY TRANSITION

While some of the partnerships have already been mentioned above, it is worth noting the strong connections the Collaboratory continues to foster among industry, educational stakeholders, non-profit organizations, and local governments to advance the success of North Carolina's energy transition. Here are some of our key partners:



COASTAL MONITORING —



Through a partnership between Elizabeth City State University, the Carolina Drone Lab, and Audubon of North Carolina, environmental researchers visited sites along the Currituck Sound to study applications of drone technologies for coastal resilience and habitat monitoring.



Megan Mendenhall/UNC Research

DIVE IN: A STUDY OF NORTH CAROLINA'S MARINE FISHERIES AND COASTAL HABITATS

This legislative-mandated study is led by researchers at the UNC-Chapel Hill Institute of Marine Sciences, with partners from East Carolina University, NC State University, and UNC-Wilmington.

The North Carolina General Assembly's 2021 Appropriations Act included a request for a multi-year study on the status and management structures of the State's marine fisheries and coastal habitats. This mandate is in response to the 25th anniversary of the NC Fisheries Reform Act and the 50th anniversary of the NC Coastal Area Management Act. These time markers represent valuable horizons to critically appraise the efficacy of these acts in serving key missions within the NC Department of Environmental Quality.

The synthesis aspect of this project has two core components:

- (1) Gauging the status of NC fisheries corporately and on a species by species basis; and,
- (2) Exploring management structures or influences, as well as coastal habitat dynamics, correlated with the status of NC fisheries.

North Carolina employs a robust fisheries management framework with best practices like peer reviewed stock assessments and stakeholder input, with increasing rigor over time. While the management intensity is higher than in comparable states, commercial and recreational harvests align with those in states along the South Atlantic (SC, FL) and Gulf of Mexico (FL, LA, TX) after standardizing by coastal water area.

Despite a long term decline in commercial yields, the percentage of overfished stocks has not significantly improved. These trends are influenced by environmental changes (e.g. temperature) and shifts in targeted species across commercial and recreational fishing sectors.

Among factors that potentially explain this mismatch between a robust management framework and slow/no recovery of stocks, data highlight the following:

- (1) Long term and continued loss/degradation of key coastal habitats such as submerged aquatic vegetation and oyster reefs;
- (2) Delayed development and acceptance of fishery management plans and subsequent amendments;
- (3) Slowed activity among governance bodies, and perceived loss of consensus over time regarding best management actions; and,
- (4) Low stakeholder participation and confidence.

From these activities and findings, an "NC Fisheries System Status Report," and a set of recommendations for improved fisheries management in NC will be submitted to the NCGA in June 2025.



PUBLIC HEALTH & MEDICAL

SUPPORTING THE FIGHT AGAINST CANCER THROUGH RESEARCH

In 2019, the NCGA directed the Collaboratory to assemble a research advisory panel to discuss, review, and analyze statewide cancer data in response to two potential cancer clusters in Iredell County and Huntersville. The panel developed recommendations for effective research project design for determining if, and where, statistically significant cancer clusters exist in North Carolina, and provided its final recommendations to the NCGA in April 2020.

Since then, the Collaboratory has expanded its scope into cancer research, dispersing over \$2.5 million to support this critical work. By developing new treatment options, improving existing therapeutics, and investigating how to limit exposure to carcinogenic materials, the cancer research funded by the Collaboratory has the potential to bring about life-saving changes in cancer prevention, therapy, and remission practices.

Outlined below are examples of some of the projects that have been funded, including several projects currently underway:

DEVELOPMENT OF A GENE THERAPY-BASED THERAPEUTIC TO TREAT UVEAL MELANOMA

DEVELOPMENT OF AN MRNA LIPID NANOPARTICLE (MRNA-LNP) CANCER VACCINE TO PREVENT LEUKEMIA RELAPSE AFTER STEM CELL TRANSPLANT

GENETICALLY ENCODED PROTEOLYSIS TARGETING CHIMERAS

ROLE OF PHYTOCHEMICALS ON HEDGEHOG SIGNALING IN INFLAMMATORY BREAST CANCER

EMPLOYING NANOPARTICLES TO TARGET FUSOBACTERIUM NUCLEATUM IN THE PANCREATIC CANCER MURINE MODEL

DEVELOPMENT OF PHF19-TARGETED THERAPEUTICS FOR MULTIPLE MYELOMA

HLA-E T CELL THERAPIES AGAINST VIRUS ASSOCIATED CANCERS

INVESTIGATION OF THE ANTI-CANCER PROPERTIES OF ARTESUNATE, METFORMIN AND TARO EXTRACT ON TRIPLE NEGATIVE BREAST CANCER (TNBC) CELL LINE.

PROJECT SPOTLIGHT: NORTH CAROLINA THYROID CANCER STUDY

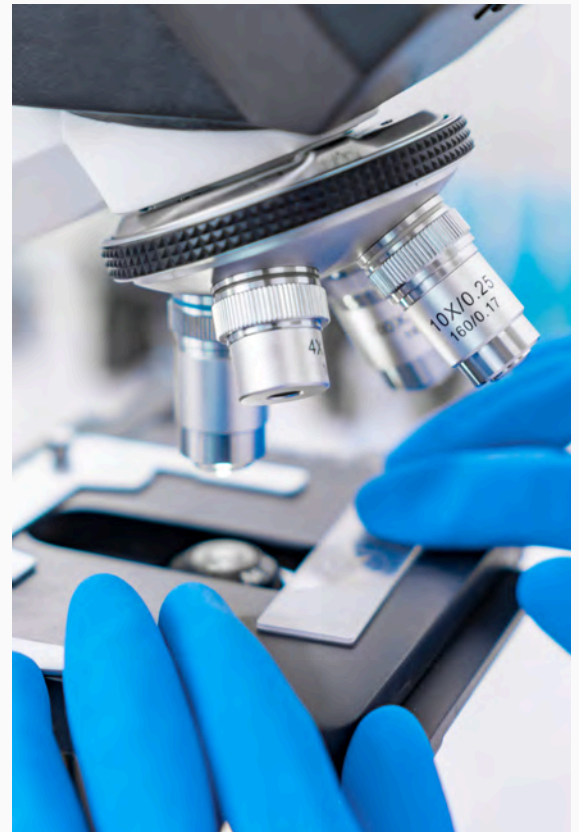
Principal Investigator: Andy Olshan

At UNC-Chapel Hill, a team of researchers received funding for a project investigating why thyroid cancer rates have increased in some parts of North Carolina, like Iredell County. Using a series of statewide geospatial analyses, this project hopes to examine the spatial pattern of thyroid cancer and test the relationship between specific environmental factors on a region's thyroid cancer rate. The data collected will be used to inform public health officials and local communities and could be used for future investigations of other cancers in North Carolina.

The project will focus on all new thyroid cancer cases diagnosed in North Carolina from 1995 to 2021. Data sources include the North Carolina Central Cancer Registry and North Carolina databases containing information on environmental and other factors. The analyses will further examine all areas of elevated incidence, prevalence, or hotspots, of papillary thyroid cancer in the State.

"Our task force quickly determined that due to the size and scope of this research that it should be spearheaded at the State level. I am grateful to my colleagues in the legislature who supported my efforts in securing funding for this project through the NC Collaboratory."

NC Senator Vickie Sawyer
District 37 (Iredell,
Mecklenburg)



SUPPORTING EFFORTS TO ADDRESS THE OPIOID CRISIS

In recent years, overdose deaths have reached historical highs. Compounded by numerous issues, such as the increased unpredictability and danger of the street drug supply during the COVID-19 pandemic, overdose deaths continue to be a major, longstanding threat to the lives of people in North Carolina.

In response to this ongoing issue, the Collaboratory received a legislative appropriation of \$5.6M in 2022 to:

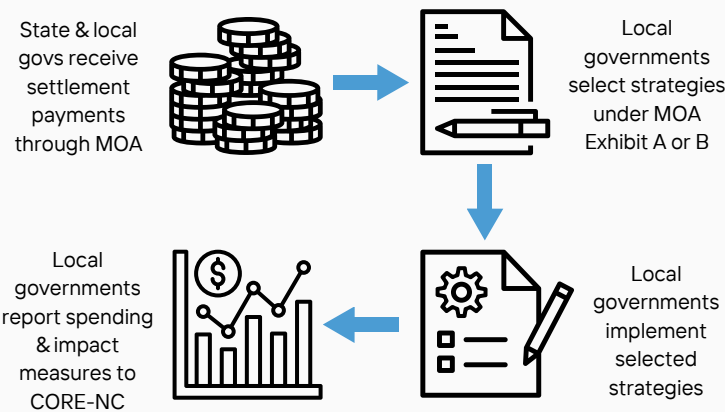
- expand and operate the Community Opioid Resources Engine for North Carolina (CORE-NC);
- support opioid remediation research and development across the State;
- establish a hub for community partnership outreach at NC Central University; and,
- build a partnership with Eshelman Innovation at the UNC-Chapel Hill School of Pharmacy.

Then, in 2023, the Collaboratory received a second appropriation of \$11M to expand opioid remediation research, including the study of the State’s judicially managed accountability and recovery courts.

EXPANDING THE COMMUNITY OPIOID RESOURCES ENGINE FOR NORTH CAROLINA (CORE-NC)

Total funding committed: \$1,030,000

CORE-NC is a public information clearinghouse that provides transparency and accountability for the use and impact of opioid settlement funds by municipal and county governments in North Carolina. Created through the collaborative efforts of the NC Department of Justice, NC Association of County Commissioners, NC Department of Health and Human Services, and the UNC-Chapel Hill Injury Prevention Research Center, the tool centralizes reporting for an estimated \$1.4 billion in national opioid settlement funds that will be distributed across the State over 18 years. All municipal and county governments that receive opioid settlement funds are required to implement opioid remediation activities and submit reports to CORE-NC as outlined below:



SUPPORTING OPIOID REMEDIATION RESEARCH AND DEVELOPMENT

Total funding committed: \$5,872,242

With issues such as the growing presence of fentanyl in the drug supply, which is contributing to a large spike in overdose deaths, research must be both timely and actionable if it is to be impactful. To achieve this, the Collaboratory has launched two competitive funding opportunities centered around cross-sector partnerships to ensure all awarded studies address challenges faced by practitioners, communities, governments, and policymakers working to reduce opioid-related deaths and lead to findings that can be used directly by these stakeholders.

The first competitive funding opportunity was launched in October 2022 and prioritized research projects that partnered with local governments or community organizations. In this first round, five research projects were selected for funding based on the urgency of the issues they aimed to target and the likelihood that they could generate actionable findings.

The second competitive opportunity was released in July 2024 with more stringent requirements on local government partnerships and a greater focus on enhancing the effectiveness of opioid settlement funds by supporting local government decision-making. Award recipient selection is currently underway, and the Collaboratory anticipates issuing 11 awards to researchers at multiple institutions across the UNC System and their local government partners in different regions of the State.



ESTABLISHING A COMMUNITY PARTNERSHIP OUTREACH HUB AT NC CENTRAL

Total funding committed: \$600,000

In 2023, the Collaboratory issued the first award to NCCU to establish a coordinating core that could achieve these goals by establishing a cross-sector network that can rapidly share information, develop best practices, publicize research findings, and establish effective partnerships that can be sustained for the duration of opioid settlement fund distribution in North Carolina.



STUDYING JUDICIALLY MANAGED ACCOUNTABILITY AND RECOVERY COURTS

Total funding committed: \$846,571

In response to a legislative appropriation in 2023, the Collaboratory has funded a study at UNCW to investigate North Carolina's judicially managed accountability and recovery courts (JMARCs). Specifically, the study examines the operating models, demand, capacity, funding sources, and feasibility of JMARCS, as well as recommendations for a potential expansion plan for JMARCs.

BUILDING A RESEARCH PARTNERSHIP WITH ESHelman INNOVATION AT UNC-CH

Total funding committed: \$5,956,203

Eshelman Innovation is an institute within the UNC-Chapel Hill School of Pharmacy that specializes in advancing biomedical research toward commercialization and identifying digital health solutions for a wide variety of problems.

To date, 13 projects have been launched, ranging from studies of the neurobiological mechanisms that underlie opioid reward, dependence, and opioid-induced respiratory depression (a common cause of fatal overdoses), to technology development projects to create software tools such as Goldie Health, which post-overdose response teams could use.



FLOWING TOGETHER: Restoring NC's Drinking Water

PFAS TESTING NETWORK



An interdisciplinary group of UNC Chapel Hill scientists and engineers are deploying and evaluating technologies that filter these difficult to remove substances from our drinking water.

In 2024, the NC PFAS Testing Network expanded significantly, adding nine experts and collaborating with three additional North Carolina institutions. The Network hosted its first All Scientists Meeting to foster collaborative research efforts and generate ideas for addressing PFAS impacts across the State. Research on PFAS health effects grew, with new health and exposure expertise added to the toxicology team.

The Network launched its first risk communication project aimed at studying public perception and developing messaging strategies around PFAS health risks.

Research progress also included published findings on filtration technologies and assisting water utilities in meeting the latest National Primary Drinking Water Regulation standards.

New treatment projects are underway, targeting innovative methods for PFAS mitigation, such as bioremediation, filtration, and destruction techniques.

Partnerships continued with the Department of Environmental Quality, utilizing Network expertise in joint field campaigns. Also, a new collaboration was formed with the Cape Fear Public Utility Authority to enhance operational monitoring and testing capacity for PFAS.

"The partnership with the Collaboratory to create the DEQ Applied Research Fellowship has been invaluable in fostering greater understanding between government and academia, and ensuring that DEQ can benefit from the outstanding research happening within the university system."

– Elizabeth Biser
Former Secretary, NC DEQ

MASS SPECTROMETRY INSTRUMENTS STRENGTHEN RESEARCH CAPACITY

The North Carolina Collaboratory has allocated \$3 million to significantly expand the State's PFAS research infrastructure by providing advanced mass-spec equipment to five UNC System campuses. This investment strengthens the NC PFAST Network, allowing for more precise identification and measurement of PFAS compounds, including emerging variants. With these tools, researchers can deepen their understanding of PFAS contamination sources, health impacts, and potential remediation strategies.

- The Orbitrap Astral mass spectrometer in Lee Ferguson's lab at Duke University will allow the first fully comprehensive analysis of known and unknown PFAS in environmental samples at ultra-trace levels.
- The Orbitrap Exploris GC systems in Heather Stapleton's (Duke) and Detlef Knappe's (NCSU) labs will allow the detection of semi-volatile PFAS in the indoor environment and volatile thermal breakdown products of PFAS treatment technologies.
- The Orbitrap Exploris 240 Isotope Solutions system in Ralph Mead's lab at UNC-Wilmington will enable source-tracing and high-resolution forensic analysis of PFAS in the environment.
- The iCAP-TQ inductively coupled plasma mass spectrometer in Professor Pingping Meng's lab at ECU will facilitate the development of new and sensitive total PFAS measurements for mass balance studies during PFAS treatment experiments.

"We're proud of the NC PFAST Network's role in advancing North Carolina's understanding of PFAS, and know that the increased capabilities of these instruments will provide our researchers the technical solutions necessary to drive their research forward."

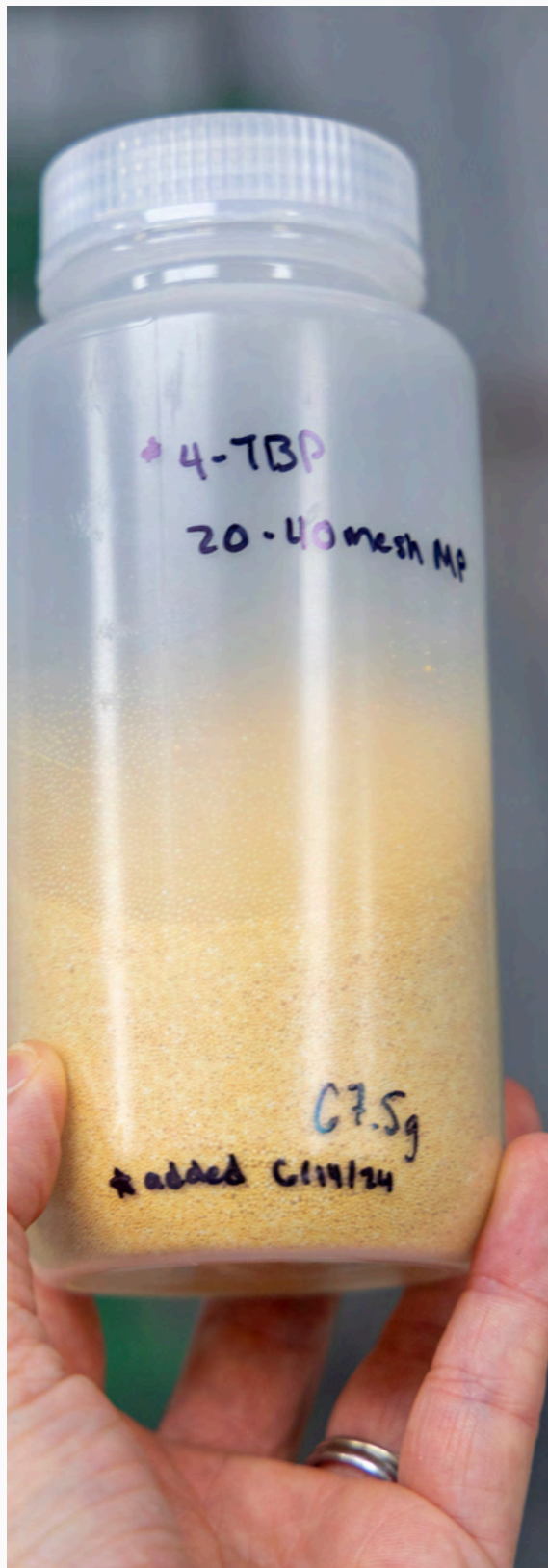
Ralph Mead
Director, NC PFAST Network

With the addition of these analytical tools, the NC PFAST Network is poised to propel North Carolina to the forefront of PFAS research, driving innovation and shaping solutions for a sustainable future.



Michael Spencer/UNCW

NC PURE



Images by Megan Mendenhall/UNC Research

NOVEL SORBENTS

NC Pure, part of the PFAS Testing Network, is advancing technologies to efficiently remove PFAS from water, including difficult-to-remove short-chain variants like GenX.

Their approach stands out by specifically targeting PFAS while minimizing interference from background organic matter, and their sorbents can be regenerated for reuse. These features enable the purification of larger water volumes per sorbent than existing commercial options. Initial tests have shown that their sorbents outperform leading alternatives.

Following significant bench-scale research, including evaluating over 150 novel and commercial sorbent formulations for water filtration, NC Pure has identified promising formulations for evaluation at the pilot scale. Three pilot systems testing filtration of both surface and groundwater have been deployed at North Carolina public utilities across the State.



AFFF TAKE-BACK PROGRAM



NC DEPARTMENT OF
INSURANCE
OFFICE OF STATE FIRE MARSHAL



NORTH CAROLINA
Environmental Quality

Fire departments across North Carolina possess over 100,000 gallons of aqueous film-forming foam (AFFF) concentrate – a substance used to extinguish flammable liquid fires such as gasoline, oil, and jet fuels. AFFF is effective in suppressing these types of fires, but it contains high levels of per- and polyfluoroalkyl substances (PFAS).

The NC Collaboratory's AFFF Take Back Program is an initiative designed to address the presence of PFAS-containing AFFF held in the inventories of fire departments across North Carolina. In partnership with the Office of the State Fire Marshal (OSFM), the Department of Environmental Quality (DEQ), and academic experts, the plan calls for inventorying, collecting, storing, and ultimately destroying AFFF. What makes our effort unique among other states with take-back programs is creating a chemical database, through the archival of collected AFFF samples, for future environmental forensic applications.

TRANSITION FROM AFFF TO FLUORINE-FREE FOAM

With the eventual removal of AFFF from fire departments around North Carolina, Bryan Ormond, Ph.D. and Arash Kasebi of North Carolina State University investigated the transition from AFFF to fluorine-free foam alternatives, including their effectiveness in fire suppression and environmental and health risks.

The State-mandated, voluntary Take-Back Program is one of several Collaboratory funded projects that seek to track and limit the release of PFAS into the environment and concern the wellbeing of firefighters. The achievements made in this project and others come through a shared commitment to public service and OSFM's relationship with the North Carolina firefighter community.

"There was a lot of AFFF bought because it was the best thing on the market for petroleum type fires. We discovered after that there were a lot of dangers from the foam."

Brian Taylor,
NC State Fire Marshal

FIREFIGHTING PROJECTS

WELL WATER TESTING NEAR FIRE STATIONS

Related to the Take-Back Program is a project involving the sampling of wells at or near fire stations. The project is being conducted by Detlef Knappe (NC State), Lee Ferguson (Duke), and Mei Sun (UNC-Charlotte) and will build on North Carolina's understanding of PFAS contamination in our public drinking water supplies related to AFFF. The results will allow communities that may be impacted to identify avenues to reduce PFAS exposure and can be used by regulatory agencies to guide State response to this aspect of PFAS contamination.



AIR EMISSIONS TESTING AT FIRE STATIONS

Because PFAS is commonly found in products used by firefighters like AFFF and personal protective gear, fire stations can be sites for potential contamination risk given the location of its living spaces. UNC-Chapel Hill researcher, Barbara Turpin, is leading a study to better understand the air emissions of PFAS-containing materials at ambient and elevated temperatures inside fire stations. This project is designed to help mitigate PFAS exposure to firefighters and others.



FIREFIGHTER CANCER COHORT STUDY

A project that investigates PFAS and chemical exposure as cancer risks is the North Carolina Firefighter Cancer Cohort Study (NC FFCCS). The NC FFCCS will become part of the National FFCCS and support its overall study goals – investigating firefighters' exposure to PFAS via AFFF and personal protective gear – as well as questions relevant to North Carolina firefighters. A team led by Heather Stapleton at Duke University will develop and implement the study, which plans to enroll 1000 firefighters and follow them every two years for the duration of the National FFCCS Study.

IMPROVING TESTING OF FIREFIGHTER TURNOUT GEAR

The Collaboratory is providing funding for a project that will renovate and outfit the Man-in-Simulant-Test (MIST) chamber in the Textile Protection and Comfort Center to accommodate aerosol studies that simulate airborne per- and poly-fluoroalkyl substances (PFAS) particulate exposure. The chamber is utilized to evaluate different types of protective gear for firefighters. This renovation will also improve the environmental conditions of the chamber to maintain more precise control of temperature, humidity, and air flow.

"The NC Collaboratory is emerging as a vital resource to support the life saving research and innovation the Textile Protection and Comfort Center (TPACC) does within the Wilson College of Textiles at NC State. Because of the Collaboratory we are able to maintain the Man In Simulant Test (MIST) chamber within TPACC as a unique state of the art research facility to advance next generation firefighter, first responder, and military protective clothing."

Dean David Hinks,
NC State University Wilson College of Textiles



Courtesy of Bryan Ormond



TECHNOLOGY & INFRASTRUCTURE

TRANSFORMING RESEARCH THROUGH HIGH-PERFORMANCE COMPUTING AND ARTIFICIAL INTELLIGENCE

The Collaboratory is launching a pilot program to address the high-performance computing (HPC) needs of academic researchers across the UNC System.

With up to \$4 million in funding allocated by the North Carolina General Assembly, this initiative aims to enhance the computational resources available for data-intensive research, such as:

- Advanced simulations;
- Machine learning;
- Deep learning algorithms;
- Computational imaging;
- Artificial intelligence; and,
- Other complex tasks requiring substantial processing power.

The Collaboratory is also supporting individual research projects that are utilizing Artificial Intelligence to support data analysis more efficiently and effectively.

PROJECT SPOTLIGHT: NORTH CAROLINA CENTER FOR ADVANCED ECONOMIC FORECASTING

Principal Investigator: Paige Ouimet

The Kenan Institute of Private Enterprise at UNC-Chapel Hill received funding to pilot a North Carolina Center for Advanced Economic Forecasting across three counties. The project will develop AI-powered economic nowcasts and forecasts utilizing machine learning for high-dimensional time series data for Rockingham, Caldwell, and New Hanover counties. The initiative draws on AI research at Kenan-Flagler Business School, focusing on signal extraction and modeling non-linear data interactions.

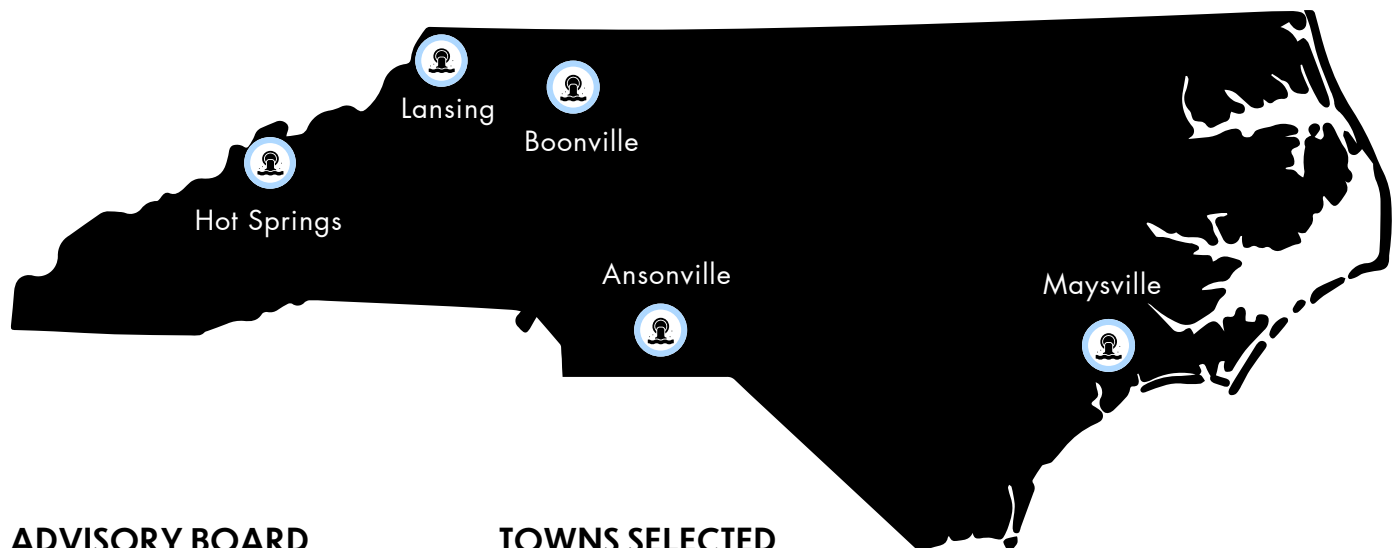
The project aims to assist local leaders in utilizing economic forecasts to benefit their regions through panel discussions, workshops, and technical assistance. By providing accurate and timely economic data, the initiative seeks to empower communities to make informed decisions regarding resource allocation and policy design. AI and high-frequency data will improve the relevance and granularity of these economic indicators.

WASTEWATER TREATMENT INFRASTRUCTURE

Many communities across North Carolina, especially in rural areas, have old and outdated wastewater systems. In 2021, the NCGA allocated \$20,000,000 from the American Rescue Plan Act (ARPA) to establish the Innovative Highly Treated Wastewater Pilot Program led by the Collaboratory. Since work began in July 2022, the Collaboratory has been tasked with:

- evaluating wastewater systems across North Carolina;
- identifying five recipient communities for the program;
- assisting them in submitting permit applications to the DEQ;
- overseeing system construction;
- and monitoring the efficacy of the newly installed wastewater systems.

To ensure the successful completion of the Program, the Collaboratory has partnered with the UNC School of Government's Environmental Finance Center (EFC), the Department of Environmental Quality (DEQ), specifically the Division of Water Infrastructure (DWI), and North Carolina State University (NCSU).



ADVISORY BOARD

Established to support the creation, implementation and review of critical components of the Program, the Advisory Board is made up of a diverse cohort of experts including representatives from state agencies, non-profits and industry. The Board has been heavily involved in setting goals for the Program, recommending and reviewing communities for participation, brainstorming resources to support selected candidates, and advising on specific policy-relevant and measurable outcomes to pursue public and financial health of the participating communities.

TOWNS SELECTED

The EFC developed evaluation criteria for selecting participant communities, incorporating input from the Board and aligning with legislative guidelines. Under Senate Bill 105, established criteria for eligible communities included: systems serving fewer than 10,000 customers, distressed systems with permit violations or pollutant concentrations exceeding legislative limits, and entities unable to connect to existing wastewater infrastructure.

The EFC identified "shovel readiness," and community willingness and capacity to participate in the program, as other

critical factors to consider. With these considerations in mind, the EFC, Collaboratory, and the Board reviewed and approved applications for five sites for participation in the Program.

PROGRESS TO DATE

Throughout 2024, the towns have been working to submit their construction permits, while researchers have been collecting water samples at each site for baseline data. The expectation is that construction of these new wastewater plants will begin in earnest in 2025.

EXPLORING NEW TECH IN SUPPORT OF THE MILITARY

North Carolina's connection to the military is a significant source of pride for the State and the Collaboratory is funding research that could be utilized for military applications.

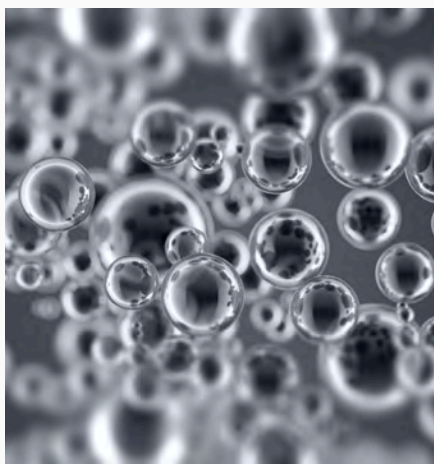
"With 24 years of service in the US Air Force, where I worked extensively on next generation technologies, I'm thrilled to be part of the Collaboratory. The Collaboratory's focus on military related research aligns perfectly with NC's reputation as a beacon of support to our nation's heroes and their families."

Robert Moore, Collaboratory Project Manager



AUTONOMOUS MULTI-DRONE SYSTEM FOR SEARCH OPS IN CHALLENGING ENVIRONMENTS

Fayetteville State University's Sambit Bhattacharya received funding for research focused on developing AI-based autonomy for multi-drone systems. The project aims to design AI software to enable drones to execute search operations in challenging environments, such as tunnels and HVAC ducts, without GPS or external localization. This research has applications for the North Carolina Department of Transportation, the US Department of Defense, and local military bases.



SUPPLEMENT TO ICONS TO EMPOWER THE FUTURE SOLDIER

North Carolina A&T's Sherine Obare received funding for a project through the Innovation Collaborative Laboratory for Nanotechnologies to Empower the Future Soldier (ICONS). A joint initiative with the U.S. Army Combat Capabilities Development Command Soldier Center, ICONS aims to develop advanced nanotechnology-based solutions to enhance soldier protection and effectiveness for the U.S. Army's 2040 operational concepts. The project seeks to design materials at the atomic level, improving the quality and functionality of materials used in soldier equipment.



SHORT-WAVE INFRARED SENSORS USING LOW-BAND GAP ORGANICS

UNC-Chapel Hill's Wei You and North Carolina State University's Franky So received funding for a project aimed at advancing short-wave infrared (SWIR) imaging technology. Their research focuses on replacing costly InGaAs sensors with more affordable organic semiconductors. SWIR light, which penetrates fog and smoke better than visible light and detects moisture, has significant applications in the automotive, military, and agricultural fields. The project seeks to design and synthesize low band gap materials for SWIR applications, and fabricate photodetectors based on these materials.

HARNESSING UNIVERSITY RESEARCH TO LAUNCH STARTUP COMPANIES

Collaboratory-funded research addresses pressing issues facing North Carolina and communities throughout the State. Its research dollars are intended to solve problems and use the power of academic research to positively impact the State's residents. In some cases, its research funding has the added benefit of helping to create a startup company.

Over the last couple of years, several research projects supported by the Collaboratory have resulted in the commercialization of technology or the development of startups. The funding provided by the Collaboratory has set the foundation for these startups to receive additional funds from governmental agencies and the private sector. These startup companies include businesses working in environmental remediation, drug discovery, public health, and biotechnology.

STARTUP SPOTLIGHT:

Patient Ready

The Collaboratory provided initial funding to Winston Salem State University for a partnership project with the UNC School of the Arts to create a virtual reality training program for nurses. That research project has grown into a startup company called Patient Ready.

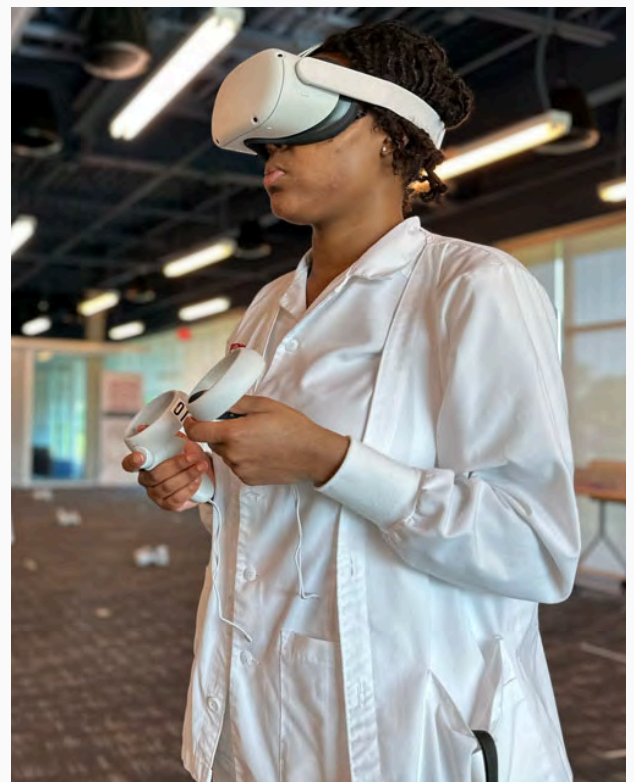
Patient Ready educates nurses through virtual reality and artificial intelligence training simulations. These simulations immerse nurses in realistic clinical environments to develop proficiency and clinical reasoning skills. These simulations allow nurses to develop enhanced engagement skills with patients.

Patient Ready has already received a \$250,000 investment from the Winston-Salem State University Foundation and is seeking additional venture capital funds.



This collaboration is not only a reflection of WSSU's dedication to innovation but also our collective belief in reshaping the future of healthcare education for the benefit of students and patients alike.

Marcus M. Cox
WSSU Foundation, Board Chair



Images by Garrett Garms/UNCSA

ECONOMY & EDUCATION



NanoDiagnostic Technology



BUSINESS ACADEMIA PARTNERSHIP PROGRAM

Supported by a \$15,000,000 appropriation made by the NCGA (Session Law 2021-180), the research program aims to foster and strengthen partnerships between businesses and academic research groups to transform applied research and innovation into technological solutions for the benefit of public health and the economy in the State.

The Collaboratory awarded eleven grants to various projects intended to address the public health and economic effects of COVID-19 in North Carolina. These Business-Academia Partnership projects used their collective insight to transform applied research and innovation into technological solutions for the benefit of the state. Preliminary findings of these projects have furthered the development of new personal protective equipment, testing and detecting devices, and more.

The details of these research projects were outlined in the Collaboratory's American Rescue Plan Act Legislative Report, which was submitted to the NCGA on September 1, 2024.

The majority of these projects will continue into 2025 with expected findings and outcomes to be shared with interested parties.



LEARNING RECOVERY NETWORK

Image: berkay08

TRANSFORMING EDUCATION POLICY

In the fall of 2022, the Collaboratory worked with the Office of Learning Recovery (OLR) within the NC Department of Public Instruction (DPI) to develop a network that could help educators and students recover from pandemic-related disruptions and lost instructional time.

Supported by \$7 million in appropriations made to the Collaboratory by the NCGA as part of the American Rescue Plan Act (ARPA), the two entities launched the North Carolina Learning Recovery Network to spur specific research on the impact of COVID-19 on student learning. All research was performed in partnership with practitioners and policymakers who could identify the most pressing problems of education practice and policy across North Carolina.

The program resulted in 21 research projects across 14 academic institutions.



IDENTIFYING PRIORITY ISSUES

Some of the most challenging aspects of the COVID-19 pandemic were its complexity and unpredictability, with far-reaching impacts on the day-to-day operations of schools across the State and family and community life. To respond to such a complex problem, the Network was developed to address critical policy and practice issues while ensuring teams did not become redundant or duplicative. This strategy involved identifying research priorities and grouping research teams into cohorts to facilitate data and information sharing, discussions of research methods, and troubleshooting issues.

PRIORITY TOPICS

Studies that could assess the effectiveness of funded policies and programs during the pandemic:

- State and local teacher bonuses;
- Statewide training for elementary school teachers;
- Supporting educators in recurring low-performing schools and districts;
- Use of software to mitigate bullying, monitor student internet activity and devices;
- School Psychologists Grant Program; and,
- Funding deployment and efficacy of funding programs

Studies were also selected to examine the impact of COVID-19 on student learning:

- Impact of the pandemic on the educator workforce;
- Impact of the pandemic on the postsecondary choices of high school juniors and seniors;
- Identifying effective practices in virtual learning by grade;
- Understanding students and families who left and returned to the public school system;
- Impact of the pandemic on persistently low-performing schools; and,
- Intervention strategies targeting the academic, social, and mental health needs of students.

RESEARCH COHORTS

After launching the research projects, the Network grouped project teams into five cohorts to facilitate learning and information sharing, avoid redundancy and duplication, share progress, and provide critique to enhance the quality and impact of each research study.

K-12 ACADEMIC SUPPORTS

Assessing the ability of K-12 classroom strategies to help students master crucial academic skills, and high-dosage programs to help students rapidly recover from pandemic learning losses.

STUDENT AND COMMUNITY WELL-BEING

Investigating the effectiveness of policies and programs that aim to ensure that students are safe and well-supported in their schools, their communities, and virtual spaces.

EDUCATOR LABOR MARKETS

Examining the impact of educator compensation, training and professional development, and support programs.

HIGHER EDUCATION

Tracking the experiences of students who finished high school during the pandemic as they move to and through postsecondary education.

POLICY STRUCTURES

Investigating how districts used federal funds, the pandemic's impact on the State's system of school choice, and the effectiveness of targeted efforts to improve low-performing schools.



SHARING RESULTS

Using this network approach, all research teams are directly connected with state and district partners, who in turn ensure that the researchers are grounded in the local and regional context of the issue and focus on answering questions related to specific policies or programs. The core network team provides critical support through their expertise in communication and policy and helps ensure each research team transforms their findings into clear, actionable recommendations for state officials and school districts.

ENHANCING RESEARCH CAPACITY

HISTORICALLY MINORITY-SERVING INSTITUTIONS PROGRAM

In 2021 the NCGA established a new program within the Collaboratory, providing sustained funding and research capacity for the UNC System's six historically minority-serving institutions: ECSU, FSU, NC A&T, NCCU, UNC-P, and WSSU. The program is supported by a recurring appropriation of \$1.5 million annually (\$3 million total over the 2023-25 biennium). The legislation directs the funds to build research capacity at these institutions and support research that is in service to the State. Each university has the flexibility to identify research projects that enhance its ongoing programs and advance its institutional mission.

Below are examples of the projects funded:



Establishing a Mobile Health and Wellness Center to reduce childhood obesity in underserved communities through nutrition, physical activity, and socio-emotional support.



Creating an Office of Research Development to enhance faculty support for securing research funding and fostering interdisciplinary collaborations.



Investigating the market fit for a healthcare innovation using customer discovery, product development, and business model testing to optimize its commercialization.



Addressing security challenges for mobile driver's licenses by developing solutions for authentication, encryption, privacy, and compliance.



Using machine learning to improve wetland mapping and flood management by integrating topographic and hydrographic data.



Expanding Virtual Reality training for nursing students to improve critical thinking and decision-making skills through immersive healthcare simulations."

"The HMSI research grant program is another specific example of how investments in cutting edge R&D has made an impact beyond lab and field work. However, Collaboratory investments extend far beyond the letters R&D for institutions like FSU. As chancellor, other letters like R&R recruitment and retention of faculty are most critical.

Thanks to the Collaboratory, FSU now has critical funding to stand up and support fresh ideas from junior faculty, which is making a tremendous overall impact on morale and motivation to be more and do more in research and development as an institution."

– **Darrell T. Allison**
Chancellor, FSU

STATE AGENCY COLLABORATIONS

Since its establishment in 2016 the Collaboratory has directly partnered with many state government agencies in North Carolina to provide research that provides new data and findings. In 2024 the Collaboratory continued to prioritize partnering with state agencies on several timely topics, such as protecting public health, promoting economic development, and preserving natural resources. Two of these noteworthy projects are highlighted below.

ASSESSMENT OF USING BUSINESS CREATION DATA FOR ECONOMIC FORECASTING IN NORTH CAROLINA

In 2024 the Collaboratory funded a major project led by researchers at the UNC-Chapel Hill Kenan-Flagler Business School in partnership with the North Carolina Secretary of State.

North Carolina policymakers and business leaders often rely on economic measures such as GDP growth, employment, wages, and skills to make decisions about where to invest their scarce resources and how best to take advantage of regional attributes that make the state, city, or county a desirable location for industry. This project will assess the needs for economic indicators by policymakers from urban and rural regions and create novel timely measures of economic health at the county level for the state of North Carolina.



Jon Gardiner/UNC-Chapel Hill

NORTH CAROLINA'S JUDICIALLY MANAGED ACCOUNTABILITY AND RECOVERY COURTS

As directed by Session Law 2023-134 the Collaboratory funded researchers at UNC-Wilmington to evaluate the existing judicially managed accountability and recovery courts (JMARC)s. The research study, which was designed to support the NC Administrative Office of the Courts, focused on three key questions:

1. Are JMARC)s operating with fidelity to the operating model (process evaluation)?
2. Are JMARC)s producing the intended outcomes (outcome evaluation) associated with each court type?
3. Are JMARC)s a cost-effective alternative to traditional case processing in NC (cost/benefit evaluation)?

The study's findings and recommendations were submitted to the NCGA on October 1, 2024.

"Providing access to substance use and mental health treatment for individuals within the court system is a priority... We're thankful to the General Assembly and the North Carolina Collaboratory for their partnership in developing a comprehensive Strategic Plan for North Carolina's recovery courts as a first step to expanding these vital services to all North Carolinians."

Ryan S. Boyce
Director, Administrative Office of the Courts

THE POWER OF PARTNERSHIP



In 2023, the NC General Assembly memorialized a pre-existing partnership between the Collaboratory and NCInnovation. NCInnovation is a non-profit entity that received a \$500 million endowment to leverage the high research and development capabilities of the UNC System and support the commercialization of technologies developed through these academic endeavors.

NCInnovation can leverage the Collaboratory's efficient deployment of grant funds, and the two entities will continue to consult on strategic R&D funding opportunities across the State to maximize economic growth and impact for its people.

While the Collaboratory and NC Innovation are both funding university research, the work of the two organizations is complementary.

TECHNOLOGY READINESS LEVELS (TRL)

When funding technology projects the Collaboratory generally focuses on projects in the early research stage (TRL levels 1-3), while NCInnovation focuses on projects in the development stage (TRL levels 4-6). Funding from venture capital that creates startup companies occurs in the deployment stage (TRL levels 7-9).

The Collaboratory and NCInnovation both play critical roles in the academic research conveyor belt, providing funding to create technology.

- The Collaboratory supports initial funding to support the concept of the technology.
- NCInnovation funds the scale-up and commercialization of the technology.
- Investment funding comes in to launch the company's deployment of the technology.

Working in partnership, the Collaboratory and NCInnovation harness academic research to develop commercial technologies and new companies that can be a driving force in North Carolina's economy.



DEPLOYMENT	9	Actual system proven in operational environment
	8	System complete and qualified
	7	System prototype demonstrated in operational environment
DEVELOPMENT	6	Technology demonstrated in relevant environment
	5	Technology validated in relevant environment
	4	Technology validated in lab
RESEARCH	3	Experimental proof of concept
	2	Technology concept formulated
	1	Basic principles observed

THE FORCE MULTIPLIER EFFECT

LA CROSSE ENCEPHALITIS – DETERMINING OPPORTUNITIES TO REDUCE ENVIRONMENTAL RISK

Collaboratory Award – \$373,913

NCInnovation provided additional grant funding to both projects, building on the Collaboratory's initial investment.

La Crosse Virus (LACV) is the most common cause of pediatric arboviral encephalitis in the United States. The disease, transmitted by the bite of infected *Aedes* mosquitoes, is highly prevalent in the Appalachian region of Western North Carolina. Between 2011 and 2020, NC reported 175 cases, accounting for nearly a quarter of all cases within the United States.

The overarching scientific goal of this pilot feasibility project is to build the appropriate infrastructure and collect preliminary data that will lay the foundation for future efforts to improve the effectiveness of care for patients hospitalized with LACV infection and reduce disease transmission in the community. An interdisciplinary team from UNC-Chapel Hill and Western Carolina University will implement a longitudinal cohort of pediatric patients at Mission Hospital, study their treatments and clinical outcomes, and estimate risk factors associated with their household to guide targeted interventions.

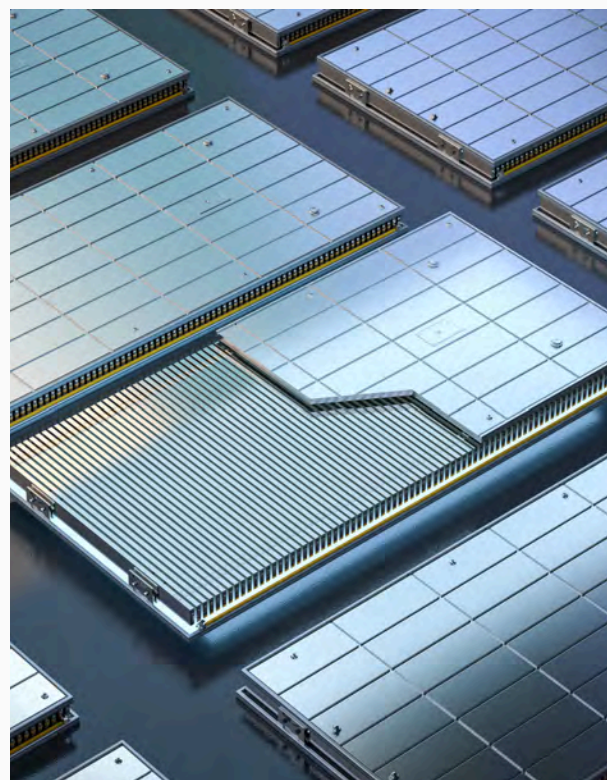


POLYMER IMPREGNATED SORBENT TECHNOLOGY FOR LITHIUM RECOVERY AND CONVERSION

Collaboratory Award - \$800,000

The global demand for lithium is expected to grow substantially, owing to its increased demand for energy storage, electronic bikes, electrification of tools, and other battery-intense applications. The lithium-ion battery market is projected to reach US \$ 76.5 billion by 2025. It is unlikely that traditional lithium extraction operations from hard rocks and brine deposits will be able to respond to future lithium markets to meet current demands.

UNC-Greensboro partnering with Minerva Lithium, LLC has previously demonstrated a proof of concept to address this unmet need by developing an efficient, rapid, and cost-effective lithium refining technology using a novel lithium sieving sorbent. This project aims to optimize the technical baseline of the sorbent's efficacy and regenerative ability, thereby improving lithium recovery and conversion.



OUR TEAM

The Collaboratory staff, which started as a team of three, now comprises eleven team members. Together, the staff manages the work of our organization, strategically appointing funds, reviewing research proposals, managing grants, and collaborating with community partners, state agencies, and policymakers. Our small-but-mighty team takes pride in our work to fund research in service to North Carolinians – we are impassioned by making a difference in our community.

NC COLLABORATORY STAFF



Jeffrey Warren, PhD
Executive Director



Al Segars, PhD
Advisory Board Chair



Greer Arthur, PhD
Research Director



Jeni Corn, PhD
Impact Evaluation &
Strategy Director



Laurie Farrar
Finance Director



Steve Wall, JD
Outreach Director



Claire Revere
Communications
Director



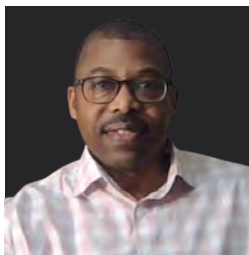
David Lambeth, JD
Strategic Research &
Compliance Director



Robert Moore
Project Manager



Susan Fratazzi
Grants Manager



Preston Clark
Field Research
Manager



Michelle Bunce
Executive Assistant

ACKNOWLEDGMENTS

Kyle McKay and Gary Wilhelm with the Service Center of Excellence contributed to finalizing and ensuring the accessibility of this report.

EDUCATING THE NEXT GENERATION OF LEADERS

IN THE CLASSROOM

The legislature mandated the Collaboratory teach and train students and faculty to engage in and administer neutral and unbiased research and advice on science policy through informal workshops and similar events, and formal development and delivery of curriculum (see GS 116-255(b)(7)).

In spring 2023, Collaboratory Executive Director Jeff Warren, PhD, who is also appointed as an adjunct Professor of the Practice in the Department of Public Policy began teaching an undergraduate course entitled, "Science for Hyperpartisan Times (IDST 132)."

This lecture, part of the campuswide Ideas, Information, and Inquiry (Triple-I) curriculum, is taught by a team of three faculty members on one subject from three perspectives. Warren's current teaching team includes Christian Lundberg, PhD (Department of Communications), and Matthew Springer, PhD (School of Data Science and Society). This course had the highest-ranked student evaluations of all Triple-I courses taught during Fall 2023.

Warren will add a second course to the newly launched UNC School of Civic Life and Leadership (SCiLL) starting in Spring 2025 entitled, "Lab Coats and Legislators: Science, Technology, Policy, and Politics."

GAINING VALUABLE POLICY EXPERIENCE

Each semester, the Collaboratory hires UNC-Chapel Hill undergraduate and graduate students for paid internships. The interns and research assistants provide critical staff support for the work of the Collaboratory and participate in career development activities.



Image by Mivvy Warren

And, yes, he sometimes brings his dog Tucker to guest lecture.



Warren was inspired to develop his course, Science for Hyperpartisan Times, after writing an article in 2021 with the same title, which examined the role of science in the current policy landscape.

With a small professional staff, the student staff is critical to the work of the Collaboratory. Some examples of the work of Collaboratory students include conducting background research on policy topics, drafting legislative reports, developing policy briefs, assisting with research administration, and aiding our communications efforts through the development of news articles, and other content.

In 2024, the Collaboratory has 20 student interns supporting our work conducting background research on topics such as the impact of PFAS on drinking water, energy technologies, and educational policy. For more information about this program visit: <https://collaboratory.unc.edu/about/student-staff/>

ADVISORY BOARD

Al Segars, Chair

Center for Sustainable Enterprise, Kenan-Flagler Business School

Anita Brown-Graham

School of Government

Jaye Cable

Department of Marine Sciences

Dedric Carter

Vice Chancellor for Innovation, Entrepreneurship and Economic Development

Greg Characklis

Department of Environmental Sciences and Engineering

Greg Copenhaver

Associate Dean for Research and Innovation, Institute for Convergent Science

Don Hobart

Associate Vice Chancellor for Research

Rick Luetlich

Institute of Marine Sciences

Mike Piehler

Institute for the Environment

STUDENT STAFF & INTERNS

Grant Alexander

William Berger

Stephanie Caddell

Monica Cardoso

Christian Chung

Alexia Civit

Anna Coley

Tiana Dinham

Silas Durham

Victoria Farella

Margot Francini

Xiomara Gomez

Caroline Gravelle

Reagan Gullede

Taylor Holbrooks

Rose Houck

Perrin Jones

Chloe Lind

Sarah Masters

Jenna Mayfield

Kaelyn McCarthy

Hannah McCloskey

Maggie Mead

Leah Morrissey

Fatima Perez-

Dominguez

Harris Pope

Maanya Rajesh

Rebecca Rice

Auburn Robertson

Jenna Rupp

Jude Saverino

Carlisle Shore

Justin Teoh

Zachary Tucker

Hallie Turner

Emery Van Voorhis

Natalie Varma

Katie Whittington

Chloe Williamson

Avianna Wooten



PROJECT SELECTION & EXECUTION: FROM ISSUE TO INTEGRATION

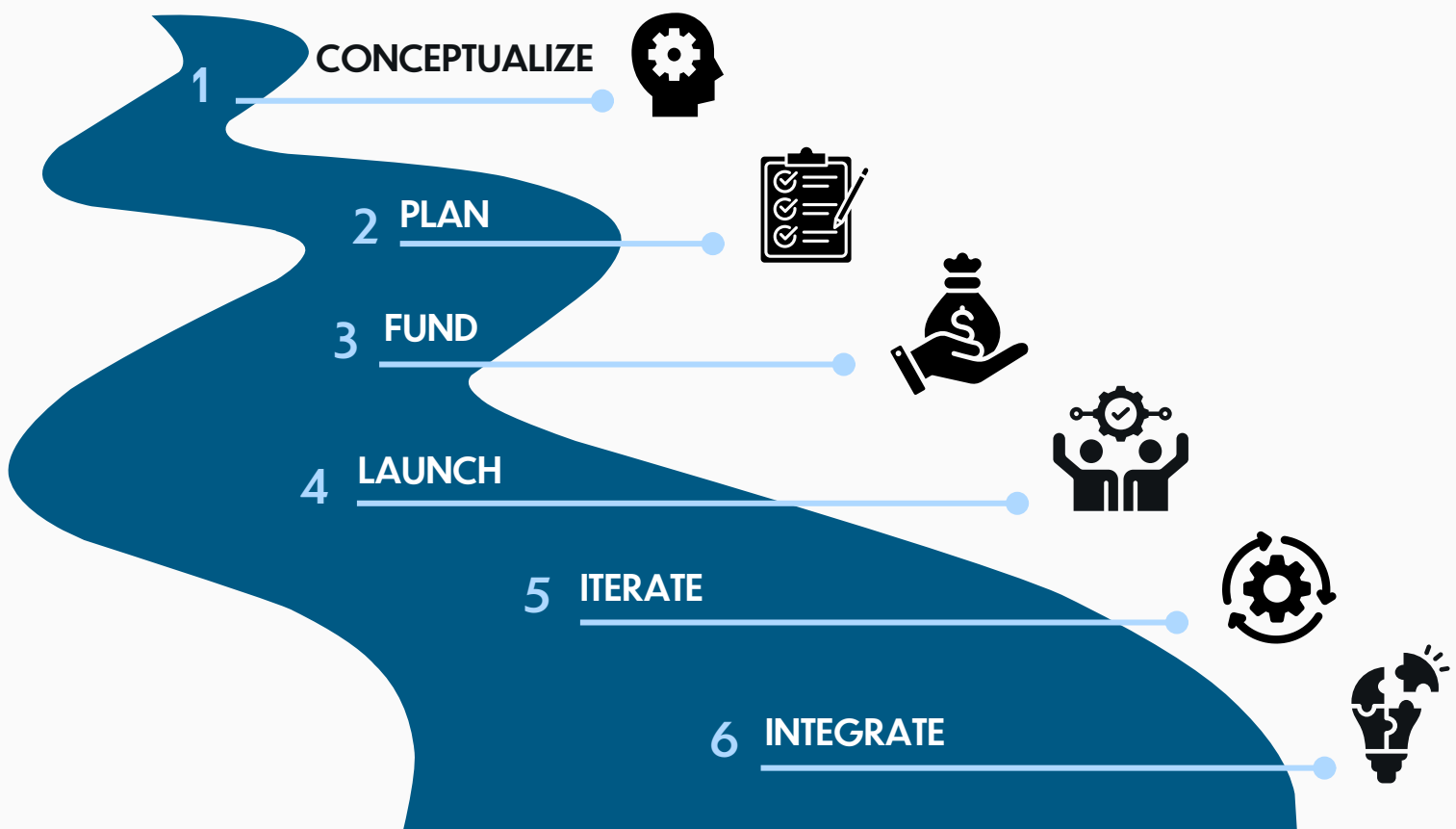
The Collaboratory has funded approximately 600 research projects since its establishment in 2016 with each of these individual projects being chosen for numerous factors. In some instances, the North Carolina General Assembly mandates that the Collaboratory focus on a specific issue with a deadline for a formal legislative report summarizing the research by a certain time.

In other cases, the Collaboratory has discretion in identifying the scope of the topic and team to conduct the research. Within this realm of discretionary projects, the Collaboratory utilizes staff review and external feedback to help guide the selection process.

This type of external review can take several forms, such as:

- Request for Proposals (RFPs) in which the Collaboratory announces a funding opportunity in which a review panel evaluates proposals;
- Projects that are assisted by partners in the selection, such as the Department of Public Instruction for education projects or the Department of Environmental Quality in the case of wastewater infrastructure funding;
- The Collaboratory's Advisory Board recommends issues and primary investigators to lead research projects.

The project selection process to the completion of the research varies for each project based on scope and timeliness but generally follows the same pattern as outlined below in six stages.





RESEARCH COMPLIANCE & ADMINISTRATION

STEWARDSHIP OF STATE DOLLARS

The Collaboratory's research portfolio is almost exclusively funded by the North Carolina General Assembly. As such, the Collaboratory takes its duty to be responsible stewards of State dollars very seriously.

The Collaboratory has established an internal database that tracks all 600 of its funded projects at every stage of the research process, including proposal, funding agreement, and final report. Each project is categorized based on funding source and institution, and every action taken with a project, such as a budget amendment or no-cost extension is loaded into the database. The database is easily searchable, allowing the Collaboratory to be responsive to legislative staff, researchers, and the public when inquiries come in about the status of projects.

FINANCIAL REVIEW

Over the last several years the Collaboratory has worked closely with the NC Pandemic Recovery Office to ensure that reporting and compliance requirements are being met for projects funded through the CARES Act and the American Rescue Plan Act.

- The CARES Act audit of the Collaboratory's \$29 million in funds for 90 projects was completed in December 2023 with no findings.
- The Collaboratory worked with staff at UNC-Chapel Hill's Office of Sponsored Research to complete our first round of desk audits with Deloitte on behalf of OSBM for the American Rescue Plan Act portfolio. To date, 24 desk audits have been conducted. This will be an annual process with them, and we will meet with them again in the coming spring.

The Collaboratory is in the process of hiring two additional staff members for the finance team, which will afford the bandwidth to do monthly desk audits on the State appropriations portfolio.

FY 2024 FUNDED PROJECTS

Project Title	PI Name	PI Campus	Award
Syngas/CO ₂ from Hog Manure derived Biochar and Its Conversion into Fuels and Value-added Chemicals	Debasish Kuila	NCA&T	\$100,000
The Fate and Geochronology of PFAS in Sediments	Brent Mckee	UNC-CH	\$115,170
TiO ₂ Catalyst and Soil Microbiome Synergy: Targeting GenX Degradation Using Soil from Nearby PFAS-Affected Sites	Dongyang Deng	NCA&T	\$149,563
PFAS in Groundwater: New Insights On Inputs and Outputs	David Genereux	NCSU	\$153,402
PFAS in North Carolina: Identification and Remediation	Pingping Meng	ECU	\$200,000
Immunotoxicological testing of per- and polyfluoroalkyl substances (PFAS) in North Carolina	Tracy Woodlief	ECU	\$230,839
Advancing techniques to assess the fate, transportation and detection of PFAS	Renzun Zhao	NCA&T	\$250,000
Sorptive treatment of PFAS and geochronology of PFAS in sediments	Detlef Knappe	NCSU	\$250,000
Mapping PFAS serum levels throughout the Cape Fear River Basin	Jane Hoppin	NCSU	\$250,000
Supercritical water oxidation for PFAS destruction	Marc Deshusses	Duke	\$250,000

Project Title	PI Name	PI Campus	Award
Equipment Purchase: Agilent 8890 GC System	Nadine Kotlarz	NCSU	\$253,477
Toward an Improved Understanding of Airborne Per- and Polyfluoroalkyl Substances (PFAS): Advancing Measurements of Air Concentrations and Emissions and Application to a North Carolina Occupational Setting	Barbara Turpin	UNC-CH	\$300,000
Improved Online Quantification of Airborne PFAS in NC by a Field-Deployable GC-CIMS Method	Jason Surratt	UNC-CH	\$300,000
Development of a Forensic Model to Trace PFAS in Atmospheric Deposition	Ralph Mead	UNCW	\$400,000
PFAST Team 1: PFAS sources and fate in public drinking waters of North Carolina impacted by firefighting and textile operations (Knappe)	Detlef Knappe	NCSU	\$500,000
PFAST Team 1: PFAS sources and fate in public drinking waters of North Carolina impacted by firefighting and textile operations (Ferguson)	Lee Ferguson	Duke	\$500,000
Continued funding for NC PFAS Testing Network Program Management Office at UNCW	Ralph Mead	UNCW	\$550,000
The North Carolina Firefighter Cancer Cohort Study (NC-FCCS): Investigating PFAS & Chemical Exposures as Cancer Risks	Heather Stapleton	Duke	\$1,113,741
OSFM Foam Analyst Division	Brian Taylor	OSFM	\$801,847
Dual employment: Evaluating technologies to remove 1,4-dioxane from wastewater effluent (SL 2023-134 Section 9b)	Detlef Knappe	Vendor	\$3,000

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Personalized Adaptive Learning for Inclusive Education in North Carolina	Mark Mcneilly	UNC-CH	\$25,000
Independent contractor: foster care	John Degarmo	Vendor	\$33,425
Lumbee Tribe Health Assessment 2023	Crystal Moore	UNC-P	\$43,897
Development of a public health partnership hub with the Lumbee Tribe and UNC-Pembroke	John Wiesman	UNC-CH	\$50,000
Bridge to 100 Innovation Design for Sustainable Impact	Gary Nelson	UNC-CH	\$50,000
Do living shorelines maintain connectivity and habitat function in intertidal landscapes?	Joel Fodrie	UNC-CH	\$74,997
Evaluate and Re-Design North Carolina's County Distress Rankings (Tiers) - Phase 1	Mark Little	UNC-CH	\$124,688
1,4-Dioxane Treatment Technologies & Implementation Costs	Alexander Gorzalski	Vendor	\$143,800
Leibfarth Lab Manager Support	Frank Leibfarth	UNC-CH	\$150,000
Dingemans: GraphenE oxide membraNES for portable kidney dialysis (GENESIS)	Greg Copenhaver	UNC-CH	\$183,598
Assessment of Using Business Creation Data for Economic Forecasting in NC	Paige Ouimet	UNC-CH	\$300,000

Project Title	PI Name	PI Campus	Award
North Carolina Thyroid Cancer Study	Andy Olshan	UNC-CH	\$450,000
Short-Wave Infrared Sensors using Low-Bandgap Organics	Wei You	UNC-CH	\$495,909
Geochemical Characterization of the Carolina Tin-Spodumene (Lithium) Belt - Phase 2	Adam Curry	NCSU	\$100,000
The Age and Thermal History of Magmatism in the North Carolina Tin-Spodumene Belt	Drew Coleman	UNC-CH	\$257,896
Polymer Impregnated Sorbent Technology for Lithium Recovery and Conversion	Hemali Rathnayake	UNCG	\$800,000
READY Explorers Camp: Reading, Enrichment, Achievement, and Discovery	Christy Thomas	FSU	\$25,000
Investigation of security and privacy issues in Mobile Driver's Licenses (mDLs) deployment	Prashanth Busireddygar	UNC-P	\$72,000
Neighborhood Microscope: Leveraging Big Data Sources to Examine Health and Well-being in Urban and Rural NC Neighborhoods	Shaohu Zhang	UNC-P	\$86,000
Addiction Education Immersion Initiative (AEII)	Stephanie Robinson	UNC-P	\$92,000
Acquisition of a Benchtop Nuclear Magnetic Resonance (NMR) Spectrometer to Enhance Scientific Research at ECSU	Tesfaye Serbessa	ECSU	\$139,000
PI and Lab Manager Salary for the Development and Deployment of Ionic Fluorogels to Remediate PFAS from North Carolina Water	Frank Leibfarth	UNC-CH	\$369,592

Project Title	PI Name	PI Campus	Award
Validating Streambank Erosion Models for Estimating Sediment and Nutrient Loads Delivered to Falls Lake, NC	Barbara Doll	NCSU	\$23,546
ModMon and FerryMon: NC Ferry-based water quality monitoring program for the Neuse River	Hans Paerl	UNC-CH	\$660,000
Future Researcher for Environmental Solutions and Health Outcomes (FRESH Outcomes)	Rebecca Fry	UNC-CH	\$10,000
Hyco Lake Vegetation Surveys	Rob Richardson	NCSU	\$27,038
A study of the marine fisheries and coastal habitats regulated by North Carolina: Year 2	Rachel Gittman	ECU	\$35,775
A study of the marine fisheries and coastal habitats regulated by North Carolina: Year 2	Eric Wade	ECU	\$39,931
A study of the marine fisheries and coastal habitats regulated by North Carolina: Year 2	Nathan Hall	UNC-CH	\$40,196
A study of the marine fisheries and coastal habitats regulated by North Carolina: Year 2	Fred Scharf	UNCW	\$47,925
Characterizing Water Quality Impacts of Tidal Floods on NC Communities	Natalie Nelson	NCSU	\$49,979
A study of the marine fisheries and coastal habitats regulated by North Carolina: Year 2	Jim Morley	ECU	\$53,922
VR Nursing Program - 4-month supplement	Ryan Schmaltz	UNCSA	\$57,500

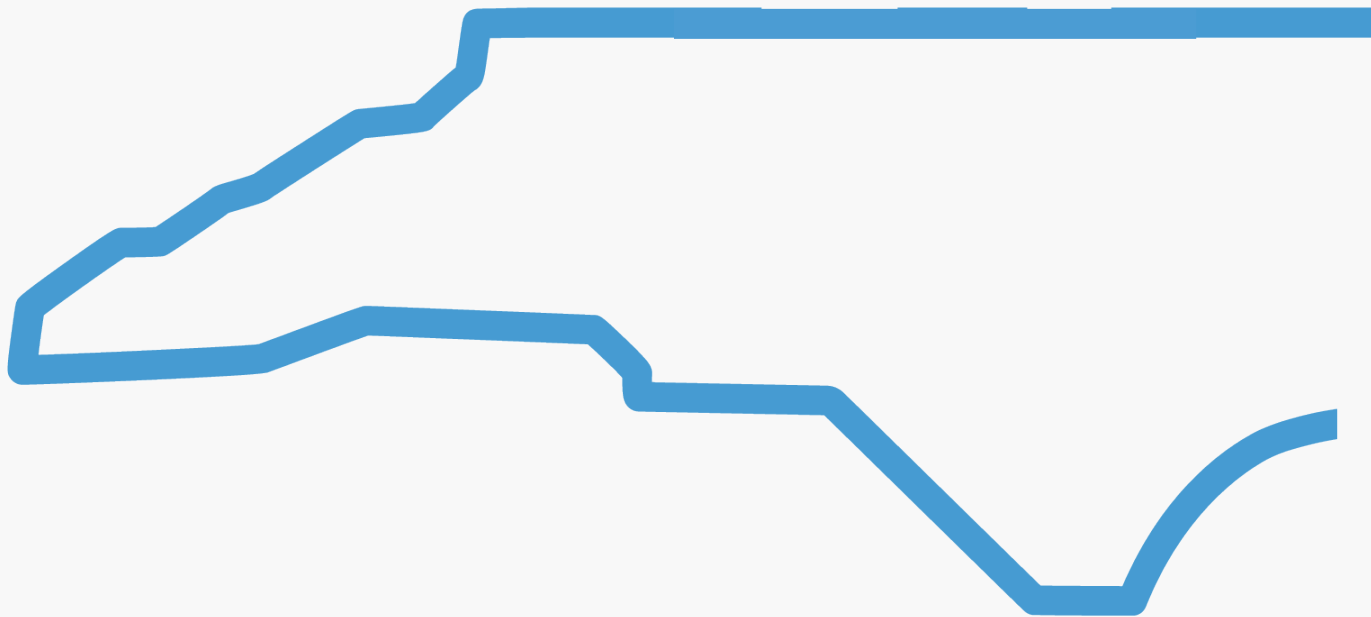
Project Title	PI Name	PI Campus	Award
A study of the marine fisheries and coastal habitats regulated by North Carolina: Year 2	Jeff Buckel	NCSU	\$62,177
A study of the marine fisheries and coastal habitats regulated by North Carolina: Year 2	Janet Nye	UNC-CH	\$63,385
A study of the marine fisheries and coastal habitats regulated by North Carolina: Year 2	Elizabeth Havice	UNC-CH	\$88,968
A study of the marine fisheries and coastal habitats regulated by North Carolina: Year 2	Joel Fodrie	UNC-CH	\$167,721
Supporting student resilience, success, and well-being during college: Evaluating the effect of the Penn Resilience Program on UNC System students	Jane Fruehwirth	UNC-CH	\$34,849
Unmanned Aircraft Systems (UAS) Technology for Conservation Research - Coastal Resiliency and Habitat Monitoring at Pine Island	Kuldeep Rawat	ECSU	\$93,811
Marsh monitoring and research with remote sensing in Currituck Sound	Susan Cohen	UNC-CH	\$227,376
IPRC Support for UNC Addiction Medicine Research Program	Steve Marshall	UNC-CH	\$85,312
PORT Conference: Opioid Overdose Response Teams	Robert Dieterle	UNC-CH	\$103,000
Implementation Study of the ATLAS Mobile Clinic	Tonya Van Deinse	UNC-CH	\$135,000
Valable - Impacting the Opioid Crisis Through Digital Health Startup Creation	Robert Dieterle	UNC-CH	\$207,000

Project Title	PI Name	PI Campus	Award
Sigma receptor modulation as an opioid-free approach to pain therapy (Year 2 and 3 supplement)	Kevin Frankowski	UNC-CH	\$401,573
Peripherally-targeted Adrb3 Antagonists for the Treatment of Pain (Year 2 supplement)	Andrea Nackley	Duke	\$417,007
Resolving the neurobiological mechanisms of opioid-induced reward, dependence, and respiratory depression to identify novel therapeutics against opioid addiction and overdose death (Year 2 and 3 supplement)	Gregory Scherrer	UNC-CH	\$481,420
Scaling Up: UNC Street Drug Analysis Lab	Nabarun Dasgupta	UNC-CH	\$525,985
Community Opioid Resources Engine for North Carolina's (CORE-NC) Phase 2	Steve Marshall	UNC-CH	\$630,000
Goldie Health – The Golden Window to Recovery	Robert Dieterle	UNC-CH	\$690,000
North Carolina's Judicially Managed Accountability & Recovery Courts (JMARC)	Kristen Devall	UNCW	\$846,571
Addressing the Opioid Use Disorder Epidemic via Digital Health Startup Creation	Robert Dieterle	UNC-CH	\$1,000,000
Cara's Project: Supportive Housing to Break the Intergenerational Cycle of Addiction and Improve the Lives of Women and Children in North Carolina	Hendrée Jones	UNC-CH	\$1,006,437
Equipment Purchase: CIA Advantage Ultra	Detlef Knappe	NCSU	\$117,700

Project Title	PI Name	PI Campus	Award
Equipment Purchase: iCAP™ TQ ICP-MS	Pingping Meng	ECU	\$285,423
Equipment Purchase: Orbitrap™ Exploris™ GC Mass Spectrometer	Heather Stapleton	Duke	\$302,245
Equipment Purchase: Orbitrap™ Exploris GC with 60K + MSMS	Detlef Knappe	NCSU	\$493,765
TPACC MIST Chamber Upgrade (Phase I)	Bryan Ormond	NCSU	\$500,000
Equipment Purchase: Orbitrap Exploris™ Iso 240 mass spectrometer	Ralph Mead	UNCW	\$599,711
PFAS-Free Foam Training Facility Construction Project	Brian Taylor	OSFM	\$881,396
Equipment Purchase: Orbitrap™ Astral™ Mass Spectrometer	Lee Ferguson	Duke	\$1,146,152
Eshelman Innovation Entrepreneur in Residence	John Bamforth	UNC-CH	\$93,000
HLA-E T cell therapies against virus associated cancers	Paul Armistead	UNC-CH	\$206,565
Development of PHF19-targeted therapeutics for multiple myeloma	Lindsey James	UNC-CH	\$288,695
Development of direct aquaporin-4 binders: A new approach for the treatment of stroke and CNS injuries	Kevin Frankowski	UNC-CH	\$478,734

Project Title	PI Name	PI Campus	Award
Restoring Lysosome Function using a Therapeutic Antibody to Prevent Disease Flare in Systemic Lupus Erythematosus	Barbara Vilen	UNC-CH	\$690,531
Evaluation of innovative technologies and practices to improve rural wastewater treatment and watershed health	Michael Burchell	NCSU	\$177,383
Town of Maysville: Improvements for Better WWTP Effluent	Schumata Brown	Local government	\$2,828,000
Town of Boonville: Improvements for Better WWTP Effluent	Vaughn Benton	Local government	\$3,576,800
Improvements for better WWTP effluent - Ansonville	Joe Estridge	Local government	\$3,948,000
Town of Hot Springs Wastewater Treatment Plant (WWTP) Expansion	Abigail Norton	Local government	\$4,000,000

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