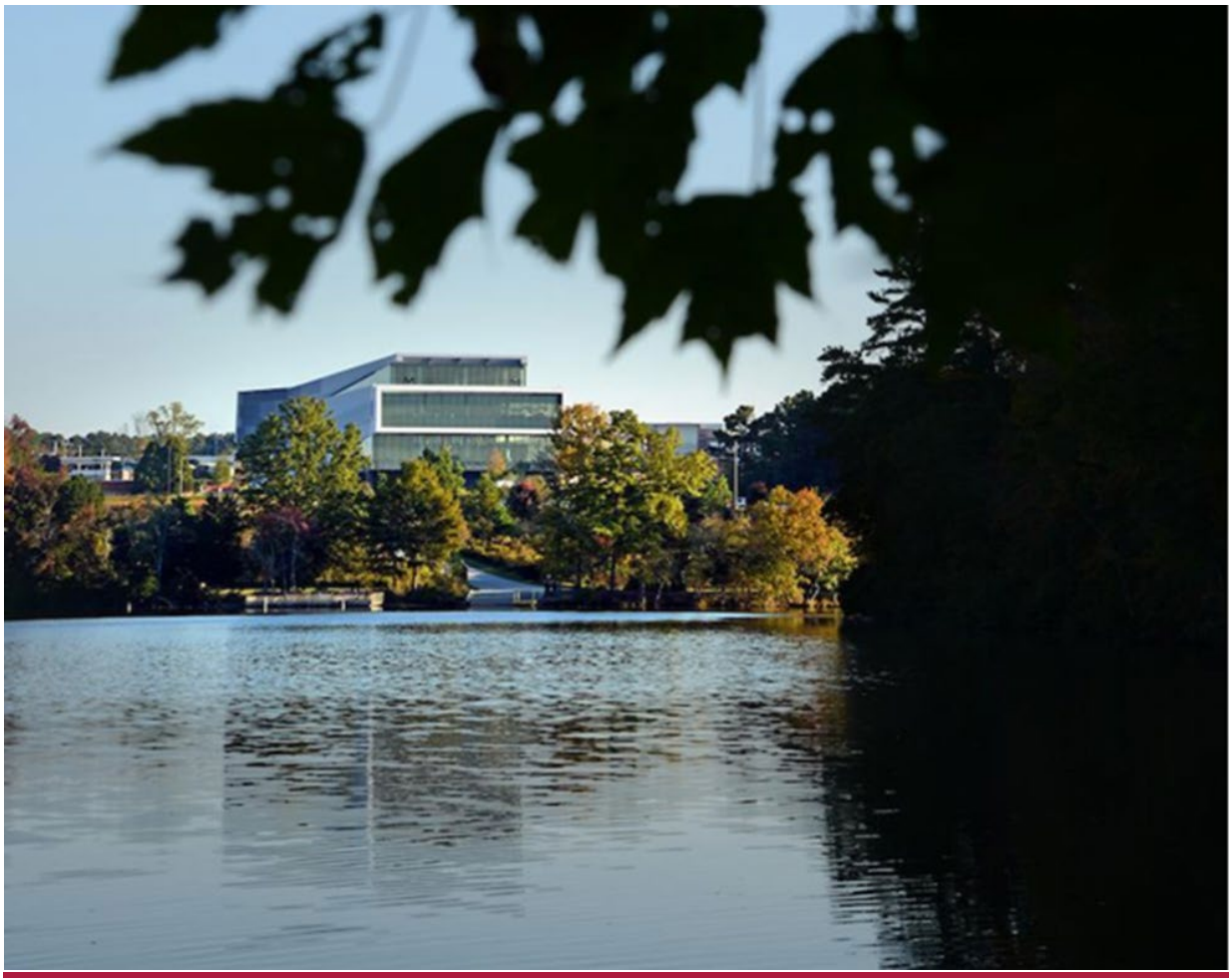
KENAN INSTITUTE
ENGINEERING, TECHNOLOGY & SCIENCE
NC STATE UNIVERSITY



KENAN INSTITUTE GOALS AND ACCOMPLISHMENTS FISCAL YEAR 2024-2025

William R. Kenan, Jr. Institute for Engineering, Technology & Science
1070 Partners Way, James B. Hunt, Jr. Library, Suite 5100
NC State University Centennial Campus, Raleigh, NC 27606

Collaboration. Innovation. Results.

TABLE OF CONTENTS

A MESSAGE FROM THE DIRECTOR

With the resources so generously provided by the William R. Kenan, Jr. Fund for Engineering, Technology & Science, NC State University, and our corporate, government, and philanthropic partners, in 2024-2025 the Kenan Institute continued to support and advance innovation in science and technology as a vehicle for our economic development and growth as a state and nation.

The Kenan Institute for Engineering, Technology & Science focuses its intellectual, human and financial resources in support of innovative individuals and programs involved in science, mathematics and engineering driven enterprises with demonstrated potential for high impact educational, economical and other benefits to society. Specifically, the Institute continues to support and enable core competencies in four strategic areas: high technology research; science, technology, engineering, and math K-12 education; technology commercialization and entrepreneurship; and science and technology policy.

We remain committed to encouraging multidisciplinary, multi-institutional teams involving government, university, and corporate partners to solve scientific and societal problems, generate technology-based economic development, and bring together the public and private resources necessary to successfully tackle the emerging issues of our time. We do this while maximizing the leverage from the significant strengths of NC State University students, faculty, and staff while focusing on programs that are consistent with the university's strategic goals in research, education, and engagement.

Our Institute support and leadership enables individuals and programs at NC State and at other institutions to continue to produce world-class research and scholarship, which enhances knowledge and learning, produces and supports new innovative companies, and informs sustainable practices and effective public policies that will have lasting impacts.

We really appreciate your interest in the Kenan Institute and welcome your comments and questions on our work and our programs.

Sincerely,

Ruben G. Carbonell

OVERVIEW OF GOALS

The Kenan Institute for Engineering, Technology & Science (KIETS) aligns its goals with NC State University strategic plan goals. KIETS also has focus areas of its own. Those goals and how KIETS has accomplished them through its support of varied programs and initiatives are outlined in this document.

GOAL 1: Empower Students for a Lifetime of Success and Impact

KIETS Goal: Identify and support NC State student focused initiatives and novel educational approaches to enhance undergraduate and graduate education.

ACCOMPLISHMENTS

KIETS Climate Leaders Program

The KIETS Climate Leaders Program (CLP) led by its Director Amanda Mueller, Program Coordinator Catherine Cole, and Senior Faculty Fellow Professor Jeremiah Johnson supports student scholars' engagement with leaders and organizations working on climate change solutions to help empower, educate and inspire young people to embark on careers and become innovative leaders in mitigating climate change. FY 2024-25 spans two CLP cohorts. The 14 students in the 2024 cohort (2 undergraduate, 12 graduate, representing six NC State Colleges) completed their program in December 2024. The 14 student/mentor teams for 2025 (3 undergraduate, 11 graduate, representing seven NC State Colleges) are approaching climate change in innovative ways to improve urban growth, renewable energy/energy waste, sustainable business practices, agri-food systems, air pollution, carbon capture/sequestration, animal conservation, fisheries and marine food webs, disaster recovery, community engagement and local stewardship, climate history and education, public policy, and the application of climate data. To date, the 2025 scholars have engaged in monthly sessions on Climate 101, Systems Thinking Approach and Mitigation, Theory of Change Model with the City of Raleigh's Community Climate Action Plan, Communications for different audiences and the three-day intensive academy. The three-day Intensive Academy took place in Morehead City, NC on May 5-7, 2025.

Technology, Entrepreneurship and Commercialization (TEC) Program

In FY 24-25, KIETS actively engaged and advised *TEC program* graduate students regarding their potential initiation and launch of high-tech companies based on technology developed at NC State and other university, government, and industry partners. TEC teams worked on commercialization plans for *Indago* authentication system and *Gradient Medical* cancer treatment. During the 2025 NC State annual entrepreneurship competition, former TEC students advised by KIETS representing startup *Loom3D* received a $10,000 award. KIETS Associate Director Raj Narayan served as faculty advisor and executive in residence to these TEC teams.

NC State Social Entrepreneurship Initiative

KIETS collaborated with the *NC State Social Entrepreneurship* initiative to enable students across NC State with opportunities to engage and learn from social entrepreneurs in North Carolina, nationally, and internationally. In FY 2024-25, the Social Innovation Fellows Program (SIF) welcomed 20 new fellows from across the university. KIETS Associate Director Raj Narayan served as one of the core faculty team mentors for the Social Innovation Fellows program. As the eighth cohort of the program, these students spent the year refining their leadership and change-making abilities while gaining deeper insights into themselves and the communities they served.

NC State Science Olympiad Student Alumni Group Division B Invitational

KIETS supported the NC State Science Olympiad Student Alumni Group second annual Division B (middle school) Science Olympiad invitational on January 18th, 2025 at NC State. 30 teams participated from across NC with 450 students and 300 parents, representing New Hanover, Wake, Mecklenburg, Moore, Orange, and Cumberland counties. Over 180 undergraduate students volunteered on the day of the tournament. The group additionally had 30 test writers encompassing all disciplines in NC State. Many of the volunteers were recruited through scholarship programs, including the Caldwell Fellows and the Goodnight Scholars. The group also coordinated with a number of clubs and student groups. The tournament also included student volunteers from UNC, Duke., and 1 from Johnston Community College. The coaches of attending teams were primarily middle school science teachers, resulting in 35-40 teachers attending on the day of the tournament.

2024 NC State University Creating Solutions for the Global Blue Economy Ideation Workshop

KIETS collaborated with Professor Christopher Osburn in the Department of Marine, Earth and Atmospheric Sciences to support the Blue Economy Innovation Program (BEIP) Workshop. The October 2024 Creating Solutions for the Global Blue Economy workshop was successfully completed October 23-24 in Morehead City, NC, at the Historical Museum of Carteret County (HMCC). Over 60 attendees were present including 5 faculty, 21 undergraduates, and 15 graduate students. The BEIP includes members from the KIETS Climate Leaders Program. In FY 2024-25, the BEIP workshop was included in an "omnibus" NSF Engine proposal submitted by UNC-Wilmington as the EcoTech program in collaboration with Duke University and several coastal community colleges. The workshop continues to be a key asset on education, innovation, and workforce development outreach.

Coastal Resilience and Sustainability Initiative Coastal Community Intensive Training (CCRIT) Program

The NC State Coastal Resilience and Sustainability Initiative (CRSI) led by Professor Erin Seekamp is part of the Provost's Office of University Interdisciplinary Programs. The CRSI is leading the Coastal Community Resilience Intensive Training (CCRIT) program in collaboration with the KIETS Climate Leaders Program (CLP) led by Amanda Mueller. In FY 2024-25, the C-CRIT program completed its partnership with Jones County, delivering a risk and vulnerability assessment report, a publicly available online story map conveying the report's findings, and a presentation to community leaders of the report findings. The C-CRIT program also hosted a symposium at NC State to share products and experiences with a broader audience (NC State faculty, staff, students; state government partners; NGO partners; and individuals contributing content to the program's training materials). In a joint session at NC Sea Grant's November 2024 North Carolina Coastal Conference, C-CRIT program mentors, student alumni, and the Jones County Manager shared their perspectives on the inaugural year of the program to an audience of academics, representatives from federal, state, and local governments, and planning and policy consultants.

NC State Engineers Without Borders Student Chapter Program

In 2024-25, KIETS supported the NC State Chapter of Engineers Without Borders (EWB-NCSU) which seeks to empower communities and equip leaders internationally and locally to meet their needs through sustainable engineering projects, all while developing students into cross-cultural servant-leaders. The Sierra Leone Renewable Energy team, working with the Goshen Academy in Rokel, Sierra Leone, installed 16 solar panels and 4 batteries that power 14 outlets and 20 light bulb at the school. The Sierra Leone Water team works with the Browndel School, in Wellington, Sierra Leone, which has approximately 200 students and 17 staff members. The Guatemala Water Systems (GWS) team has positively affected the lives of over 300 people in rural Guatemala by installing seventy rainwater harvesting systems in the community of Caserio Panhux. KIETS Associate Director Raj Narayan serves as a member of the EWB-NCSU advisory board.

GOAL 2: Ensure Preeminence in Research, Scholarship, Innovation and Collaboration

KIETS Goal: Identify programs that support faculty research efforts, promote career development, and help enhance the research infrastructure at the university.

ACCOMPLISHMENTS

KIETS is supporting several research programs involving NC State faculty and students:

Bioseparations/Bioprocessing Development Center (BBDC)

KIETS supported the *Bioseparations/Bioprocessing Development Center* (BBDC) initiative led by KIETS Director Dr. Ruben Carbonell in partnership with BTEC. The BBDC funding provided by the Kenan Institute is helping BTEC staff, graduate and postdoctoral students participate in industry analytical and process development projects, which are not funded by the State. BTEC provides matching funds in the amount of $2.5 million in facilities for this effort. In addition, BTEC is providing leverage in the amount of $350,000 per year in staff salaries to support the analytical and process services program. BTEC has over $300,000 in bioprocess services projects for small and large companies in NC. BBDC also enabled BTEC to succeed in getting three major grants from the National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL), and more recently, from the Clean Energy Smart Manufacturing Institute (CESSMI) and the Bio-industrial Manufacturing Institute (BioMADE). In addition to participating in several NIIMBL grants with NC State faculty, BTEC has initiated a long-term contract with NIIMBL to develop a testbed for studies on adaptive process control methodologies for the production of biopharmaceuticals and the development of process and raw materials data ontologies that can be disseminated to NIIMBL companies. This program provided BTEC with approximately $1.3 million in new equipment, and several hundred thousand dollars for support of personnel, supplies, and other related expenditures. These funds are also supporting efforts on the development of new projects to be proposed to federal agencies and private foundations. The BBDC played a key role in helping develop the technology that led to the formation of a new start-up, MembraneWorks, Inc., to develop all-membrane processes to increase the productivity of biologics manufacturing up to 10-fold, and reduce costs significantly. The services provided by BBDC play an increasingly important role in the ability of NC State to establish new partnerships and develop new proposals for future funding from industry, non-profits, and federal sources.

BTEC received the 2024 Economic Development Partnership Award at the annual awards ceremony held by NC State's Office of Outreach and Engagement on April 29. Pictured (left to right) are Ruben Carbonell, who presented the award to BTEC's leadership team, Gary Gilleskie, Jennifer Pancorbo and Bala Rao.

Reimagining Soft Materials for Haptic Engineering Initiative

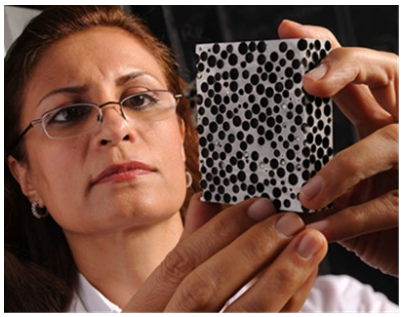
KIETS supported NC State Chemical and Biomolecular Engineering Professor Lilian Hsiao's research program centered around intelligent soft materials focused on enhancing virtual reality through haptic materials that can alter the sense of touch to the user. Dr. Hsiao's project addresses NC State's strategic research area in "Enriching the Human Experience" as well as in "Secure and Intelligent Systems". In FY 2024-25, Dr. Hsiao's group published a paper that describes how molecular additives affect wearable devices in tribologically generated energy and tactile sensation. These devices will pave the way for a sustainable future, where energy can be generated from large-scale ambient motion as opposed to harmful environmental extraction of chemical fuels. Also, in FY 2024-25, Dr. Hsiao's team have been developing triboelectric elastomer sensors that can be embedded in running shoes. KIETS funds support Dr. Hsiao's graduate students working towards wearable energy harvesters using triboelectric effects generated by polymeric substrates. Dr. Hsiao's research complements the efforts of a startup company called X-MED Hydrogels, which will commercialize hydrogel fibers that are tailored for stable and long-duration release of drug cocktails to burn wounds. In 2024, Dr. Hsiao was awarded the Society of Rheology Metzner Award for distinguished early career research in the field of rheology. Dr. Hsiao was also named a NC State University Faculty Scholar in 2025.

Modeling Electrostatically Charged Filters Loaded with Liquid Aerosols

KIETS supported Professor Hooman Tafreshi in the NC State Department of Mechanical and Aerospace Engineering along with Dr. Behnam Pourdeyhimi, Director of the NC State Nonwovens Institute (NWI) who are collaborating to address the need for efficient, sustainable, and affordable aerosol filter manufacturing. Despite its widespread applications, aerosol filtration has remained an empirical trial-and-error-based art in desperate need of a design theory and a generalizable manufacturing methodology. Professors Tafreshi and Pourdeyhimi are developing a computational model to simulate the process of charging a filter. Such high efficiency filters generate less pressure drop as they operate, which results in significant energy savings. In 2024-25, the PIs developed a CPU-friendly simulation technique, referred to as pore morphology method (PMM), that can predict how liquid distributes in a virtual filter under different operating pressures. This CPU-friendly PMM model can potentially allow the PIs to design, for the first time, face masks that are resistant to performance degradation (e.g., due to the wearer coughing and sneezing) or HVAC filters that can perform in moist environments. KIETS leverages support from the NWI.

Metal Foams as Innovative Materials for Bioseparations

KIETS supported NC State Mechanical and Aerospace Engineering Professor Afsaneh Rabiei and Chemical Engineering Professor Cristiana Boi's research focused on the development and validation of metal foam-based filters as high-performance, chemically robust, and sustainable replacements for traditional filtration media used in applications such as protein separation and downstream processing of biomolecules. While existing filters are widely adopted, they are hindered by issues such as membrane fouling, poor thermal resilience, and challenges related to waste management. During FY 2024-25, the PIs report that substantial progress has been made in both experimental and computational modeling efforts, particularly involving open-cell metal foams in macro-scale aluminum and micro-scale stainless steel forms. These studies have produced quantifiable metrics—including permeability and pressure drop measurements—that showcase the performance of metal foams under realistic conditions. As the research transitions into its second phase, major objectives include holder optimization, foam fabrication, biomolecule selection, and surface modification. KIETS funds support a PhD student and are leveraged with support from the Department of Chemical and Biomolecular Engineering as well as the Department of Mechanical and Aerospace Engineering. The preliminary results from this research program will be used to put together full proposals submitted to NSF, NIH, and DoD as well as the Gates Foundation.



GOAL 3: Expand and Advance our Engagement with and Service to North Carolina and beyond, defining the standard for a 21st-century land-grant University

KIETS Goal: Support strategic partnership among industry, state government, federal agencies, and state school districts to enhance STEM education in our schools.

ACCOMPLISHMENTS

Kenan Fellows Program for Teacher Leadership (KFP)

The 2024-2025 Kenan Fellows Program cohort of 37 fellows expreienced a successful program and are leading and making a difference in their communities. Some impact highlists are as follows:

- 33,884 students served.
- 300+ Teachers served by district level Fellows.
- 27 of the Fellows provided 335 hours of professional development to 2,178 other educators.
- 15 of the Fellows gave presentations to 778 non-educator education stakeholders.
- 12 of the Fellows gave 27 regional, state, and national conference presentations to 1,440 people.
- 15 of the educators had been awarded grants totaling $44,950.
- 11 of the educators had received accolades in addition to the Kenan Fellowships, including 6 school and district Teacher of the Year awards and the NC Teacher of the Year (Rachel Candaso).

In FY 2024-25 KFP continued to offer the Mountains to Sea Scholars program and two additional outreach initiatives, Not Your Average PD (NYAPD) and STEMwork Sprint. STEMwork Sprint provides educators the opportunity to earn micro credentials, and enough Continuing Education Units for a full, five-year teaching license renewal. Not Your Average PD (NYAPD) leverages the instructional expertise of KFP alumni to provide one-hour, live streamed professional development (PD) sessions to anyone with an internet connection.

In May 2025, KFP announced its newest cohort. These 30 Fellows hail from 24 North Carolina districts; one of the districts is new to KFP: Alexander. 17 teachers serve in economically distressed (Tier 1 or Tier 2) counties. More than half of this cohort is from rural communities and the majority teach in high school or middle school; 10 teach at the elementary level or in K-12 schools. The 2025-2026 Fellowships are being made possible through the generous support of KFP's corporate, education, government, and foundation partners including: The BelleJar Foundation, Burroughs Wellcome Fund, Deborah Mangum, Duke Energy, Duke University Marine Lab, Dogwood Health Trust, Fleet Readiness Center East, Goodnight Educational Foundation, Kenan Institute for Engineering, Technology & Science, NC Afterschool Programs, North Carolina Department of Environmental Quality, North Carolina Department of Public Instruction, North Carolina's Electric Cooperatives and Lumbee River EMC, North Carolina Farm Bureau and Henderson County Farm Bureau, NC State Genetics and Genomics Academy, NC State EE Lab, Meta, NSF grants to Dr. Amy Maddox of UNC-Chapel Hill and Dr. Alexander Nevzorov of NCSU, and the Gorlin Family Foundation. A complete list of the universities, industries, and foundations that provide support for KFP through funding and/or hosting/mentoring Fellows can be found at https://kenanfellows.org/partners/

NC Children's Museum

In FY 2024-25, KIETS supported the Kidzu Children's Museum which became officially known as The North Carolina Children's Museum (NCCM), having received this designation from the North Carolina Department of the Secretary of State. With support from the Kenan Charitable Trust of $1.5 million, the NCCM was able to acquire 45 acres of land in January 2024 at 510 Mt. Carmel Church Road in Chapel Hill for its new museum home. The property will be home to an early learning campus with indoor and outdoor programming for children – birth through teens, their caregivers, educators, and researchers. Kidzu also developed a partnership and collaboration with the Kenan Fellows Program for Teacher Leadership and hosted a Kenan Fellow in FY 2024-25. Among the partners supporting the NC Children's Museum initiative are the Kenan Charitable Trust, Burroughs Wellcome Fund, National Endowment for the Arts, North Carolina Arts Council, Kohl's National Giveback Initiative, Institute of Museum and Library Services – Museums for America, GlaxoSmithKline Ribbon of Hope, The Grable Foundation, Frances R. Dewing Foundation, and the Orange County Partnership for Young Children.

KIETS Goal: Seek and support efforts that will inform research, public policy and engagement for the benefit of North Carolina and the Nation.

ACCOMPLISHMENTS

NC Coastal Federation Newport River Estuary Protection and Restoration Strategic Plan

The NC Coastal Federation (NCCF) is working with key partners to develop a watershed action plan for the Newport River. In FY 2024-25, KIETS support enabled the NCCF worked to incorporate feedback from local governments to finalize the Newport River Watershed Plan. The Plan provides an overview of the past, present, and projected water quality conditions of the Newport River, as well as methods and strategies intended to reduce the rate and volume of polluted stormwater runoff to improve water quality and mitigate flooding. NC State researchers Dr. Natalie Nelson and Dr. Angela Harris, and PhD student Julia Harrison continued their water quality sampling and analysis. The Federation partnered with the KIETS Climate Leaders Program to host a scholar in Summer 2024 at the Federation's Central Office. Swarna Chowdhury, NC State PhD Student in Environmental Engineering, has expertise in coastal modeling that evaluates coastal hydrodynamics and sediment transport in the face of different environmental and anthropogenic activities, which include extreme events like hurricanes, aquatic habitat changes, shoreline migration and aquaculture. The Federation mentored a Kenan Fellow, Jason Vanzant, in Summer 2024, and continues to work with Jason in his new role as Schools in Parks Coordinator at Hammocks Beach State Park. The NCCF has partnered with the North Carolina Coastal Land Trust on a multi-year acquisition and restoration project within the watershed. To date, this effort has resulted in securing 2,030 acres of riparian property.

NC Sea Grant /WRRI/ NC Space Grant Community Collaborative Research Grant Program

KIETS collaborated with the NC Sea Grant in support of the Community Collaborative Research Grant (CCRG) program to address priority coastal issues in the state through strategically linking local ecological knowledge (LEK) sources with academic experts in the field. For the FY 2024-25 solicitation, 17 applications were received proposing over $1.4 million worth of work. This remains the highest ever number of applications for the CCRG program. FY 2024-25 projects selected include David Cerino, Carteret Community College, *Utilizing Advanced Technology for Automated Plankton Sampling and Counting in Hatcheries*; Joel Fodrie, University of North Carolina at Chapel Hill, *DNA Detectives: Working with Local Charter Fishermen to Understand Shark Depredation Events in North Carolina*; Kathryn Stevenson, North Carolina State University, *Supporting Community-Driven Resilience Education and Research (partnered with the Kenan Fellows Program);* Lisa Satterwhite, Duke University, *Community-led Validation of a Remote Sensing and Deep Learning Approach to Identify Cyanobacteria Harmful Algal Blooms and Toxins in the Chowan River and Tributaries of the Albemarle Sound*. KIETS Associate Director Raj Narayan served on the CCRG review and selection committee.

Science Writers 2024 National Conference

KIETS supported the 2024 ScienceWriters conference that connects a vibrant community of science journalists, informal educators, and artists to local expertise. The Fall 2024 national conference took place on November 8-11, 2024 at the Raleigh Convention Center. The conference was co-hosted by the Science Communicators of North Carolina (SCONC), the National Association of Science Writers (NASW), and the Council for the Advancement of Science Writing (CASW). The lead organizers in NC included Michelle Jewell (President, Science Communicators of North Carolina), Jory Weintraub (Director of Science Engagement, Office of University Interdisciplinary Programs, NC State), Matt Shipman (Assistant Director of Research Communications, NC State). The Science Writers conference had 776 attendees from 16 countries. 645 journalists, authors, podcasters, and artists joined the conference in-person at the Raleigh Convention Center. KIETS support leveraged resources from the NC State Office of University Interdisciplinary Programs, Plant Sciences Initiative, and the Data Sciences Academy. The conference also received financial support and partnerships with the Kavli Foundation, Burroughs Wellcome Fund, Michaelson Philanthropies, American Chemical Society, and the North Carolina Museum of Natural Sciences.

GOAL 4: Champion a Culture of Equality, Belonging and Well-Being in All We Do

KIETS Goal: Seek opportunities for enabling equality, belonging and well-being, maximizing efficiency and effectiveness, enhancing resources for KIETS operations and continuously improving services for our stakeholders and partners.

ACCOMPLISHMENTS

Enabling Equality, Belonging and Wellbeing

The Kenan Fellows Program for Teacher Leadership (KFP) continues to prioritize inclusive classrooms as a core element of its Fellowship model. Since 2019, KFP has partnered with the Burroughs Wellcome Fund (BWF) to support a growing portfolio of Fellowships focused on this value. These efforts have included collaborations with organizations such as the Dudley Flood Center for Educational Equity and Opportunity, LatinxEd, the Southern Appalachian Wilderness Stewards, and participation in statewide initiatives including the Color of Education, Science for All, and DRIVE (Developing a Representative and Inclusive Vision for Education) Summits. Fellows have engaged in work ranging from asset mapping of STEM ecosystems to developing bilingual outreach materials and creating inclusive outdoor education programming.

In FY 2024-25, KFP built upon this work through continued partnership with BWF and the addition of three new Fellowships, co-supported by PBS North Carolina and the NC Department of Natural and Cultural Resources (NCDNCR). One Fellow is partnering with NCDNCR to develop educational resources centered on Indigenous experiences in North Carolina through visits to eight Indigenous sites. Another Fellow is collaborating with the Dudley Flood Center to create instructional materials focused on the history of the civil rights movement in North Carolina, based on visits to key civil rights landmarks. A third Fellow is working with WeAre to explore how historical systems continue to shape contemporary life in North Carolina, with a focus on applying this understanding to classroom instruction. Additionally, for the first time, KFP partnered with the NC Center for Afterschool Programs to offer a Fellowship to an afterschool educator. This Fellowship focuses on STEM careers and was designed to extend the program's reach to a broader and more diverse population of students.

The KIETS Climate Leaders Program (CLP) aims to build a network of Scholars comprised of committed, emerging, innovative leaders focused on finding solutions to mitigate or reversing the negative effects of climate change. In FY 2024-25, the CLP continued its outreach to the colleges and student programs that serve a diverse population across campus. The 2025 CLP cohort of 14 students includes five international students, students from seven of our 10 Colleges and 8 women and 6 men. In preparation for the 2026 cohort applications, CLP will partner with additional groups on campus that work to provide equitable access to all NC State students. In establishing the cohort each year, the selection committee seeks an interdisciplinary group with a variety of academic pursuits, lived experiences, and career goals and interests. The CLP annual symposium is free to all attendees and seeks to address aspects of belonging and wellbeing for everyone. In Fall 2024, the symposium keynote speakers engaged with the audience with discussions on mental health and environmental policies, while panel topics on extreme temperature and health, flooding, transportation and food production allowed for dialogue around issues that have directly and/or indirectly impacted everyone. The CLP also collaborates with NC State University's Coastal Resilience and Sustainability Initiative to support rural and unincorporated communities in eastern North Carolina through interns who partner with local communities (Jones County in 2024, Gates County in 2025) to provide countywide vulnerability assessments and asset mapping.

Collaborating on University Wide Initiatives

KIETS collaborated with the Office of the Provost in support of the KIETS Climate Leaders Program as well as with the NC State Coastal Resilience and Sustainability Initiative. KIETS support for the Climate Leaders Program is leveraged with complementary support from the Office of the Provost. KIETS also continued to work collaboratively with the NC State Advancement on the NC State Day of Giving to identify and develop resources for priority initiative such as the Kenan Fellows Program and Climate Leaders Program. KIETS supported the Goodnight Scholars and Caldwell Scholars annual interviews providing space and organizational support. KIETS University Program Associate Tara Spivey helped organize and support the annual interviews, which were held at the Kenan Institute offices in Spring 2025. KIETS also collaborated with NC State Innovation and Entrepreneurship (TEC Program and Social Innovation Fellows), the Office of University Interdisciplinary Programs (Long View Initiative), Centennial Campus Partnerships Office (Daugherty Initiative) and Office of Research Commercialization (ICorps and Spark Plug) initiatives as well as with the Plant Sciences Initiative (PSI Multimodal Sensors in Agriculture) and NC State Comparative Medicine Institute (Promoting Interdisciplinary Research).

Improving Operational and Program Effectiveness, Outcomes and Impact and Empowering Strategic Partnerships

The Kenan Fellows Program (KFP) for Teacher Leadership continues to refine its processes and adapt novel strategies for improved program effectiveness, outcomes, and impact while implementing strategies for long-term sustainability. The NC State Friday Institute conducts the KFP annual program evaluation. In addition to this external evaluation, the KFP gathers data regarding the impact that the current cohort of Fellows is having on students, teachers, and other key stakeholders. KFP has adopted the lighthouse as its symbol for 2025. With an eye towards celebrating KFP's 25 years of success,

ensuring long-term program values alignment, and establishing KFP as an integral component of NC's education and STEM workforce development landscape, the KFP continues to assess the focus of KFP professional development offerings and trusted partnerships, and as needed, realign efforts to more effectively reflect values and maximize strengths. The CLP continues to collaborate with NC State University's new Climate and Sustainability Academy, Climate Solutions Collaborative, Coastal Resilience and Sustainablity Initiative, Sustainable Futures Initiative, Sustainability Office, and the Office of Global Engagement's work with Fulbright Germany. Additional efforts have the CLP collaborating with the Consulate General of the Federal Republic of Germany – Atlanta, the Transatlantic Climate Bridge and Raleigh's Sister Cities program, the North Carolina State Climate Office, and the Southeast Climate Adaptation Science Center. KIETS continues to refine its operating efficiency aligning responsibilities and roles while effectively leveraging its core resources and maximizing program quality and impact.

Leveraging KIETS Resources

In FY 2024-25, KIETS' core operating and program investments of $1,945,576 were leveraged by approximately $21,695,422 in complementary funding from NC State University and external partners. While only a portion of these funds flow directly through KIETS, the resulting impact of the Institute's ability to enable leveraged support for its programs is significant and continues to grow annually. KIETS continued to maintain a healthy and active portfolio of 29 supported projects representing a 38% turnover ratio and 24% new projects at the start of FY 24-25.

GOAL 5: Improve University Effectiveness Through Transformative Technologies, Cutting-Edge Processes and Actionable Data

KIETS Goal: Identify, develop, and foster new interdisciplinary approaches in research, education, outreach that address the Grand Challenges of Society.

ACCOMPLISHMENTS

National Institute for Innovation in Manufacturing Biopharmaceuticals

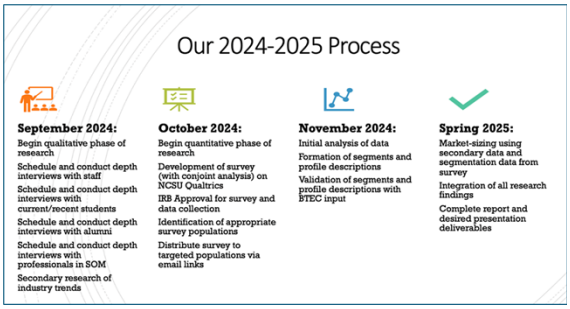
KIETS supported the National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL), a $70M collaborative agreement over five years from the National Institute for Standards and Technology (NIST). KIETS Director Ruben Carbonell serves as NIIMBL's Senior Technology Strategist. Since its inception in FY 2017-18, the State of NC has provided $10 million in funding to be used as cost-share matches for NIIMBL projects being led by NC companies or academic institutions, and laboratory renovations necessary to carry out NIIMBL projects. These funds also helped to pay NIIMBL membership fees for small NC companies and community colleges. 33 different NC entities participate in NIIMBL, including 5 universities (ECU, NCCU, NC State, UNC-CH, and UNC-W), 12 community colleges, 15 small- and medium-sized companies (4 in Wilmington, 10 in RTP and 1 in Charlotte), and 2 non-profit organizations. In the first six years of NIIMBL operations, NC members participated in projects totaling $25.6 million (federal funds, state funds and other member cost share) including $9.3M of federal funds received by NC entities. Of the $9.3 million federal project support, $7.8 million went to NC Universities, $1.4 million went to small and medium sized enterprises, and $100K went to NC non-profits. During the same six-year period, the $10 million in State cost share funds were utilized as follows: $5.5 million to NC Universities, $3.3 million for membership dues, travel awards, and program management, and $1.2 million for small and medium enterprises, community colleges, and non-profits. From 2017-2024, NC State University has received approximately $13.8 million in federal funding and $11.2 million in State cost share for project and operational expenditures. The early support of the Kenan Institute for the BBDC program at BTEC played a key role in positioning BTEC to become a major player in biopharmaceutical manufacturing nationwide and taking a leadership position within NIIMBL. NIIMBL has been expanded for another five years with a budget of $70 million from NIST, and an additional $83 million dollars from the ARP budget for COVID-19 related efforts. New efforts are under development in vaccine technologies, gene and cell therapy, applications of big data to biomanufacturing and process intensification and control.

Comparative Medicine Institute Promoting Interdisciplinary Research Project

KIETS collaborated with the NC State Comparative Medicine Institute (CMI) to provide clinical and research opportunities to professional students, graduate students, clinical residents, postdoctoral fellows, and undergraduates. Led by CMI Co-Directors Professor Jorge Piedrahita and Ashley Brown, the CMI holds the "Think, Collaborate & Do" Ideation event. The goals of this initiative are to encourage interdisciplinary collaborations among research groups, provide seed funding to develop preliminary data that can be used to obtain extramural funding, provide graduate students and postdoctoral fellows with the opportunity to develop their own projects and get experience in grant writing and project management, and incentivize the development of larger collaborative groups that can be competitive for NIH program projects. In FY 2024-25, CMI and KIETS supported 14 faculty projects and 2 student projects. KIETS support is leveraged with funding from the CMI, Data Sciences Academy, Genetic and Genomics Academy, Office of University Interdisciplinary Research, Provost Office, Office of Research Innovation, Colleges of Veterinary Medicine, College of Engineering, College of Sciences, College of Textiles and College of Agriculture and Life Science. The PIs also reported 1 publication generated, 1 invention disclosure, 40 faculty members engaged, 16 undergraduate students, 27 graduate students, 6 post docs, 18 conference presentations, and collaborations with UNC-Chapel Hill and The College of New Jersey.

BTEC Professional Development Course Marketing Initiative

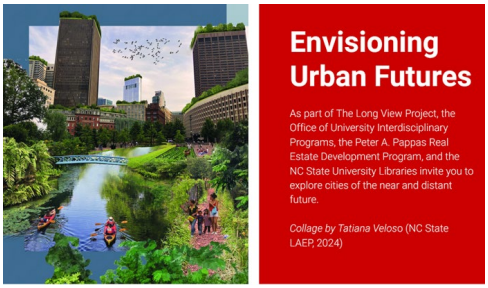
KIETS supported the BTEC Professional Development Course Marketing Initiative to help BTEC better understand the market for professional development training in biomanufacturing. With KIETS support, in FY 2024-25 BTEC partnered with Dr. Stacy Wood, Langdon Distinguished University Professor of Marketing at NC State, to conduct a comprehensive research project to better understand the market for professional development training in biomanufacturing. Dr. Wood has 20+ years of experience in consulting with Fortune 500 companies to determine growth opportunities. The overall purpose was to provide actionable insights about the best path to growth as BTEC expands online, on-demand offerings and optimizes their leadership in hands-on training. The marketing study will help BTEC expand its reach for online, on-demand training. It will also help BTEC maximize the value of hands-on training within the BTEC facility by underpinning curriculum planning with courses better aligned with customer requirements. This project directly supports BTEC's strategic goal to enhance the knowledge and skills of biomanufacturing industry professionals. BTEC anticipates sharing this research and associated survey tools widely among NC State College of Engineering stakeholders supporting professional development training, as well as to the entire NC State University population. KIETS support for this initiative leverages in-kind support from BTEC.



The Long View, Conversations on the Future

KIETS supported *The Long View, Conversations on the Future* initiative led by Professor Rob Dunn, NC State Senior Vice Provost for Interdisciplinary Programs, in collaboration with Greg Raschke, Director of NC State Libraries to help guide future planning for NC State's diverse portfolio of interdisciplinary centers. In FY 2024-25, the Long View hosted Professor Iain Stewart, El Hassan Research Chair for Sustainability and UNESCO Chair in Geoscience and Society at the Sustainable Earth Institute of the University of Plymouth, UK, who gave a talk titled, "Beyond the Third Mission: Re-purposing Universities for Sustainable Human Progress." Also, in FY 2024-25, the Long View Initiative continued to engage freelance science journalist JoAnna Klein to conduct Long View Interviews and communicate insights to various audiences, both within the university and to the general public. The second annual Envisioning Urban Futures event took place on Wednesday, November 13th, 2024 at the James B. Hunt Library on NC State's Centennial Campus. It built upon the success of the previous year's event, bringing together experts from across disciplines to critically examine the Southeastern megalopolis and share creative visions for how to shape this region during its predicted growth in ways that are beautiful and sustainable. In her opening talk, Raleigh Mayor Janet Cowell spoke about the power of collaboration, public art and green

infrastructure to transform cities, and their promise for the future of the capital city. Featured speakers discussed how reimagining our food systems, water infrastructure, and the built environment can open opportunities for people, culture, and nature to thrive. The talks wrapped up with urban planning thought leader Dan Burden, who relayed the ways walkable cities promote healthier communities. Over 240 students, educators, public officials, and community members from NC State and beyond attended. KIETS support leverages cash and in-kind commitments from the NC State Libraries, SE Climate Adaptation Science Center, Comparative Medicine Institute, TriCEM, Sigma Xi, NC Museum of Natural Sciences, Danish Natural History Museum, and the College of Agriculture and Life Sciences.



Multimodal Sensors in Agriculture: Enhancing Sustainability through Graduate Student Support (PSI Connecting2Grow Initiative)

KIETS supported the NC State Plant Sciences Initiative (PSI) Multimodal Sensors in Agriculture program as part of its Connecting2Grow effort. This is an outgrowth of the prior GRIP4PSI effort which was previously supported by KIETS. Led by Adrian Percy (PSI Executive Director), Prof. Cranos Williams (PSI Platform Director) and Lauren Maynard (PSI Interdisciplinary Project Launch Director), this project extends and amplifies the collaboration and support between the PSI and the Institute for Connected Sensor Systems (IConS). This collaborative initiative supports proposals from faculty to provide multimodal sensor solutions for monitoring agricultural systems across one or more scales (e.g., molecular, physiological, or environmental). It seeks innovative and cutting-edge sensor technologies that can contribute to advancing sustainable agriculture practices, improving yield, and reducing the negative impact of extreme environmental conditions. KIETS support complements funding being provided by the PSI and IConS to support two graduate research assistantships over a period of two years. Projects currently supported include (1) *Non-Invasive Detection and Measurements of Underground Tuber Plants with Radio-Frequency Signals and Stereo Imaging* - PIs: Wenye Wang (Electrical and Computer Engineering), Lirong Xiang (Biological and Agricultural Engineering) and Ruozhou Yu (Computer Science); and (2) *Agrivoltaics Synergy: Maximizing Agricultural Potential and Energy Harvest Via Solar Splitting* - PIs: Ricardo Hernández (Horticulture); Michale Kudenov (Electrical and Computer Engineering); Brendan O'Connor (Mechanical and Aerospace Engineering); Chris Reberg-Horton (Computer Science); Andrea Monteza (PSI); Mark Hoffman (Horticulture); Central Crops Research Station.

GOAL 6: Lead in Developing Innovative Partnerships, Entrepreneurial Thinking and Applied Problem-Solving

KIETS Goal: Support the launch of high technology start-ups based on NC State innovations and support technology commercialization programs at NC State, North Carolina and the Nation.

ACCOMPLISHMENTS

Richard and Marlene Daugherty Centennial Campus Entrepreneurism Endowment

KIETS provided matching funds for the *Richard and Marlene Daugherty Centennial Campus Entrepreneurism Endowment* that supports startup companies initiated with university intellectual property. The Daugherty Initiative continued its collaboration with the NC State Innovation and Entrepreneurship to feature the selection of the Daugherty Initiative recipients as part of the NC State Venture Pack Challenge. The 2024 Daugherty Initiative track at the NC State eGames supported three awards and took place on April 15, 2024. The 2025 Daugherty Initiative awardees are as follows: The 2025 Daugherty Initiative track at the NC State eGames supported five awards and took place on April 14, 2025. The 2025 Daugherty Initiative awardees are as follows: 1st Place – $25,000 – *Soteria Formulations* minimizes agrochemical overuse and off-target losses by converting crop harvest biomass into

modern farming equipment-compatible seed coatings and pelleted granules; 2nd Place – $15,000 – *Nicelle Technologies* produces acrylic fibers and precursors to carbon fiber in the US that are economical, nontoxic, and eco-friendly; 3rd Place – $10,000 – *MyoMech* is developing a wearable afferent stimulation sleeve to provide real-time, on-demand tremor suppression; 3rd Place – $10,000 – *Verdia* is developing on-plant sensor technology that diagnoses diseases in real-time, significantly earlier than traditional methods; 3rd Place – $10,000 – *LOOM3D* is pioneering a revolutionary technology that eliminates the need for traditional cut-and-sew processes, significantly reducing material waste, shortening production timelines, and cutting manufacturing costs. Since 2008, the Daugherty Initiative has invested $688,847 in 54 companies with 70% still active. Cumulative follow-on funding received by the awardees since 2008 is now $71.8M. KIETS Director Ruben Carbonell and Associate Director Raj Narayan serve on the Daugherty Initiative Governance and Selection Committee.

NC State Office of Research Commercialization SBIR/STTR Spark Plug Initiative

KIETS collaborated with the NC State Office of Research Commercialization (ORC) in support of the SBIR/STTR Spark Plug Initiative. The SBIR/STTR Spark Plug program is a coordinated and formalized strategy to assist researchers in NC State startup companies help write the SBIR/STTR proposals. The goal is to increase university startup's chances of winning non-dilutive grant funding from the Federal SBIR/STTR Programs. In FY 2024-25, the Spark Plug program engaged 23 faculty, five graduate students, and two post docs and supported three companies including (1) *Soteria Formulations*: Developing innovative solutions that increase crop yield, and farmer's return on investment, while reducing the use of petroleum- based products; (2) *Structeryx, Inc*: Reinventing lightweight fiber-composites to inherit multi-functional properties for aerospace, automotive, civil, naval, energy infrastructure; (3) *BioSensys, Inc*: Developing a wearable sensor for continuous lactate monitoring in intensive care units. Since its launch in late 2019, the Spark Plug program has funded 22 NC State startups that have gone on to generate over $7.2 million in SBIR/STTR funding. Among recent follow-on awards for SparkPlug support recipients, in Summer 2024 DNAli Data Technologies won a $399,538 NIH Phase 1 STTR award.

NC State Office of Research Commercialization NSF ICorps Program

In FY 2024-25, KIETS collaborated with the NC State Office of Research Commercialization (ORC) on the NSF ICorps program in support of the Summer 2024, Fall 2024 and Spring 2025 cohorts. The total program participants included 30 teams and 89 total participants. The total program participants included 32 teams and 72 total participants.

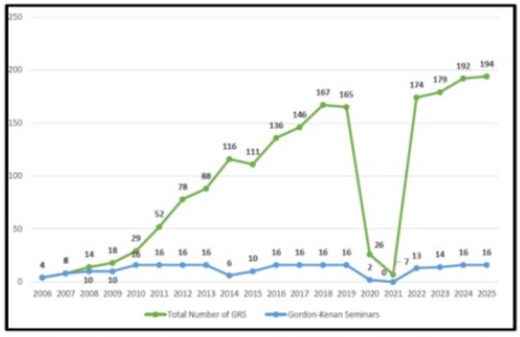
NC State also co-hosted a collaborative, two-day founder's education workshop in December 2024 with Duke and UNC-Chapel Hill for academic startup founders, which was attended by multiple I-Corps program graduates. In FY 2024-25, two startups were formed upon completion of the ICorps program including Soteria Formulations and VibraPower LLC. ORC reported that 20 faculty members, 7 undergraduates, 19 graduate students, and 6 post docs participated in the ICorps Program. UNC-Chapel Hill, UNC Charlotte, UNC-Wilmington, NC A&T, Fayetteville State University Virginia Tech, and Clemson University each had teams participating during FY 2024-25. Some notable accomplishments of prior NC State I-Corps Hub participants during FY 2024-25 include the following (1) I-Corps graduate QuikCal, a Duke team led by student entrepreneurs, was successfully acquired by MOCHA Systems in Spring 2025, representing the first acquisition of an NC State I-Corps graduate; (2) I-Corps graduate and founder of Elysia Creative Biology Eli Hornstein received a $200K Activate Fellowship, a highly competitive, national entrepreneur-focused support program. Both QuikCal and Elysia Bio were mentored by KIETS Associate Director Raj Narayan who serves as an NC State I-Corps ORC faculty instructor and advises the mentors and entrepreneurial leads in the NC State ICorps program. Also, during FY 2024-25, graduates of NC State's I-Corps Program secured over $2.1 million in follow-on funding. As of April 2025, teams completing the NC State Regional I-Corps Program have generated a cumulative $67M in follow-on funding from grant and investment sources. Participating teams have gone on to form 39 new startup companies and have submitted 58 SBIR/STTR awards, 25 of which have been awarded. 15 total program graduates have also been accepted into NSF's National I-Corps Teams Program, totaling $750,000 in follow-on NSF funding.

GOAL 7: Elevate the National and Global Reputation and Visibility of NC State

ACCOMPLISHMENTS

Gordon-Kenan Graduate Research Seminars (GKGRS)

A Gordon-Kenan Graduate Research Seminar (GKGRS) is a two-day meeting designed specifically for graduate students, post-doctoral students, and other scientists with comparable levels of experience. Gordon Research Conferences held a total of 196 research seminars between July 1, 2024, and June 30, 2025. Of those 196, the 16 new seminars added to the portfolio were provided with seed funding from the Kenan Institute. A total of 791 attendees participated in 16 Gordon-Kenan Research Seminars from July 1, 2024, to June 30, 2025. The average attendance at the Gordon-Kenan Research Seminars was 49 attendees. The majority of attendees were young investigators, including a total of 446 graduate students and 223 postdocs. North Carolina was represented at the seminars during FY 2024-25: Duke University was represented 4 times, The University of North Carolina – Charlotte and NC A&T University were represented 1 time by a participant. From 2001 to 2022, GKGRS/GRC Chairs have raised $4,072,666 from federal funding and $7,200,495 from private industry partners. During that time, 4,712 scientists from North Carolina attended 3221 GRC conferences or seminars. In addition, NC State University scientists have participated as speakers 307 times and have chaired 20 GRC conferences or seminars. Since KIETS began collaborating with the GRC in 2001, the GRS program has expanded exponentially, from 1 GRS to the 372 seminars held in the portfolio today. Since the start of the program, over 11,500 early career scientists have attended a Gordon-Kenan Research Seminar, with an average registration of 47 attendees at each event. The program has been so successful that as of 2024, all eligible GRCs were required by the GRC board to hold an associated GRS, institutionalizing the program in perpetuity.



2020 and 2021 meetings were affected by the COVID-19 Pandemic. GRC ran a small sub-set of conferences within the portfolio during this time.

Novo Nordisk Foundation International Collaboration on Bioprocessing (AIM-Bio)

KIETS supported the Accelerated Innovation in Manufacturing Biologics (AIM-Bio) project enabled by funding from the Novo Nordisk Foundation (NNF). KIETS Director Ruben Carbonell and Gary Gilleskie, Director of BTEC, serve as principal investigators for the grant. NC State and BTEC, in conjunction with the Technical University of Denmark (DTU) in Copenhagen, are engaged in an international collaborative research and training program in biomanufacturing science and technology. NC State and DTU developed eight new combined lecture and hands-on short courses aimed at industry professionals on topics that are particularly relevant to the future of biopharmaceutical manufacturing, including the manufacturing of vectors for gene and cell therapies, automation and process control, and analytical methods. Four of these courses are taught by faculty members and staff at both DTU and NC State and offered to students and industry professionals from both Denmark and the US. In addition, three BTEC courses that are in very high demand by industry were transferred to DTU, so they can be taught in Denmark for both academic and lifelong learning credit. The program has also established new research projects focusing on technologies of critical importance to biopharmaceutical manufacturing, ranging from cell factory engineering to upstream bioreactor design and optimization, to downstream capture and purification operations. To weave this ambitious program into the fabric of both institutions, DTU and NC State, and promote continued synergism between them, the AIM-Bio program has established an External Advisory Board of industry and academic leaders in biopharmaceutical manufacturing. It also established an annual Biopharmaceutical Manufacturing Symposium to foster the development of new knowledge that will ultimately lead to funding sources to ensure the sustainability of this collaborative effort. KIETS Associate Director Raj Narayan shared a presentation on university research commercialization at the November 2024 symposium. The AIM-Bio research team also received a grant in 2025 from the Gates Foundation for the improved production of anti-malarial antibodies.

The AIM-Bio Biopharmaceutical Manufacturing Symposium was held at NC State University in November 2024. The meeting was attended by faculty, staff and students from DTU and NC State, Novo Nordisk Foundation representatives, External Advisory Board members, guest speakers and industry representatives.

Novo Nordisk Foundation Research Proposal Initiative in Partnership with ORI / External Affairs

The Office of Research and Innovation (ORI) and External Affairs, Partnerships and Economic Development (EAPED) at NC State University has sought to identify multidisciplinary faculty teams (led by NC State faculty) and transformative

research concepts that align with the Novo Nordisk Foundation (NNF) 2030 Strategy. With support from KIETS in FY 2024-25, an NC State – NNF liaison, Dr. Brian Hawkins, provided institutional focus, development, and management of the Novo Nordisk Foundation relationship with NC State. This includes interactions with Novozymes and Novo Nordisk. Dr. Hawkins supported the successful execution and development of three currently funded projects including Collaborative Crop Resilience Program (CCRP), Accelerated Innovation in Manufacturing in Biologics (AIM-Bio), and Biocatalyst Interactions with Gases (BIG) projects. Dr. Hawkins also secured an additional $7M in bridge funding from the NNF to support the Collaborative Crop Resilience Program. The Biocatalyst Interactions with Gases (BIG) project is in its second year and progressing successfully. Support from the College of Agriculture and Life Sciences (CALS), College of Engineering, College of Textiles and the Office of Partnerships leveraged KIETS support for the resources related to Dr. Hawkins' appointment.

Leadership from NC State's Office of External Affairs, Partnerships and Economic Development and Office of Research and Innovation share with DTU about strategic research opportunities.

BTEC 2.0 Senior Research Scientist Initiative

With the leadership of KIETS Director Ruben Carbonell and BTEC Executive Director Gary Gilleskie, the Golden LEAF Biomanufacturing Training and Education Center (BTEC) continued to work toward expanding its research and educational programs in an initiative called BTEC 2.0. Dr. Juan Torres was hired as the Sr. Research scientist and started at BTEC on January 16, 2024 in a part-time role. During FY 2024-25, Dr. Torres focused on the critical foundational work of stakeholder engagement to build momentum for BTEC's continued evolution and impact. Specifically, BTEC's participation in research efforts, covering areas from drug development to drug manufacturing, will be significantly enhanced through the establishment of a multi-disciplinary biopharmaceutical faculty research cluster at NC State. This cluster, which has been approved by the Provost and is currently undergoing faculty recruitment, will aim to address critical global health challenges and drive innovation in the biopharmaceutical sector. BTEC is in a unique position to evolve and meet the new expectations of the biomanufacturing industry that is undergoing unprecedented growth and investment in NC. BTEC's plan to meet these challenges is the creation of the North Carolina Facility for Advanced Biomanufacturing (NCFAB). Plans have been designed for the creation of this new facility and the NC State Centennial campus offers a singular environment for the success of this enterprise that will ensure the future viability of one of the most important sources of economic strengths for the state of North Carolina. At its core, the creation of the NCFAB elevates the role of NC State University as a premier center of biomanufacturing training, support, and innovation, principally for North Carolina, but also nationally and internationally. Research is an integral part of education, and BTEC 2.0 is intentionally designed to foster a strong research focus in biopharmaceutical manufacturing that aligns with its well-established training and education programs at both university and professional levels.

8th International Conference on Soft Matter

KIETS supported the 8th International Soft Matter Conference (ISMC-2024) which was held in Raleigh, NC from July 29 to August 2, 2024. Dr. Jan Genzer, NC State Chemical and Biomolecular Engineering Professor served as one of the organizing Chairs of the conference. This event brought together approximately 500 scientists from different subfields of soft matter (polymers, colloids, biological systems) with different expertise (chemists, physicists, biologists, engineers) to exchange ideas and techniques to accelerate progress in each area and soft matter science. KIETS support leveraged complementary support from the NC State Vice Chancellor for Research, Provost Office, College of Sciences, College of Engineering, Department of Chemical and Biomolecular Engineering, Nonwovens Institute, BTEC and conference partners at Duke University and UNC-Chapel Hill.

2025 Affinity Conference

KIETS supported the 2025 Affinity Conference organized by NC State Professors Dr. Stefano Menegatti and Dr. Michael Daniele. The conference was held at NC State University on June 1-4, 2025. The Affinity 2025 meeting was opened by the KIETS director, Dr. Ruben Carbonell, who presented a historical overview of affinity technologies and the role of North Carolina's universities and entrepreneurship initiatives in advancing affinity applications in biotechnology and biopharmaceutics. The focus areas of Affinity 2025 included: (A) experimental and AI-driven engineering biological

therapeutics, (B) next-generation biosensors, and (C) affinity bioseparations. Affinity 2025 gathered a diverse community of scientists and engineers working in biorecognition-based disciplines, encompassing the design of biological drugs, affinity ligands for bioseparations, and biosensors. The conference engaged approximately 120 attendees from academia and industry and across three continents (America, Europe, and Asia), and included 30 oral and 45 poster presentations. Dr. Menegatti and Dr. Daniele will be Guest Editors for an Affinity 2025 special issue of *Biotechnology and Bioengineering* (Wiley, Inc.), dedicated to showcasing research outcomes from all project participants. This issue will be open to submissions from all participants, providing a highly visible platform for disseminating findings to the broader scientific and engineering communities. KIETS support leveraged complementary support from BIO-RAD, empBiotech, Millipore Sigma, Sartorius, BioNavis, Cytiva, Gyros Protein Technologies, Isolere Bio, KBI Pharma, LigaTrap, Sanofi, Sepax, Nicoya, ThermoFischer Scientific, Tosho, and NIIMBL.

2024 KIETS Climate Leaders Symposium

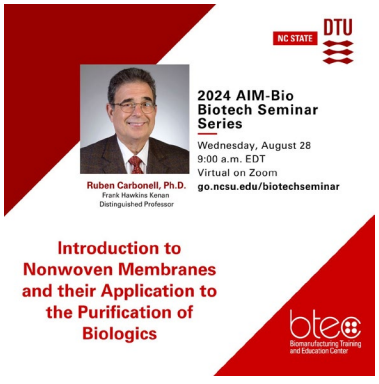
The 3rd Annual Climate Leaders Program Fall Symposium, "Think and Do: Climate Challenges and Solutions" was held September 19-20, 2024. Over 229 people attended the symposium which was an increase from 2023. CLP scholars presented lightning talks and posters on their internships and/or their related research. The 2024 keynote speakers and panelists discussed Climate Change and Mental Health, Innovations in US Domestic Climate Policy, Extreme Temperature and Health, Comparing Flooding in Global Watersheds, Electrifying Transportation, and Reducing Greenhouse Gases in Food Production. Twenty-three students presented posters and University programs and local non-profits and businesses hosted tables at our Innovation Showcase. The 4th Annual Climate Leaders Program Fall Symposium, "Think and Do: Climate Challenges and Solutions" will be held October 1-2, 2025 in Duke Energy Hall in Hunt Library on NC State University's Centennial Campus.

Staff Leadership

KIETS staff also served in leadership and advisory roles in several initiatives at NC State and with external groups.

ACCOMPLISHMENTS

- KIETS Director Dr. Ruben Carbonell served on the IEI National Advisory Board, the Daugherty Endowment Governance Committee, the Advisory Board for the FSU-FAMU Chemical Engineering Department, the National Academy of Engineering's Audit Committee, and he is in the NAE Peer Review Committee for Section 3 (Chemical Engineering). He also serves as Senior Technology Strategist for the National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL) and he is a member of the National Academy of Sciences Board of Chemical Sciences and Technology, helping to guide the future of the nation's educational and technical priorities in chemistry and chemical engineering. Dr. Carbonell is one of the leaders in the AIM-Bio Program, supported by the Novo Nordisk Foundation (NNF). He serves as a member of its Advisory Board and Steering Committee, and is one of the lead principal investigators on the Single Use Devices (SUD) workstream, where he heads a research group on the development of new membrane technologies for high productivity bioseparations. His group received support from the Chancellor's Innovation Fund (CIF) and 2ndF to commercialize the technology. Dr. Carbonell lead the charge on the development of a new proposal to the NNF that builds on the knowledge generated through the AIM-Bio Program. He also maintains a close working relationship with BTEC and has been instrumental in gathering funding for BTEC from NIIMBL, AIM-Bio and other sources. Dr. Carbonell initiated an effort to establish the NC Facility for Advanced Biomanufacturing (NCFAB) on Centennial Campus, and is currently working with a small group of NC State faculty and staff to win the support of the NC Biotechnology



Center, the NC Life Sciences Organization and major biomanufacturers in NC to make this facility a reality for the benefit of the state of NC, and the university. Dr. Carbonell and his group have published 6 refereed publications in international journals, and has given several oral and poster presentations at international meetings on bioseparations.

- KIETS Associate Director Raj Narayan served as a Professor of the Practice of Entrepreneurship and Executive in Residence in the TEC Program within the Poole College of Management. Mr. Narayan served as a mentor for the NC State Social Innovation Fellows program, the NC Sea Grant CCRG Review Committee, the Daugherty Endowment Governance Committee, the RISF selection committee, and the Wolfpack Investor Network (WIN) Steering Committee. Mr. Narayan was an instructor with the NC State Office of Research Commercialization ICorps program. Mr. Narayan also served on Board of Advisors of the UNC School of Law Institute for Innovation as well as NC State Engineers Without Borders. He was also an active participant in the NC Eisenhower Fellows and completed his term as Vice President of the NC Eisenhower Fellows Alumni Chapter. Mr. Narayan also served as a mentor for Ms. Tammy King, 2024-25 Kenan Fellow in collaboration with the NC State Innovation and Entrepreneurship on a K-12 entrepreneurship course at Vernon Malone College and Career Academy in Raleigh, where Ms. King teaches.

- KIETS Assistant Director for Grants and Finance Cordella Rashid served on the HR Connections Committee, Business Connections Committee, African American Faculty & Staff Organization Committee, the Society for Human Resource Management, and the National Council of University Research Administrators. Ms. Rashid also continued her service and was reelected to the NC State Staff Senate as a representative of the Chancellor's Unit.

- KIETS University Program Associate Tara Spivey served as the Hunt Library building liaison team on behalf of the tenants in our Hunt Library office suite. Ms. Spivey also participated on the following committees: NC State Event Planners Council, Hunt Library Partners Meeting Committee, TSS LanTech Meeting Committee, Facilities Liaison Briefing Meetings Committee, Chancellor's Unit Awards for Excellence, and African American Faculty & Staff Organization. Ms. Spivey is also an alumnus of the William C. Friday Fellows program which is a highly respected cross sector leadership program focused on adaptive leadership and impact on our communities statewide.

- Lindsay Skinner completed her first year as the KIETS Associate Director of Philanthropy. Skinner previously served as the Associate Director and Interim Director of Annual Giving at UNC Wilmington for the past two years. Before her time at UNC Wilmington, Skinner dedicated seven years to NC State, initially as the Assistant Coordinator of Student and Young Alumni Programs in the Alumni Association, followed by a term as the Assistant Director of Alumni & Friends for the College of Agriculture and Life Sciences.

- Amanda Mueller, Director of the KIETS Climate Leaders Program, continued to serve as a collaborator with the Office of the Provost Coastal Resilience and Sustainability Initiative. Ms. Mueller leads a monthly talk on "Current Conversations" as part of North Raleigh United Methodist Church's series on "climate issues. She is also collaborating with the NC State's Office of Global Engagement on a partnership with Rostock Germany and Raleigh Sister Cities. Ms. Mueller was a guest lecturer AEE 350: Personal Leadership Development in Ag & Life Sciences, a class taught by Dr. Katherine McKee. Ms. Mueller also served on the steering committee of the Office of University Interdisciplinary Programs (OUIP) Community of Interdisciplinary Graduate Research and Training Programs.

- Ms. Catherine Cole was hired as the Climate Leaders Program Coordinator in April 2025. Ms. Cole has over a decade of experience in environmental education, having worked with both nonprofit organizations and local government. She earned her B.S. in Environmental Science and Conservation from the University of North Carolina Wilmington (UNCW) in 2019. During her time at UNCW, she studied abroad in Iceland with The Green Program and The University of Reykjavik's Iceland School of Energy, focusing on sustainable energy, ecotourism,

sustainable fisheries, and land stewardship. She completed a Graduate Certificate in Policy Analysis from NC State in 2024 and is currently completing her Master of Public Administration (MPA) at NC State.

- Professor Jeremiah Johnson (Department of Civil, Construction and Environmental Engineering) continued his service as Senior Faculty Fellow of the KIETS Climate Leaders Program.

- Vance Kite continued as Director of the Kenan Fellows Program. Over the past year, Dr. Kite taught a course in the College of Education *EMS 375 – Introduction to Science Teaching Methods I*. Dr. Kite also presented *From Industry to Classroom: The Benefits of Combining STEM Industry Immersion with Pedagogical PD* at the Annual Meeting of the National Association for Research in Science Teaching (NARST) in Washington, DC. Dr. Kite served on the doctoral committee of Jesus Esquibal, a doctoral student in the Department of Science Education at Texas Tech University. Dr. Kite was nominated for the Chancellor's Unit Award for Excellence in Spring 2025.

- Mark Townley, Associate Director of the Kenan Fellows Program served on the Governor's Teacher Advisory Committee for Governor Roy Cooper and on the Board of Directors for the Exploris School in Raleigh, NC.

- Amneris Solano, Assistant Director for Communications for the Kenan Fellows Program continued to assist KIETS with supporting KIETS website improvements and social media presence. Ms. Solano was invited to serve on EdNC's Strategic Council. The purpose of the strategic council is to inform the work of EdNC by giving the board and CEO feedback and counsel. Ms. Solano also served as a judge for the 2025 CASE Circle of Excellence Awards in the Video: Fundraising and Stewardship category. The Circle of Excellence Awards showcase outstanding work in advancement services, alumni relations, communications, fundraising, and marketing

- Carrie Horton, Program Manager for the Kenan Fellows Program completed a Graduate Certificate program for Nonprofit Management at NC State in December 2024. Ms. Horton also volunteers as a co-leader for the NC Coastal Pines Girl Scout Troop #11 in Johnston County.

- Ms. Linda Dion served as program coordinator for the Kenan Fellows Program and continues to encourage curiosity with intention through her work with educators and their students. Mrs. Dion was a 2017-18 Kenan Fellow and has served on the Kenan Fellow Program faculty since 2018. Ms. Dion is working towards completing the Equal Opportunity Essentials Certificate offered by the Office of Equal Opportunity (OIED) at NCSU.

- Randy Pinion continued his service as the Logistics and Data Manager for the Kenan Fellows Program.

- Kenan Fellows Program Director Dr. Vance Kite served as the Executive Editor, Amneris Solano served as the Managing Editor, and Randy Pinion served as the Copy Editor of the Kenan Fellows Program *Journal for Interdisciplinary Teacher Leadership*.

- NC State Chancellor Randy Woodson retired and Chancellor Kevin Howell became the Chair of the Board of Trustees of KIETS in May 2025.

Recommendations and Future Concerns

To build on its past successes, the Kenan Institute requires continued commitment and financial support from its partners including NC State University, the Kenan Fund for Engineering, Technology & Science, and other universities, foundations, and government partners.

In FY 24-25, KIETS remained responsive to stakeholder needs and continued to identify high impact investment opportunities while remaining vigilant of potential impacts to available funding for key initiatives. Among the key priorities for KIETS moving forward remains a focus on grand challenges in global health and climate change. These two areas of focus for KIETS amplify the strategic interests and capabilities of NC State University and its partners toward developing innovative solutions addressing enduring problems in our State, Nation, and the World. KIETS looks forward to building this work in collaboration with key partners including the Provost, Vice Chancellor for Research, and leadership of NC State University's Colleges.

We anticipate that our two flagship programs, the Kenan Fellows Program for Teacher Leadership (KFP) and the KIETS Climate Leaders Program (CLP) will be impacted by recent changes in federal funding and corporate support. There have

also been significant cuts to the research budgets of federal agencies including the NSF, NIH, FDA, and DOE. These cuts will have a negative impact on the number of opportunities for NC State researchers to pursue proposals and will make federal grants even more competitive. It remains essential for leadership from within the University, Kenan Fund, and industry to work closely with the Institute's leadership to serve as high-level advocates on behalf of Institute programs such as the Kenan Fellows Program and Climate Leaders Program. This strategic advocacy will help the Institute promote the impact of its programs and build its reputation as an honest broker of best practices in research, education, entrepreneurship, and public policy.

The KFP will continue leveraging its portfolio of programming to establish a physical footprint in each of the state's 100 counties and a virtual footprint nationwide. KFP continues to engage with school districts, local and national industries, and other partners to build inroads into new geographic locales. The KFP currently receives a small portion of its annual operating budget from a recurring state appropriation. With an eye towards further expanding our services to serve more teachers, KFP is currently working through approved University channels to seek expansion of its recurring state appropriation to cover the program's operating costs. The KFP has established an endowment fund and will seek to continue to grow that fund to provide long-term support for KFP's operational needs.

The CLP has obtained significant support for its operations from the Office of the Executive Vice Chancellor and Provost and continues to provide valuable internship opportunities for undergraduate and graduate students throughout the university. The CLP is closely linked with other groups and organizations focused on the coastal resilience and sustainability, and in due course, KIETS will consider how the CLP should be integrated more formally as a university-wide initiative. While both the CLP and KFP are important KIETS investments, they make up a considerable percentage of the KIETS programmatic budget each year. KIETS would like to identify additional fundraising opportunities to lower the percentage of these programs on the KIETS budget to fund a wider range of programs at NC State. KIETS will work with its Associate Director of Philanthropy to make a significant positive impact on KIETS fundraising efforts.

In addition to financial support, the Institute will need continued in-kind support from the University such as the office space provided in the Hunt Library and support from units such as the Office of Advancement, Office of Communications, and Office of Sponsored Programs' Integrated Support Services Center. KIETS continues to maintain very efficient operations with a small staff which poses challenges in managing large-scale events. As KIETS continues to develop its programs, it seeks to leverage and complement its resources from university partners including Special Events and the McKimmon Center to help manage event planning and program implementation. KIETS will also continue to work closely with University Advancement as it seeks resources to leverage its investment in core programs and operations. Ultimately, these are issues related to the sustainability of the Institute and its programs and how the Kenan Institute is regarded in terms of University fundraising priorities.

In consideration of leadership transitions at NC State University and at the Kenan Fund for Engineering, Technology and Science, the leadership of KIETS will do everything it can to advise the new university and Kenan Fund leadership regarding the role and objectives of KIETS, and how it hopes to serve the university community, and the world at large, in years to come.