



KENAN INSTITUTE

ENGINEERING, TECHNOLOGY & SCIENCE

NC STATE UNIVERSITY



KENAN INSTITUTE GOALS AND ACCOMPLISHMENTS FISCAL YEAR 2021-2022

Kenan Institute for Engineering,
Technology & Science
1070 Partners Way
Hunt Library, Suite 5100
NCSU Centennial Campus
Raleigh, NC 27606

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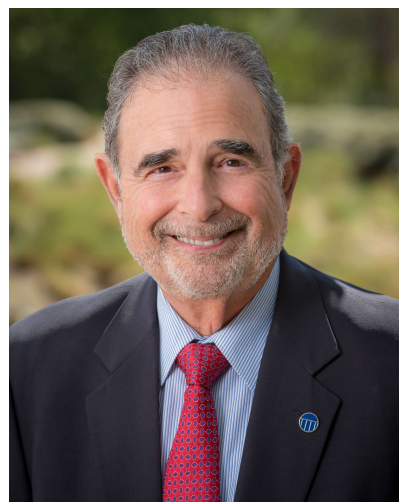
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A MESSAGE FROM THE DIRECTOR

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 2021-2022 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 will 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 will enable individuals and programs at NC State and at other institutions to continue to produce world-class research and scholarship, which will enhance knowledge and learning, produce and support new innovative companies, and inform 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,

A stylized, handwritten signature in black ink, appearing to read 'Ruben Carbonell'.

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 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 led initiatives and novel educational approaches to enhance undergraduate and graduate education.

ACCOMPLISHMENTS

KIETS Climate Leaders Program



The KIETS Climate Leaders Program (CLP) led by Amanda Mueller and Professor Roy He 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. In FY 21-22, Ten NC State students (2 undergraduate, 8 graduate), representing 6 NC State Colleges, were selected as the inaugural cohort of Scholars. The Scholars were paired with 11 NC State Faculty Mentors who helped guide their progress in the program. The Scholars began their program in January 2022 and attended monthly evening sessions in Spring

2022 and will participate in internships in Summer 2022. A two-day Leadership Academy was held May 8-10, 2022. Many of the CLP Scholars, and their faculty mentors, are conducting research as part of their degree program. Experiences and information learned during their internships will be shared at the Fall 2022 Climate Leaders Symposium.

TEC Program

In FY 21-22, 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. KIETS Associate Director Raj Narayan served as faculty member and executive in residence to TEC teams. During the 2022 NC State annual entrepreneurship competition, TEC team *Wolfpack Medical* placed first and received \$10,000 and TEC team *Rampart Crop Defense* placed second and received \$7,500.

NC State Social Entrepreneurship Initiative

KIETS collaborated with the *NC State Social Entrepreneurship* initiative led by the College of Humanities and Social Sciences to provide students across NC State with opportunities to engage and learn from social entrepreneurs in North Carolina, nationally, and internationally. In FY 21-22, the NC State Social Innovation Fellows program continued to thrive in its sixth year of operation. The 2021-22 cohort of Fellows included 25 undergraduates, 2 graduate students, and 7 Senior Fellows from prior cohorts as mentors. The Fellows focused on six of the 17 UN Sustainable Development Goals as a part of NC State's Sustainable Development Goals Initiative. Of note, the SIF team who worked with NC State Compost Facility in 2020-21 succeeded in securing passage of a bill by NC State Student Government to require educational workshops on the importance of composting for all incoming NC State students. KIETS Associate Director Raj Narayan serves as one of the core faculty team mentors for the Social Innovation Fellows program.



Fellows and team mentor Raj Narayan discuss Goal 12: responsible consumption and production during an innovation lab.

NC State Engineers Without Borders Student Chapter Initiative

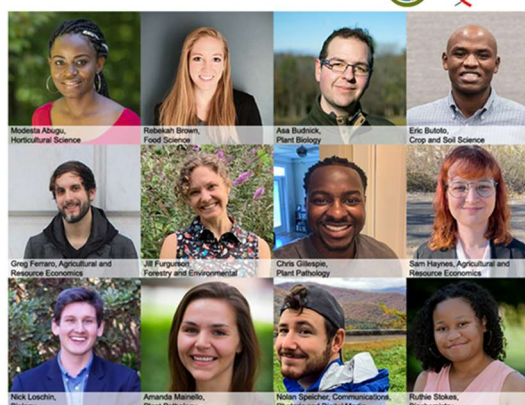


KIETS supported the NC State Engineers Without Borders Student Chapter in FY 21-22. The North Carolina Projects team completed their implementation of an irrigation system for a community garden and educational curriculum at Powell Elementary School in Raleigh, NC. The North Carolina Projects team also began a collaboration with Inter-Faith Food Shuttle in Raleigh, NC to create a hydroponics system for their greenhouse to help produce and distribute low-cost, sustainable, and healthy food for multiple underserved populations. The Guatemala Water Systems (GWS) project team has continued to remotely oversee maintenance and implementation of rainwater harvesting systems in the indigenous Guatemalan community of Caserio Panhux to provide households with sustained access to and storage of clean water. On April 20, 2022, the GWS project team began its fifth and final round of implementation, and 13 additional systems were installed in Caserio Panhux, a community of over 300 people across 64 families. Professor Andrew Grieshop from the College of Engineering serves as the faculty advisor for EWB-NCSU and KIETS Associate Director Raj Narayan serves as a member of their advisory board.

Agricultural Biotechnology in Our Evolving Food, Energy and Water Systems

KIETS supported the AgBioFEWS program in FY 21-22 led by Dr. Fred Gould and the Genetic Engineering in Society (GES) Center. The first cohort completed two group projects, one that utilizes databases to assess impacts of genetic engineering and other agricultural practices on farm biodiversity. The second project looks at what factors affect the research to product pipeline. The output from this second project is an article that was accepted for publication in *Frontiers* and is titled “Lessons for a SECURE future: Evaluating diversity in crop biotechnology across regulatory regimes”. The second cohort presented their group project at a GES colloquium at the end of the Spring semester of 2022. The title of the project is “Developing a Research Agenda for genetically engineered Carbon Capture and Sequestration Crops”. They will be writing a manuscript in summer 2022. The third and final cohort was announced on April 4, 2022 and is comprised of 12 students who represent 10 different PhD departments. They will spend the Summer of 2022 focusing on farming systems in Eastern North Carolina.

NC STATE UNIVERSITY 2022 Cohort Fellows



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

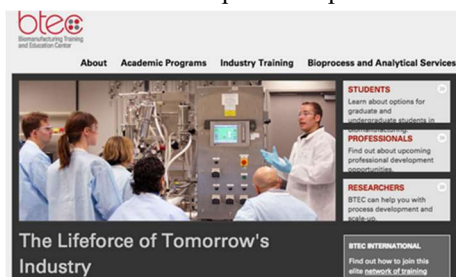
KIETS Goal: Identify programs that support faculty research efforts, promote career development, and help enhance the research infrastructure at the university.

ACCOMPLISHMENTS

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

Bioseparations/Bioprocessing Development Center (BBDC)

KIETS enabled 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 million in facilities for this effort. In addition, BTEC is providing leverage in the amount of \$200,000 per year in staff salaries to support the analytical and process services program. BTEC has nearly \$250,000 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). 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 will provide BTEC with approximately \$1.3 million in new equipment, and several hundred thousand dollars a year during the next five years for support of personnel, supplies and other related expenditures.

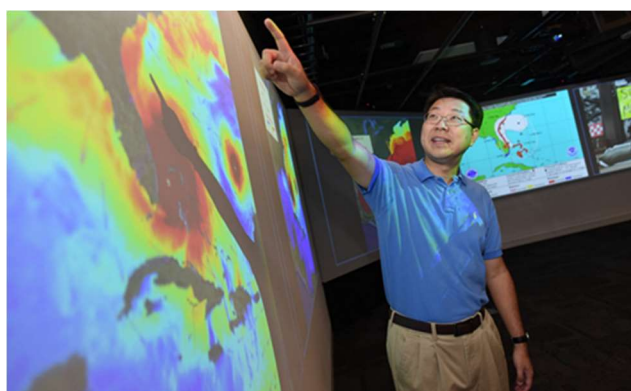
Novel Material Platform for Crop Protection

KIETS supported Professor Saad Khan who is investigating ways to create a platform for crop protection from fungi and insects using biodegradable matrices. In FY 21-22, Dr. Khan reported that they have developed a novel wrap and plant technology for smallholder farmers in Benin and Kenya and other parts of Africa. These results have prompted the Bill and Melinda Gates Foundation (BMGF) to fund further studies in this important field of food security. Promising results in Kenya and Benin have opened opportunities to expand the trials further to other countries, Tanzania, Togo, Ghana and Nigeria, which is an exciting achievement of this project. Besides development of matrices using indigenously available resources, Dr. Khan and his colleagues have expanded the trials in sweet potato fields in North Carolina and the plants to transition this approach to mechanized farming are in the pipeline. Dr. Khan also reported two invention disclosures, two patent applications filed, four publications generated, three graduate students, two undergraduate and one post doc supported. Dr. Khan and his colleagues are also investigating the commercial application of these innovations and their post-doc participated in NC State's ICorps program to investigate the commercialization pathways for their inventions.



Developing an Integrated Marine Environment Observation and Prediction System in Support of NC Energy Initiatives

KIETS supported Professor Roy He in FY 21-22 on a project to refine and implement state-of-the-art marine environment observing and prediction (both hindcast and forecast) capabilities that can support wind, current, and wave energy development, and risk mitigation offshore of NC. Dr. He's team is conducting extensive coastal observations from ongoing NSF PEACH and NC Renewable Ocean Energy programs by utilizing state-of-the-art data assimilation and adaptive sampling methodology and enabling efficient scaling-up of routine integration using emerging powerful cloud-computing technology. For FY 21-22, Dr. He reported 8 publications, 4 graduate students, 5 post docs, 14 universities, 10 corporate



Ruoying He directs the Ocean Observing and Modeling Group at NC State.

partners engaged in this project, and one startup company – Fathom Science. Fathom Science has a contract to create an operational metocean (weather + ocean) model for the government of Indonesia and a contract with Sandia National Labs on marine hydrokinetic and wave energy for Powering the Blue Economy. Fathom also has an ongoing contract for product development with NASA, and is working on a hurricane forecasting contract with the National Ocean Partnership Program. On December 8-9, 2021, Fathom was invited to participate in the NASA iTech 2021 Cycle II Forum in the category “Technologies using NASA data to foster climate resilience.” KIETS support for this project leverages resources from NSF, NASA, NOAA, Office of Naval Research, US Geological Survey and the NC Renewable Ocean Energy Program.

Renewable Natural Gas from Carbonaceous Wastes via Phase Transition CO₂/O₂ Sorbent Enhanced Chemical Looping Gasification

In FY 21-22, KIETS supported Professor Fanxing Li on a project to develop a significantly intensified, sorbent enhanced – chemical looping gasification (SE-CLG) process, which combines biomass gasification, air separation, and syngas conditioning and cleaning into a single circulating fluidized bed (CFB) gasifier to produce methanation ready syngas. The SE-CLG technology being developed has excellent potential to produce cost-competitive renewable natural gas (RNG) to serve the domestic market. During FY 21-22, Dr. Li reported that KIETS support benefited his research efforts in rationalizing the optimization of mixed oxides in terms of their redox and catalytic properties, which enabled them to leverage external funding to explore related novel concepts for process intensification in chemical manufacturing. For FY 21-22, Dr. Li reported 8 published articles in leading peer-reviewed journals; one patent application filed to cover the mixed oxides given unique properties and extensive applications; 9 invited seminars and conference presentations; and 3

graduate students and one post doc directly involved in the research project. Also, Catalytic and Redox Solutions LLC (CatRedox), an NC State based start-up, was created and licensed technologies developed with KIETS support. CatRedox has continued to perform well, having leveraged \$1.75 million R&D funding from both the government and private sectors. Further scale up and technology verification is underway. CatRedox is also in close contact with several large chemical and petrochemical companies for further technology development. KIETS support for this research is leveraged with support from the Department of Energy (DOE), NSF, and CatRedox.



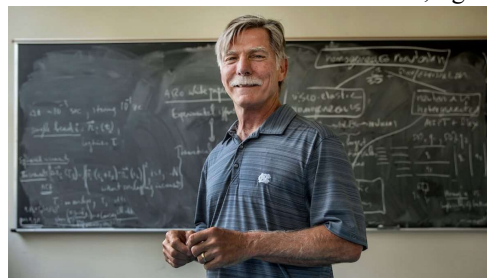
Matrix Assisted Pulsed Laser Evaporation

In FY 21-22, KIETS supported NC State Professor Roger Narayan's research on the translation of an existing physical vapor deposition technology known as matrix assisted pulsed laser evaporation for instantly manufacturing the dry product form of the Measles-Rubella (MR) vaccine. The matrix assisted pulsed laser evaporation approach would be transformative for vaccine manufacturers in developing countries since the matrix assisted pulsed laser evaporation process instantly creates the dry product vaccine. Developing country vaccine manufacturers will have a low-cost processing approach to create dry product vaccines for BCG, Japanese encephalitis, measles, measles/rubella, meningococcal A, rabies, rotavirus, varicella, and yellow fever. The data obtained in this project will provide a new body of knowledge on the relationships between the matrix assisted pulsed laser evaporation processing parameters and the critical quality attributes for a commonly used vaccine. Dr. Narayan has also received support from the Bill and Melinda Gates Foundation for this project which officially launched on January 19, 2022.



Triangle Computational and Applied Mathematics Symposium (TriCAMS)

Led by Professor Greg Forest, UNC Professor of Mathematics, in collaboration with NC State Professor Alina Chertock, Chair of the Department of Mathematics in the College of Sciences, along with Duke Professor Hongkai Zhao and NC Central Professor Kimberly Weems, the Triangle Computational and Applied Mathematics (TriCAMS) symposium is an inaugural event to launch collaborations and engage the computational and applied mathematics community in academia, industry, and government in areas of application where computational and applied mathematics can address enduring problems and issues. This 2-day symposium will include plenary talks, speakers from each of the host institutions, lightning round sessions and a poster session for attendees to discuss their research with faculty, students and external guests from industry. The symposium was originally scheduled to be held at NC State University on October 16-17, 2021 but has been postponed to September 17-18, 2022 due to the COVID pandemic. In FY 21-22, KIETS helped the PIs identify academic and industry collaborators in support of this initiative. Specifically, KIETS has helped facilitate an introduction to executive leadership at Certara, Inc. who will present their work at the inaugural Symposium to highlight internships and job opportunities at Certara for TRICAM graduate students.



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

The 2021-22 cohort consisted of 26 teachers selected from 11 school districts and 2 charter schools; 16 of the teachers were in Title I schools, 22 are female and 4 are male. The breakdown between community type was well balanced, with 9 from rural schools, 9 urban, and 8 mixed.

Funding partners for the Fellowships included GE Aviation, American Zinc Products, the Burroughs Wellcome Fund, Cornerstone Building Brands, Meta, Fidelity Investments, the NC and Chowan Farm Bureaus, Biogen Foundation, Duke Energy, Charlotte-Mecklenburg Schools, NC ACCESS Program Grant, and NSF grants to Drs. Paul Maddox and Toshihide Hige. A complete list of the universities, industries, and foundations that provide support for the KFP through funding and/or hosting/mentoring Fellows can be found at

<https://kenanfellow.org/partners/> and <https://kenanfellow.org/mentors/>

The KFP published an issue of JoITL in 2021 which included seven articles: *JOITL Vol. 5, No. 1*. Since the journal was founded in 2016, the KFP has published articles from 18 universities: UNC-Chapel Hill, Texas Tech University, NC State University, UNC-Greensboro, East Carolina University, University of North Texas, UNC-Charlotte, Walla Walla University, Elon University, Idaho State University, University of Washington, California State University-East Bay, UNC-Wilmington, University of Nevada-Las Vegas, Bradley University, Oklahoma State University, Western Kentucky University, and UNC-Pembroke. Articles have also been published from NASA Langley Research Center, The North Carolina Arboretum, Voyager Academy Middle School, EvalWorks L.L.C., and independent researcher, Dr. Rolf Blank. The KFP piloted its new blended learning program, STEMwork, in two NC regions in 2021-22: Western North Carolina and the Triangle. The pilot was funded by the Biogen Foundation, the Dogwood Health Trust, and individual contributions. STEMwork utilizes trained KFP alumni as facilitators for small teams of local teachers in a given county or school district. At the conclusion of the pilot, 12 teams and 36 teachers participated in a symposium held in each region to reflect on the pilot and share experiences.



Applied Synergies Partnership (ASaP) Entrepreneurship Leadership Program



Since 2016, Apex Friendship High School teacher Dan Jackson has been collaborating with KIETS Associate Director Raj Narayan to develop the *Applied Synergies Partnership (ASaP) Entrepreneurship Leadership Program* focused on enabling entrepreneurial analytical skills in his high school students. In FY 21-22, three new cohorts of Honors 1 and Honors 2 entrepreneurship students at Apex Friendship High School began their course of study in Fall 2021 and completed their business plans for their envisioned projects. In addition, Dan Jackson collaborated with David McNeil at the NC

State Global Entrepreneurship Initiative to deliver an introduction to entrepreneurship for Japanese high school students in March 2022. Additionally, Dan Jackson has been invited to speak at the upcoming 2022 NC CTE summer conference in Winston-Salem on the topic of implementing Performance Based Mastery in an active-learning, hands-on learning environment. KIETS Associate Director Raj Narayan serves on the board of directors of the ASaP nonprofit established in 2019 and as a mentor to the entrepreneurship students.

NC Children’s Museum

In FY 21-22, KIETS supported the Kidzu NC Children’s Museum initiative. Museum educators, in partnership with university researchers, will develop robust research projects to study informal learning within the physical and virtual campuses. In February, 2022, on the facilitation of KIETS, Kidzu leadership toured the NC State D.H. Hill Library and visited virtual learning and maker spaces to ideate about possible uses and collaboration for NCCM. They met with Adam Rogers (Head of Making & Innovation Studio; Learning Spaces & Services), Marian Fragola (Director of Community Engagement), and David Woodbury (Head of Learning Spaces & Services). KIETS and NC State staff are participating in an advisory council that consists of leading early childhood researchers from neighboring universities, social service providers, and other experts. Several prototype programs and sessions are being developed throughout Summer 2022 to develop the operational framework for programs.

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

In FY 21-22, KIETS supported the NC Coastal Federation on its Newport River Estuary Protection and Restoration initiative. In October 2021, the North Carolina Coastal Federation (NCCF) formalized a partnership with NC State professors Dr. Natalie Nelson and Dr. Angela Harris to develop a water quality sampling and analysis strategy that will serve as a baseline of important data to inform development of the restoration plan. The Coastal Federation, NC State



research team and staff with the Shellfish Sanitation Section of the N.C. Division of Marine Fisheries worked together to finalize the sampling criteria and plan. Two field campaigns were developed for this first phase of the watershed restoration-planning project, one that targets base flow and one that targets stormflow conditions after at least a 1.5- inch rain event. The baseflow campaign was initiated on March 4, 2022, during which NC State researchers provided training to N.C. Coastal Federation staff and additional project team members on how to collect samples. The final plan will include targeted and prioritized implementation strategies that will include on-the-ground projects to protect and improve

water quality in the Newport River.

NC Sea Grant /WRII/ 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 21-22, 10 applications were received proposing over \$290,000 worth of work. The applicants included 9 Universities (North Carolina State University, University of North Carolina at Chapel Hill, University of North Carolina Wilmington, Western Carolina University, Duke University, University of North Carolina Charlotte, University of North Carolina Asheville, Appalachian State University, and Virginia Tech), one community college (Asheville-Buncombe Technical Community College), and one high school (Tuscola High School). Eight proposals include topics related to resilience and planning in the face of changing climates. KIETS Associate Director Raj Narayan serves on the CCRG review and selection committee. Projects supported in FY 21-22 RFP include the following:

Jerry Miller (Western Carolina University), *Source, Transport Rates, and Transport Dynamics of Plastic Particles in Small Headwater Basins of the Southern Appalachians*; Olya Keen (UNC-Charlotte), *Building Agents of Change within Community through Youth and Resident Education, Career Awareness and Community Science Initiative*; Hans Paerl (UNC-Chapel Hill), *HAPs and HABs: Investigating Associations between Air and Water Quality through Community Collaborations in Eastern North Carolina*; Ashley Patrick Lomboy (Waccamaw Siouan Tribe Member and Founder of Waccamaw Siouan STEM Studio), *Reinforcing Resilience: Gleaning Knowledge from the Land and Water of the Waccamaw Siouan Tribe*.



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

KIETS Goal: Seek opportunities for enabling diversity and inclusion, maximizing efficiency and effectiveness, enhancing resources for KIETS operations and continuously improving services for our stakeholders and partners.

ACCOMPLISHMENTS

Enabling Diversity, Equity, and Inclusion

KIETS continues to focus on engaging a diverse community of individuals who bring multi-faceted perspectives and experiences to serve diverse stakeholders and communities. In this regard, all KIETS staff members completed NC State's DEI training in FY 21-22. Moreover, the Kenan Fellows Program (KFP) for Teacher Leadership added procedures, support mechanisms, and professional development into their program to ensure that diversity, equity and inclusion (DEI) are an important strategic element of the KFP. KFP partnered with the Burroughs Wellcome Fund to create five Diversity in Leadership Kenan Fellowships that have assisted all of the STEM Ecosystems in NC with asset mapping regarding DEI. Two of these Fellowships have enabled connectivity for all KFP alumni through collaborations with the Dudley Flood Center, the Color of Education summit, and the DRIVE (Developing a Representative and Inclusive Vision for Education) Summit through the Governor's office. LaTanya Pattillo, Kenan Fellow Alumnus and former teacher advisor to Governor Roy Cooper, led the first DRIVE Summit in 2019. Kenan Fellow Alumnus and current teacher advisor to Governor Cooper, Dayson Pasion, led the second DRIVE Summit held in June 2022. Mark Townley, Assistant Director of Programs for KFP serves on the Governor's Teacher Advisory Committee and has been a part of the planning process for both DRIVE Summit's as well.



Kenan Fellow Wendell Smith and a student conduct a science experiment on how infectious diseases spread.

The NC State Office of Institutional Equity and Diversity (OIED) has served as a mentor for KFP Diversity in Leadership Fellows along with Alfred Mays at the Burroughs Wellcome Fund, the NC DPI Office of Educator Engagement, No Kid Hungry, and the Village of Wisdom organization. OIED provided support for KFP to create an Equity Team that has representation across NC to assist KFP with making sure that every educator has access to opportunities regarding inclusion in KFP programming. The KFP's newest initiative, STEMwork, relies on individual school districts to select educators to participate. In order to ensure that KFP STEMwork Scholar

Educators are representative of our state's students, KFP has collaborated with organizations such as LatinXEd, Profound Ladies, and Profound Gentlemen to create two or more STEMwork teams of five to seven educators from underrepresented groups each year.

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 its collaboration with the Vice Chancellor for Research in supporting the Research Innovation Seed Fund (RISF) Program as well as the newly implemented Global Health and Climate Change RISF. 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. 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 2022.

Improving Program Effectiveness, Outcomes and Impact

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. At the close of FY 21-22, each Kenan Fellow had completed 80 hours of professional development and a three-week internship with their business/industry or university mentor. In addition, the KFP impact log reflects the following activities since they began the Fellowship in June: Over 3,000 Students impacted; 172 other educators impacted; 242 community business members impacted through presentations; \$93,607.00 secured in grant funding.

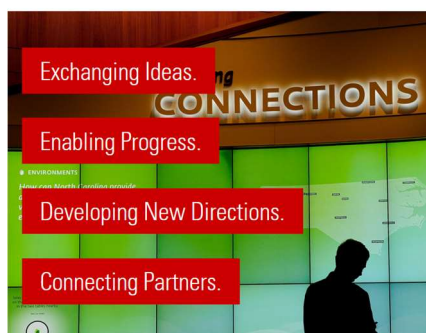
Leveraging KIETS Resources

In FY 21-22, KIETS core operating and program investments of \$2,111,622 were leveraged by approximately \$23,705,104 in complementary funding from NC State University and external partners. While only a portion of these funds flows 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 27 supported projects representing a 65% turnover ratio and 33% new projects at the start of FY 21-22.



KIETS 30th Anniversary Documentary Initiative

On November 1, 2022, KIETS will host an event to celebrate 30 years of leadership consistent with its mission to develop partnerships in basic research, education, commercialization and public outreach with individuals and organizations dedicated to the advancement of science, engineering, and technology as a force in improving the economic and social well-being of the nation and the world. Georgann Eubanks and Donna Campbell with Minnow Media, in association with Alexander Isley Inc., are collaborating with KIETS to develop a catalogue of stories and collateral material to include a short video, a historical book, a timeline brochure and updatable folder. Minnow Media is providing all creative writing and copy for books and other print materials that will illustrate the history of KIETS, its values and impact, in a documentary-style video, creating a compelling presentation for the 30th anniversary celebration. Alex Isley and Minnow Media have collaborated closely for many years and have a unique capability to integrate their expertise seamlessly in a manner that allows for a cohesive and comprehensive approach to developing the video and written materials. This enables significant efficiencies and timely production in addressing the various needs for KIETS including not only the 30th anniversary celebration but also longer-term strategic communication.



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 as a Senior Technology Strategist. To date, the State of NC has provided \$8 M 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.. different NC entities participate in NIIMBL, including 5 universities (ECU, NCCU, NC State, UNC-CH and UNC-W), community colleges, 15 small- and medium-sized companies (4 Wilmington, 10 in RTP and 1 in Charlotte), and 2 non-profit organizations. In the first five years of NIIMBL operations, NC members participated in projects totaling \$21.4M (federal funds, state funds and other member cost share) including \$8.9M of federal funds received by NC entities. Thus, federal funds to NC exceed funds provided by the State of NC (\$8M) and from other members and were leveraged 2.4:1 relative to total NIIMBL project costs. 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 now 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 the area of vaccine technologies, gene and cell therapy, applications of big data to biomanufacturing and process intensification and control.



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Research Innovation Seed Funding Program

KIETS provided support for the *Research Innovation Seed Funding (RISF) program* which is a collaboration with the Vice Chancellor for Research that assists researchers in developing new and innovative pilot projects that have the potential for future support from government agencies, corporations, or foundations towards large-scale research centers or industrial consortia. For reported outcomes since 2010, the RISF program has received 367 proposals and awarded 60 projects. These RISF projects have generated approximately 125 follow-on proposals to external organizations of which 36 received awards totaling \$17,976,857 and leveraged the total ORIED/KIETS awards of \$1,365,359 during the corresponding period. In addition, 66 students were supported, 235 publications or presentations made and 26 workshops/symposia held during



that period. KIETS Director Ruben Carbonell and Associate Director Raj Narayan served on the RISF selection committee. The traditional FY 21-22 RISF awards include the following: Dr. Kathy Dello, College of Sciences / State Climate Office, *Future Ready Farmer's Almanac*; Dr. Colleen Doherty, College of Agriculture and Life Sciences, *Mining the Potential of Rare Earth Elements as Biological Tools*; Dr. Tiegang Fang, College of Engineering, *Interaction Between Plasma Generated Shockwave with Liquid for Intravascular Lithotripsy*; Dr. Jessica Gluck, College of Textiles,

Optimizing Timing and Delivery of Electrical Stimulation via Conductive Nanotube Biotextile Scaffolds for Better Differentiation of HiPSC-derived Cardiomyocytes; Dr. Amay Bandodkar, College of Engineering, *Soft, Wearable, Sweat Sensors for Monitoring the Effects of Ill-Fitted Prosthetic Sockets and Risks of Infection on the Residual Limb Skin of Amputees*; Dr. Nitin Sharma, College of Engineering, *Towards Non-invasive Multi-modal Neuromodulation of Spinal Cord for Assisting Locomotion*; Dr. Sanjay Shah, College of Agriculture and Life Sciences, *Proof-of-Concept Cooling Mat to Improve Sow Welfare and Performance*; Dr. Jing Feng, College of Humanities and Social Sciences, *Teleoperation of Automated Vehicles: Human Factors and Logistics Considerations*.

Global Health and Climate Change Grand Challenges RISF Program

In FY 21-22, KIETS and the NC State Office of Research and Innovation (ORI) developed a new RISF program to offer a special funding opportunity for research initiatives focused on two very broad topics: *Global Health* and *Climate Change*. This program is planned to run for a two-year period (FY 2021-2022 and 2022-2023). The program encourages the formation of research teams in these two areas which are likely to dominate research funding cycles from Federal, State, industry and nonprofit sectors for the next 10 years or more. Moreover, the program would increase the visibility of NC



State as a major contributor to solutions to the major challenges facing humankind. In response to the FY 2021-22 RISF Global Health / Climate Change RFP, 13 awards were made including the following: Dr. Autumn Proudlove, College of Engineering, *Developing Decarbonization Data for Open Energy Modeling and Policy Analysis*; Dr. Yu Takeuchi, College of Agriculture and Life Sciences, *Investigating the Impacts and Adaptation Strategies to Current and Emerging Agricultural Pests in the Face of Climate Change*; Dr. Justin Whitehill, College of Natural Resources, *Novel Applications for Fraser Fir Christmas Tree Waste*; Dr. Sara Shashaani, College of Engineering, *Impact of Future Climate Events on NC Animal Agriculture Systems*; Dr. William Sagues, College of Agriculture and Life Sciences, *Electrifying*

Animal Feed: Leveraging Microbial Communities in Formicine Ants to Produce Single Cell Protein via Assimilation of CO₂-Derived Formic Acid; Dr. Hooman Tafreshi, College of Engineering, *Novel Solar Distillation Membrane for Water Purification*; Dr. Aram Amassian, College of Engineering, *Climate-Resilient Greenhouse Agriculture using AgriEC: The System-Level Case for Dynamic Heat-Blocking Envelopes to Enable Net-Zero Energy Greenhouses*; Dr. Yevgeny Brudno, College of Engineering, *Repairing Broken Hearts with Living Drugs*; Dr. Michael Sikes, College of Sciences, *USF Control of the DNA Damage Response: Establishing a Novel Target for Cancer Prevention Therapy*; Dr. Paul Hess, College of Veterinary Medicine, *Expanding the Promise of CAR-T Cell Therapy to Resource-Poor Healthcare Settings*; Dr. Marie Muller, College of Engineering, *Real-Time Detection of Lung Nodules Using a Robotically-Actuated Ultrasound Probe*; Dr. Nathan Hostetter, College of Agriculture and Life Sciences, *SARS-CoV-2 at the Human-Wildlife Interface: Understanding Wildlife as Potential Reservoirs for COVID-19 Across Urban-Rural Gradients*; Dr. Fred Gould, College of Agriculture and Life Sciences, *Identifying the Contributions to Pyrethroid Resistance by Specific SNPs in the Voltage Gated Sodium Channel Gene*.

Game-Changing Research Incentive Program for Plant Sciences Initiative

In FY 21-22, KIETS collaborated with the Office of the Vice Chancellor for Research and College of Agriculture and Life Sciences to support the Game Changing Research Incentive Program for Plant Sciences. The GRIP4PSI initiative

enables the NC State community to collaborate on integrated research/outreach projects that are focused on plant improvement, data-driven agricultural bioscience, and resilient agricultural systems. The current GRIP4PSI projects are as follows: Dr. Christine Hawkes, Department of Plant and Microbial Biology, *FUN-CROPS: Foliar Fungal Endophytes for Enhanced Crop Sustainability and Resilience*; Dr. Jean Ristaino, William Neal Reynolds Distinguished Professor and Director of Emerging Plant Disease, Department of Plant and Microbial Biology, *Plant-Aid: A Data-Driven and Sensor-Integrated Platform for Monitoring Emerging Plant Diseases*; Dr. Katharina Stapelmann, Department of Nuclear Engineering, *Harnessing (Bio-) Electrochemical Technologies as Sustainable Sources for On-Demand Precision Agriculture*; Dr. Cranos Williams, Department of Electrical and Computer Engineering, *Improving Crop Productivity and Value Through Heterogeneous Data Integration, Analytics, and Decision Support Platforms*. Outcomes for the GRIP4PSI initial fiscal year included the following: 24 follow up funding proposals submitted; 7 follow up funding proposals awarded for a total of \$2,072,636; 29 students supported; 39 publications or presentations generated; 1 workshop and 3 patents. In addition, the work conducted under several GRIP4PSI projects (Katharina Stapelmann and Cranos Williams) was instrumental in an extensive effort to obtain a recently awarded National Science Foundation (NSF) Science and Technology Center (STC) grant (*Science and Technologies for Phosphorus Sustainability - STEPS*, PI Jacob Jones, funding amount \$25,000,000), which was an outcome of the original GRIP project previously supported by KIETS in collaboration with the Vice Chancellor for Research and RTI.



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 NCSU, the State 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 firms initiated with university intellectual property. The Daugherty Initiative continued its collaboration with the NC State Entrepreneurship Initiative to feature the selection of the Daugherty Initiative recipients as part of the NC State eGames. The 2022 Daugherty Initiative track at the NC State eGames supported three awards including two first place winners and took place on April 18, 2022. The 2022 Daugherty Initiative awardees are as follows:

- **1st Place** – \$25,000 *Vizma Life Sciences* is developing next-generation, low-cost molecular imaging as an alternative to existing medical imaging technologies to deliver unprecedented diagnostic power that is safer and more convenient.
- **2nd Place** – \$15,000 – *Mammae Biosciences* is working to commercialize a cost-effective and scalable method for producing LacNAc, a key probiotic and beneficial, health-promoting human milk oligosaccharide (HMO), to meet the growing consumer demand for foods containing HMOs.
- **3rd Place** – \$10,000 – *DNAli Data Technologies* is developing an end-to-end DNA data storage platform to enable long lasting and eternally relevant data storage that is also sustainable and environmentally friendly.

Since 2008, the Daugherty Initiative has invested \$468,000 in 45 companies with 73% of the companies still in business. Cumulative follow-on funding received by the awardees since 2008 is over \$39 million. 2021 Daugherty Initiative awardee Gradient Medical received a second SBIR for \$251K and have submitted approximately \$20.5M in additional proposals to support their work. 2021 awardee Indago also received a \$250K NSF Partnerships for Innovation Grant. The Daugherty Initiative is managed by the NC State Office of Partnerships. KIETS Director Ruben Carbonell and Associate Director Raj Narayan serve on the Daugherty Initiative Governance and Selection Committee. New promotional materials have been developed including a website and video documenting the impact of the program and are available on the following webpage: <https://partnerships.ncsu.edu/daugherty-endowment/>

Wolfpack Investor Network (WIN)



KIETS continued to support the *Wolfpack Investor Network (WIN)* initiative focused on connecting alumni investors with promising NC State-affiliated startup companies to facilitate angel investments. In FY 21-22, WIN members and sidecar investment vehicles surpassed investing over \$17 million into NC State-related startups since the network's inception in December of 2016. During FY 21-22, WIN invested over \$2 million into 14 portfolio company transactions screened by WIN staff. In the past year, WIN was able to celebrate its first two portfolio company exits. In July 2021, WIN portfolio company EmployUs was acquired by Hireology, and in January 2022, WIN portfolio company The Climate Service was acquired by S&P Global. WIN engaged 18 MBA and STEM graduate students to perform due diligence on each company that presents to the membership. In addition, WIN had 3 undergraduate interns who were involved in the past year. To date, approximately 45 faculty members have aided in the WIN screening processes. The 14 WIN portfolio companies closed within FY 2020-21 drive innovation, job creation, and positive environmental impact in North Carolina and beyond. The WIN initiative is currently being

housed in the Kenan Institute offices and KIETS Associate Director Raj Narayan serves as a member of the WIN Steering committee. NC State University, along with UNC-Chapel Hill and Duke University have created the Triangle Venture Alliance to build a network of angel groups that will tap into each university's alumni base and come together to invest jointly when there are alumni overlap within the startup company as well as shared interest in the investment opportunity. As of February 2022, the Triangle Venture Alliance had invested over \$74 million dollars into approximately 85 portfolio companies.

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. In FY 21-22, ORC continued a partnership with the First Flight Venture Center (FFVC) and their Liftoff, FAST and Propeller Programs. This was the first year that Spark Plug funding has been used to support teams in all three of the programs. The Spark Plug Program has funded eight companies in fiscal year 2021-22 including the following: *DNALI Data Technologies, Inc.*, Focused on pairing molecular biology and encoding technologies to be able to scale DNA data storage systems; *Mammae Biosciences Inc.*: A simple solution able to transform lactose in milk; *Bay Nano, Inc.*: Makes energy-saving low-cost smart glass and smart EC plastic laminates for applications such as windows, curtain wall/architectural glass, automotive glass, and roof-coverings; *Helixomer*: Developed RNA origami anticoagulants and a specific reversal agent to address the critical problems of traditional anticoagulants; *Vizma Life Sciences*: Develops next-generation molecular imaging and chemical analysis solutions; *TreeCo*: Revolutionizing the forestry industry by combining insights from tree genetics with the power of CRISPR-Cas3 genome editing to breed more resilient trees in a faster time frame; *Vector Textiles*: Developing non-chemical-based insect and bite resistant products; *Vetletics*:

Commercializing a pneumatic dynamic compression device for equine use to improve recovery and promote overall horse health; As a result of the Spark Plug program, ORC reports 15 faculty members engaged, 3 graduate students, 2 post docs, and 2 partners engaged. DNALI Data Technologies was selected as a top company and received a FAST PLUS award which includes 5-hour consultation with Eva Garland Consulting.



NC State Office of Research Commercialization NSF ICorps Program



In FY 21-22, KIETS collaborated with the NC State Office of Research Commercialization (ORC) on the NSF ICorps program in support of the Summer 2021, Fall 2021 and Spring 2022 cohorts. Moreover, NC State University, in partnership with nine other leading research universities, was selected by the National Science Foundation to be one of the five national I-Corps Hubs, a \$15 million, five-year award. NC State will receive \$2M over five years and will serve as one of three partner organizations in the Hub, leading efforts to attract, train, and match industry mentors with I-Corps teams from all universities in the Mid-Atlantic Hub. January 2022 was the official launch of the \$15M NSF Mid Atlantic I-Corps Hub in January 2022. With KIETS support, ORC is also launching a new mentorship network ORCA that will benefit the NC State I-Corps Program. Under this new model, interested mentors can engage with ORC and NC State startups and research teams through a tiered model. This new network launched in June 2022 and key stakeholders will be engaged to develop a I-Corps mentor training program for new mentors entering the Hub. Six new NC State startups were launched in FY 21-22 and completed the NC State I-Corps Program: Grade-It, Washington's Hammer, Teen Health Research, Qnandryd, Netlocal Games, and Watson Nano. ORC reported that 17 faculty members participated in NC State I-Corps in this reporting period. NC State faculty Reza Ghiladi and Frank Scholle of startup Photocide Protection also participated as the case study for the Hub curriculum videos. Also, 6 undergraduates, 14 graduate students, and 2 post docs participated in the ICorps Program in fiscal year 2021-22. Two I-Corps projects were selected for the Summer 2022 National I-Corps cohort. KIETS Associate Director Raj Narayan serves as an NC State I-Corps ORC faculty instructor and advises the mentors and entrepreneurial leads in the NC State ICorps program.

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. More than 80% of Gordon Research Conferences now have a corresponding Gordon Research Seminar. The Kenan Institute supports approximately 16 brand new GKGRS annually. The GRC had originally planned to resume the 2021 conference season in May 2021 and operate through August 2021 in the U.S. and Europe. However, with the enduring effects of the pandemic, the GRC decided to

postpone its summer conferences and resume operations with a subset of three conferences and related Graduate Research Seminars that took place in the Fall of 2021. The Spring 2022 conference season resumed with 10 New GKGRS scheduled to be held through June 30, 2022. Since 2001, Kenan Institute support has provided seed funding for 200 new Gordon-Kenan Research Seminars, helped leverage \$10,470,671 from private & federal sources, and helped provide registration and travel support for 4,074 GKRS registrants, roughly 44% of all GKRS participants. From 2001 to 2021, GKRS/GRC Chairs have raised \$3,682,428 from federal funding and \$6,788,243 from private industry partners. During that time, 4,365 scientists from North Carolina have attended 2,968 GRC conferences or seminars. In addition, NC State University scientists have participated as a speaker 279 times, and have chaired 17 GRC conferences or seminars.



Novo Nordisk Foundation International Collaboration on Bioprocessing

KIETS supported the Accelerated Innovation in Manufacturing Biologics (AIM-Bio) project enabled by funding from the Novo Nordisk Foundation. KIETS Director Ruben Carbonell and Gary Gilleskie, Director of BTEC, serve as principal investigators for the grant. NC State will receive \$18 million to achieve its activities. NC State and BTEC, in conjunction with the Technical University of Denmark (DTU) in Copenhagen, are in the middle of the third year of a five-year international collaborative research and training program in biomanufacturing science and technology. NC State and DTU are developing 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 will be co-developed and 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 will be 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. Each project will involve tasks executed by investigators, graduate and postdoctoral students from both DTU and NC State to make the best use of each institution's strengths, infrastructure and capabilities. Among the topics being investigated: novel yeast cell therapeutic modalities, high productivity perfusion bioreactor systems, automation and high-throughput fermentation, specific ligands for affinity purification of next-generation protein therapeutics, membrane and resins enabling continuous manufacturing with single-use devices, biosensors for multiplexed real-time monitoring of critical product quality attributes, and modeling and simulation of bioprocesses. AIM-Bio held a very successful second Annual Symposium on Biopharmaceutical Manufacturing from October 4-6, featuring distinguished speakers from its Biopharma Leaders Network. Discussions are underway with the Novo Nordisk Foundation and NC State University on potential future expansions of this program.

2021 AIM-Bio Biopharmaceutical Manufacturing Symposium

Funded by the Novo Nordisk Foundation, the AIM-Bio Program brings together two academic universities, the Technical University of Denmark (DTU) and North Carolina State University, to create an international collaboration to drive innovation in research and education in manufacturing biopharmaceuticals. For the 2021 AIM-Bio Symposium, participants were invited to join in-person or virtually on Tuesday October 5, 2021. The meeting included a combination of virtual, in-person and hybrid formats. Topics included continuing education, research, international exchange and time for networking with working groups. The overall goal of the symposium was to build new relationships with Danish industry and academic members that can serve as partners for future extensions of the AIM-Bio program.

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 RISF Selection Committee, the IEI National Advisory Board, the COE Executive Committee, the Daugherty Endowment Board, the Advisory Board for the FSU-FAMU Chemical Engineering Department, the National Academy of Engineering's Audit Committee, the Plant Sciences

Initiative Leadership Committee, the Kenan Institute for Private Enterprise Advisory Board, the Executive Committee of the NC Association for Biomedical Research, and as Chief Technology Officer for the National Institute for Innovation in Manufacturing Biopharmaceuticals. He also served on the National Academy of Sciences Board of Chemical Sciences and Technology, and the EU Academy of Sciences.



- 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. He served as a mentor with the Apex Friendship High School Honors Entrepreneurship program and as a board member of the Applied Synergies Partnership, Inc. (ASaP). Mr. Narayan served on the NC State Entrepreneurship Alliance Steering Committee, as a mentor for the NC State Social Innovation Fellows program, the NC Sea Grant CCRG Review Committee, the Daugherty Entrepreneurship 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 as Chairman of the UNC School of Law Institute for Innovation Board of Advisors. He was also an active participant in the NC Eisenhower Fellows, Marshall Memorial Fellows, and William C. Friday Fellows alumni initiatives and was named Vice President of the NC Eisenhower Fellows Alumni Chapter.
- 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 was recognized with her 15 Year Service award for her service to the State of North Carolina and NC State. Ms. Rashid also served on the Chancellor's Awards for Excellence selection committee. In June 2022, Ms. Rashid was appointed 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, and African American Faculty & Staff Organization. In June 2022, Ms. Spivey completed her Fellowship as a member of the 2020-22 cohort 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.
- Dr. Elaine Franklin, Director of the Kenan Fellows Program served as an Adjunct Assistant Professor in the Department of Teacher Education and Learning Sciences in the NC State College of Education. She served as a member of the Advisory Council for the NC State Teaching Fellows Program Board, as a Board Member of The Heritage Education Network (THEN), as a member of the Publications Committee for The Heritage Education Network (THEN), and as a panelist for the National Endowment for the Humanities CARES Grants. Dr. Franklin retired on June 1, 2022 and was recognized with the Order of the Long Leaf Pine for her service to NC.



- Mr. Darrell Kain, Assistant Director of Development for the Kenan Fellows Program Board served as a member of the Wake County Schools, School to Career Council, which advises the county's Career and Technical Education department. He also

serves on several committees supporting diversity and inclusion on campus including the University Advancement's program TIDE. Recently Darrell has started a podcast highlighting community leadership across the country; the podcast is titled "Reach and Thrive Together" and is available on Apple and Spotify platforms. Darrell also volunteers with the YES Consortium to provide career guidance to under-resourced youth.

- Mark Townley was promoted to Assistant Director of Programs for the Kenan Fellows Program. He serves on the Board of Directors for the Exploris School in Raleigh, NC. He has continued to serve on the Governor's Teacher Advisory Committee for Governor Roy Cooper through both terms and has worked with BEST NC as an educator ambassador or "FIT Leader" for their Innovation Lab each year for the past few years. Mark also teaches courses at UNC and NC State with pre-service teachers and non-profit majors regarding how to create a personal position statement and utilize their strengths through personal branding.
- Amneris Solano was promoted to Assistant Director for Communications for the Kenan Fellows Program. She also continued to assist KIETS with supporting KIETS website improvements and social media presence. Ms. Solano is working toward her MS in Communication from NC State University. She shared her work at the 2022 NC State Graduate Student Research Symposium about her research paper titled, *#FutureTechBoss: Analyzing How Black Girls and Girls Who Code Use Intersectionality and Speculative Feminism to Address the STEM Diversity Gap*. Additionally, she was selected to present a paper at the virtual 2022 Communication, Rhetoric, and Digital Media (CRDM) Symposium at NC State on her paper titled, *#foodie: A Comparative Analysis of How Two Latina Chefs Articulate Their Cultural Identities on Instagram*.
- Randy Pinion transitioned from Activities Coordinator to a new role as the Logistics and Data Manager for the Kenan Fellows Program.
- Kenan Fellows Program Director Dr. Elaine Franklin 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*.

New Staff and Board Appointments

In FY 21-22, Ms. Carrie Horton joined the Kenan Fellows Program as the new Program Manager. KIETS welcomed Dr. Roy He as its inaugural Senior Faculty Fellow and Ms. Amanda Mueller as the Program Manager of the KIETS Climate Leaders Program. In addition, KIETS engaged Dr. Mary Watzin (Chair) as well as Dr. Roy He, Dr. Gavin Smith, Dr. Susan White, Dr. Kathy Dello, Dr. Christopher Galik, and Ms. Anita Brown-Graham on the KIETS Climate Leaders Program Steering Committee. KIETS welcomed two new Board of Trustees members, Dr. Laura Niklason, CEO of Humacyte and Dr. Philippe Gilbert, Senior Program Officer of the Bill and Melinda Gates Foundation. The Kenan Fellows Program also welcomed new Board of Advisors Members including Dr. Mary Hemphill, Director of Computer Science and Technology Education with the NC Department of Public Instruction, Dr. Jamie Lathan, Dean of Distance Education at the NC School of Science and Math, Dr. Kim Morrison, Superintendent of Mount Airy Schools, Ms. LaTanya Pattillo, Director of Policy and Advocacy at NWEA and Former Kenan Fellow / Teacher Advisor to Governor Roy Cooper, Dr. Mark Sorrells, Senior Vice President for Academic and Student Services at Fayetteville Technical Community College, Dr. Robert Witchger, Director of Career and Technical Education with the NC Community Colleges System, and Sedrick McCallum, SVP Community Development Officer, South State Bank. Mr. Dave Kaiser, Deputy Director of the NC Board of Science and Technology was named the Chair of the Kenan Fellows Program Board of Advisors. In FY 21-22, KIETS also led the recruitment of a new Director for the Kenan Fellows Program with a selection committee comprised of Raj Narayan, Cordella Rashid, Tara Spivey, Charles Coble, David Kaiser, Tia McLaurin, Malinda Faber, Darrell Kain, and Mark Townley. Over 80 applications were received, 11 initial interviews conducted, and five finalists interviews completed. After a highly selective process, Dr. Vance Kite was selected as the incoming director of the Kenan Fellows Program.

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 21-22, KIETS remained responsive to stakeholder needs while effectively managing the continuity of its operations following NC State guidelines to ensure effective follow up and implementation of core organizational functions and priorities including support of its partners and programs. With the return to an on-campus presence and activity, KIETS continued to prioritize the health, safety and wellbeing of its staff, advisors, and program partners. Moreover, KIETS 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.

In addition, 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. 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 a 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 implementation. 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.