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ROSENWALD SCHOOL
Research and Cultural Heritage

SPRING 2020

BEYOND

RESEARCH AT ELIZABETH CITY STATE UNIVERSITY

STEM: PIPELINE FOR PLANT SCIENCES

SPRING 2020

BEYOND

RESEARCH AT ELIZABETH CITY STATE UNIVERSITY

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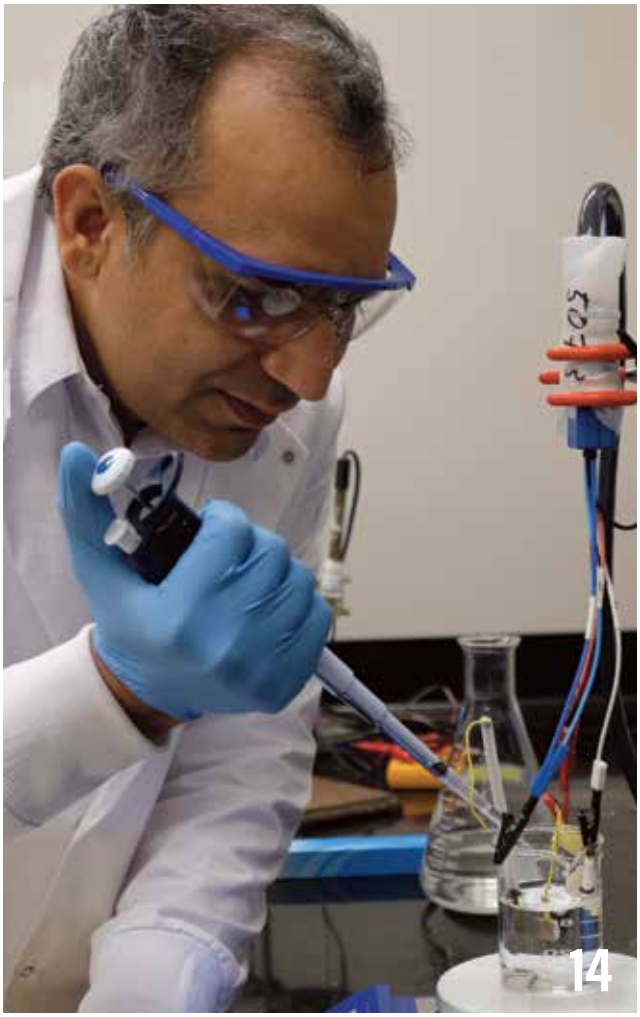
Dr. Margaret Young
Associate Professor
Natural Sciences



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STEM Complex

The STEM Complex is the new home for ECSU's Aviation Program, Emergency Management, Unmanned Aircraft Systems, Pharmaceutical Sciences, Psychology, and Social Work programs. The STEM Complex houses several biology, chemistry, and aviation labs, as well as a Flight Simulation Lab, Drone Lab, two Air Traffic Control Labs and a Pharmaceutical Compounding Lab.


STEM COMPLEX

FROM THE PROVOST AND VICE CHANCELLOR

Greetings,

This edition of the 2020 Beyond Research Magazine highlights the outstanding research and scholarly accomplishments by Elizabeth City State University's faculty across campus. Our feature story, *STEM: Pipeline for Plant Sciences*, looks at climate change and crop improvement strategies. As our environment continues to rapidly evolve, Dr. Margaret Young's research is timely, and the results of her work will impact future generations.

Not only are faculty making unprecedented accomplishments in STEM fields, faculty in our School of Humanities and Social Sciences, such as Dr. Glen Bowman and Dr. Melissa Stuckey, are highlighting the historical significance of ECSU's campus and connections among African American communities in North Carolina. The University has received grants from the North Carolina Humanities Council, the National Park Service (NPS), and the Institute of Museum and Library Services (IMLS), to explore our history while developing symposiums and student learning opportunities. Recent funding for these projects have greatly enhanced our academic and cultural connections.

It is my hope that, as you read this edition, you will be inspired by our diverse research and will partner in our continued endeavors!

Sincerely,

Farrah Jackson Ward, Ph.D.
Provost and Vice Chancellor for Academic Affairs

WINTER 2020

BEYOND

RESEARCH AT ELIZABETH CITY STATE UNIVERSITY

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FROM THE DIRECTOR OF SPONSORED PROGRAMS

Dear Friends of ECSU,

Dr. Margaret Young has a passion for plants and an even greater passion for her students. As one of Elizabeth City State University's (ECSU) most beloved professors, Dr. Young is a leader in STEM education. A funded investigator by the National Science Foundation and the U.S. Department of Education, she joined ECSU's biology department in 2003. Her research has always been student centered, focusing on course-based undergraduate research experiences (CUREs). This spring edition of BEYOND profiles Dr. Young's research in plant biology, including crop improvement strategies, that is timely considering the climate changes our world now faces. In addition to her teaching and research endeavors, Dr. Young serves as the Director for Undergraduate Research and leads the University's annual Undergraduate Research Week. This annual event brings speakers and workshops to campus from across all disciplines and showcases an impressive student research poster session for both the campus community and the community at-large.

This edition features photos of ECSU's STEM Complex. Last August, the ECSU community gathered to celebrate the complex's grand opening. Home to the new Unmanned Aircraft Systems Program and the only four-year degree Aviation Science Program in North Carolina, this state-of-the-art facility has become ECSU's epicenter for research and innovation. In this 52,000 square foot glass complex, faculty and students are charting the course for the future of aviation. The STEM Complex houses the Department of Health and Human Studies, the Department of Aviation and Emergency Management, flight simulators, a drone lab, two Air Traffic Control Labs, a Pharmaceutical Compounding Lab and other research labs. Aviation Science, ECSU's signature program, currently has a fleet that boasts 10 fixed-wing aircraft and one gyrocopter, and continues to grow with support from external sponsors.

So, as we recognize the importance of our ECSU history and cultural ties, we set our sights higher, aiming to broaden our research capabilities and taking to the skies.

Annemarie Delgado, MPA, MA, CRA
Director of Sponsored Programs

2019 MARKS A HISTORICALLY SIGNIFICANT YEAR IN U.S. HISTORY

◁ Dr. Glen Bowman

Exactly 400 years ago, approximately twenty African captives arrived on the shores of colonial Virginia. They soon would be followed by tens of thousands more, and together they changed the course of American history. Although many enslaved Africans had already landed in certain parts of the Americas, including Florida, 1619 marks the first time Africans reached British North America, the thirteen original colonies. Their arrival on these shores, more than 150 years before the United States became a nation, marked the beginning of an African American identity and the centuries' long struggle for African-American freedom and citizenship. To mark this anniversary, Congress passed the "400 Years of African-American History Commission Act."

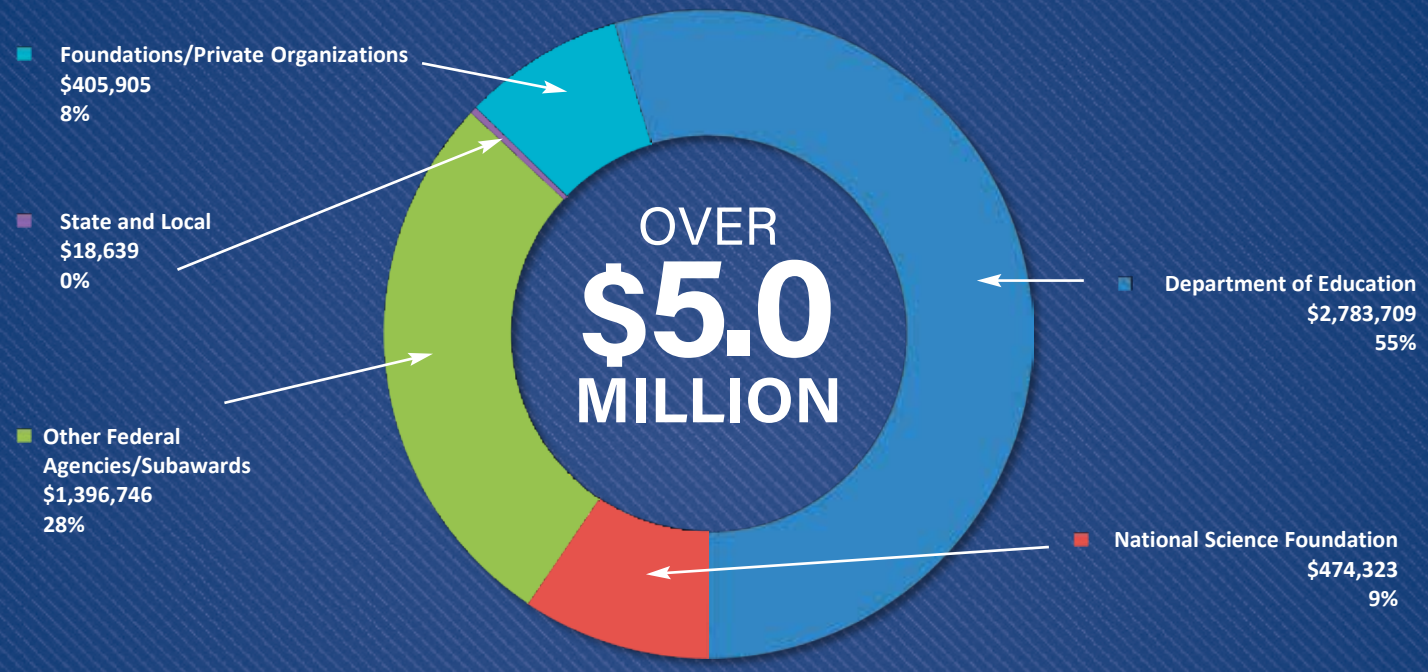
Locally, three ECSU History professors are marking this anniversary in another way—by traveling throughout the region to deliver free presentations to the community about African American history. Their goal is to serve the community by bringing history to those who might not be able to attend functions on campus—to churches, schools, civic gatherings, and other such grassroots venues.

Dr. Glen Bowman, Professor of History, has been speaking on "Celebrating a Tri-centennial: Elizabeth City's African-American community and the pivotal year of 1919." This talk is based on his research about how Elizabeth City celebrated the 300th anniversary—called a tercentennial--of the 1619 voyage back in 1919. Dr. Melissa Stuckey, Assistant Professor of History, has been talking about "Freedmen Communities and Black Towns in North Carolina." Dr. Latif Turik, Assistant Professor of History, has been sharing his research in a talk entitled "Revisiting the works of Herbert Aptherker: Maroons Within the Present Limits of the United States."

To help fund these trips, Dr. Bowman successfully wrote a grant with the North Carolina Humanities Council. Founded in 1972, this organization is a statewide nonprofit and affiliate of the National Endowment for the Humanities. The Council is dedicated to exploring and celebrating North Carolina's heritage, history and people, as well as preserving and sharing the stories that bring this state's culture to life and enrich the lives of residents across the state.

Each of the three professors made at least two speaking engagements. According to Dr. Bowman, "Since learning that our grant was successfully funded, all three of us have been traveling throughout the area, to Edenton, Hertford, and Murfreesboro, and not just Elizabeth City. Three symposia were held this summer alone." Drs. Stuckey and Tarik spoke at the Museum of the Albemarle in Fall 2019, and Dr. Bowman is trying to schedule additional engagements up through and during Black History Month in 2020.

2018 – 2019 AWARDS RECEIVED



ECSU Mini-Grants

In December 2018, ECSU's Division of Academic Affairs and the Office of Sponsored Programs announced 21 award recipients to the Mini-Grant Proposal Competition that awarded nearly $32,000 in grant funds. Over 40 proposal submissions were received from ECSU's faculty and a review panel was convened to thoroughly review submissions. Over the past year, ECSU's mini-grant proposal competition has supported research activity across all disciplines. Mini-grants have funded a variety of activities including lecture series, early-stage investigative studies, and support for pilot data collection.

Advocacy Matters: Training BSW Students for Legislative Advocacy and Policy, Dr. Melody Brackett

ELIZABETH CITY STATE UNIVERSITY MINI-GRANT RECIPIENTS 2018-19

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Department of Health & Human Studies

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MELODY BRACKETT, PhD
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SHERYL BRADFORD, MS
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JAY FORTENBERY, PhD
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Department of Aviation & Emergency Management

PETER LOEBACH, PhD
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Department of English & Digital Media

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Associate Professor
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(Music), MLIS
Music Librarian & Cataloger
ECSU NC DOCKS Coordinator

MARGARET YOUNG, PhD
Associate Professor, Director of Undergraduate Research
Department of Natural Sciences

U.S.-EAST AFRICA RESEARCH AND EDUCATION PARTNERSHIP:

Cassava Mosaic Disease – A Paradigm for the Evolution of Insect-Transmitted Plant Virus Pathosystems

▷ Dr. Timothy Goodale

Issues surrounding food security and hunger cause many East African citizens to scour wastelands like the "Dandora Dump" and compromise their health and well-being in order to survive or face possible death through starvation.

The agricultural crop Cassava is a crucial food source and has the potential to help alleviate many of the issues in East Africa surrounding food access and security. Cassava has the potential to increase farm incomes, reduce rural and urban poverty and help alleviate many food security issues. Cassava is an important subsistence food crop in Kenya and Tanzania, especially in the semi-arid areas and is an important crop within the region's famine reserve. Cassava diseases such as mosaic virus are transmitted through vectors (white fly) and cause crop yield losses of up to 70%. Thus exacerbating an already complex problem. This backdrop establishes the importance of a 5 year, $5,000,000.00 dollar project for which ECSU Associate Professor, Dr. Timothy Goodale serves as the Principal Investigator. The project is funded through the National Science Foundation's "Partnerships in International Research and Education (PIRE) Program". Dr. Goodale leads project efforts in regards to education and training of project personnel and associated outreach efforts. Currently, an international team of researchers (See page 12), from North Carolina State University, Rutgers University, Auburn University, North Carolina A&T, Beca-ILLRI (Biosciences eastern and central Africa) in Nairobi, Kenya and MARI (Mikocheni Agricultural Research Institute) in Tanzania along with Dr. Goodale at ECSU are investigating the genetic causes and impacts of cassava mosaic virus across many environmental variables. The hope is to one day identify resistant varieties of cassava and to better disseminate agricultural techniques to small holding farmers in Africa.

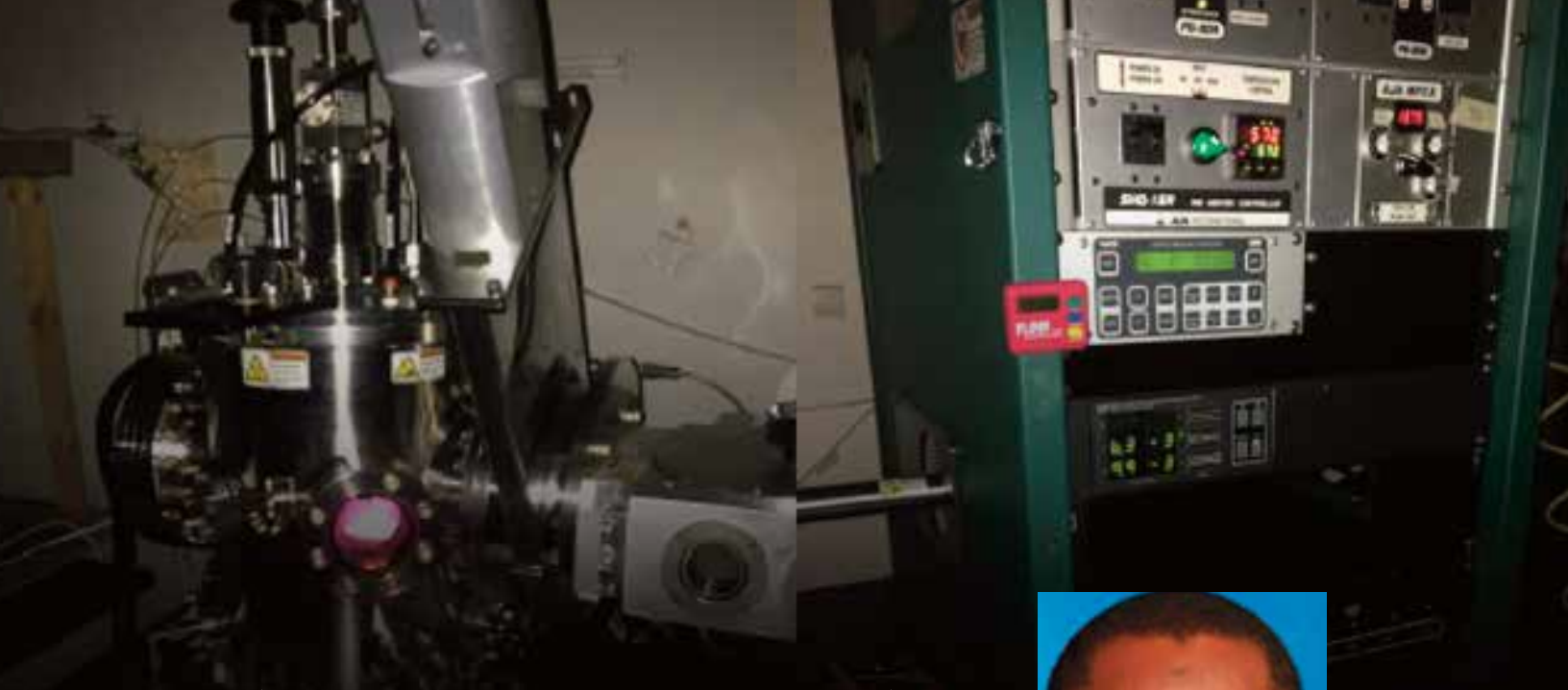
PIRE: U.S.-East Africa Research and Education Partnership: Cassava mosaic disease - A paradigm for the evolution of insect-transmitted plant virus pathosystems

The project has always touched home for Dr. Goodale, who was born and raised on a potato farm in New York. Immediately, he could see its potential and coinciding with the ongoing scientific research he developed a new curriculum aimed at high school biology. The curriculum is a modern way to teach evolution and genetics through context based learning. Students put themselves in the "lab coat" of one of our diverse team members and go about solving the issues surrounding cassava. Students learn to extract DNA, code and map genetic characteristics, identify mutations through electrophoresis and utilize argumentations to pose solutions. A learner is required to consider the pros and cons of insecticides, genetically modified foods, poverty, environmental impact and communication limitations. So far, Dr. Goodale has conducted seven presentations and workshops at International, National and State level meetings aimed at science educators and has published an article in a newly released research handbook aimed at Evolution Education:

Goodale,T.A. (2019) Utility of Context Based Learning to Influence Teacher Understanding of Evolution and Genetics Concepts Related to Food Security Issues in East Africa. Evolution Education Reconsidered. Eds., Reiss, M. and Harms, U. Sense Publishers, Rotterdam, Netherlands

The project has been an amazing experience thus far, as Dr. Goodale has been able to travel to Kenya, Tanzania, Zanzibar and India in project related activities. Two years remain on the project and he is excited to see where it ends up and keep collaborating in the future with his international peers.

▷ Dr. Timothy Goodale



Faculty Summer Research Fellowship at Air Force Research Laboratory

▷ **Dr. Victor Adedeji**

Dr. A. Victor Adedeji, Associate Professor of Physics in the Department of Natural Sciences, was appointed as a summer faculty fellow at Wright Patterson Air Force Research Laboratory in Dayton Ohio in the summer of 2019. Drs. James Scofield and Neil Merrett at the Aerospace Systems Directorate (RQ) hosted Dr. Adedeji over his 8 week fellowship. He worked on growth and contact metallization of Ultra-Wide Band Gap (UWBG) semiconductor, beta gallium oxide (β-Ga_2O_3).

UWBG semiconductors are those materials with significantly wider energy gap than 3.4 eV (GaN band gap). Examples of UWBG include β-Ga_2O_3, AlGaN, AlN, diamond, cubic BN, and ZnMgO. Because of the very wide energy gap, these materials have potential for applications in high power, high frequency, high radiation, high temperature and other harsh environments microelectronic devices. Beta-Ga_2O_3 is the most promising of the few UWBG listed above to build the next generation of high power electronic devices because native substrates of the material are available and they are relatively not expensive. Beta-Ga_2O_3 is also a candidate for the following applications as well; solar-blind UV photodetectors, photocatalysts, gas sensors, solar cells, phosphors, and transparent conducting films for electrodes on a variety of optoelectronic devices. Despite all the positives in favor of β-Ga_2O_3, there are basic research and development issues that researchers are still trying to understand and address.

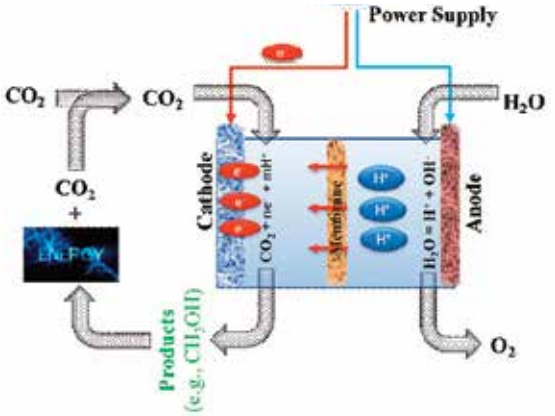
During the summer program, Dr. Adedeji and his collaborators grew crystalline β-Ga_2O_3 with the magnetron sputtering system at Elizabeth City State University. The success stories of the summer research fellowship include the following: (i) finding the right condition to grow single crystal β-Ga_2O_3 with a routine and cheap deposition technique – magnetron sputtering, (ii) growing Si-doped β-Ga_2O_3 (n-type) by co-sputtering Si target with β-Ga_2O_3 target, and (iii) fabricating ohmic contacts on the material. The investigator is currently preparing an article that captures the work accomplished. Dr. Adedeji has stated that the summer experience was an exciting and productive experience. He has already submitted several proposals to address some of the β-Ga_2O_3 issues.

Clean Energy at ECSU:
Creating Fuel from Carbon Dioxide

▷ Dr. Bijandra Kumar

Energy demand continues to rise as the world's population is increasing and expected to reach 9.8 billion in 2050. Non-renewable resources (notably fossil fuels) are limited on earth and the burning of fossil fuels is associated with the generation of solid, liquid, and gas wastes. Particularly, excessive emission of carbon dioxide into the environment is a serious concern for our climate. Through the greenhouse effect, this can cause an increase in the mean global temperature resulting in a catastrophic environmental impact. However, we have a source of virtually unlimited clean energy in the form of solar power. The sunlight-striking the earth's surface in approximately one hour delivers enough energy to power the world economy for an entire year. However, intermittency is an issue with solar or wind energy. Therefore, the scientific community is looking to develop an efficient energy storage system.

Dr. Kumar is actively working with other professors at ECSU with the aim of developing a state-of-the art research facility in the field of materials science and engineering. Dr. Kumar is establishing an advanced research laboratory "Smart Nanomaterials and Clean Energy



Laboratory (SNCEL)" at ECSU. His research is highly interdisciplinary and lies in the frame of material science and engineering. The development of efficient energy storage systems is one of them. Dr. Kumar is more focused on storing energy in the form of chemical bonds rather than using standard Li-ion based batteries. It can be accomplished by producing directly liquid fuels (e.g., methanol) from carbon dioxide electrochemical conversion using water and renewable energy sources Solar energy can also be used to produce hydrogen via an electrochemical water splitting reaction. With recent funding from the National Science Foundation and NC Space Grant, Dr. Kumar will be able to provide advance research training and prepare students interested in material science and renewable energy storage system. On one hand, students will learn the fundamentals of electrochemistry and actively participate in this cutting-edge research. On the other hand, students will get experience identifying and understanding research problems, data analysis, manuscript preparation and more importantly research ethics.

STEM: *PipeLine for Plant Sciences*

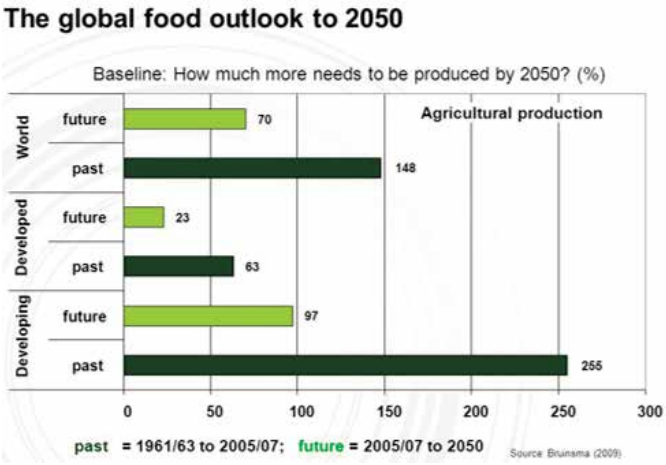
▷ Dr. Margaret Young

The National Science Foundation Targeted Infusion Project recently awarded a grant of $399,719 to Dr. Margaret Young (Department of Natural Sciences) and Dr. Gloria Payne (Interim Associate Vice Chancellor of Academic Affairs). Crop improvement strategies will need to be enhanced in a world where the climate is changing, and the human population and food insecurity is increasing. Therefore, the overall goal of the proposal: STEM: PipeLine for Plant Sciences is to enhance plant biology at Elizabeth City State University. In addition, this proposal seeks to increase plant awareness (demystify plants), and diversify the career opportunities available to our future scientists.

The proposal will introduce semester long CUREs (course-based undergraduate research experiences) into two required courses in biology. CUREs are high-impact strategies that increase students' learning and understanding of complex materials. They are an opportunity for all students (who may have other obligations) to do research. These CUREs will focus on real-world problems in tissue culture and molecular transformation (one of the bottlenecks to crop improvement strategies). All students will help to design, and complete their experiments; and have access to peer tutors for the theoretical aspects of the courses.

They will also be introduced to hierarchal mentoring and self-regulated strategies to improve performances in these courses. Selected students will continue their research experiences at ECSU and attend summer internships at research-intensive universities.

Faculty expertise in pedagogy and cutting-edge plant engineering techniques such as CRISPR, will also be improved by attendance at workshops, seminars and conferences. By bringing noted plant scientists to campus to interact with the community, the grant will elevate the awareness of plants, and the field of plant sciences as viable career options.



THE SECRET SAUCE OF SCIENCE

▷ Dr. Linda Hayden

Science Gateways are often called the secret sauce of science, a simple ingredient that boosts scientific discovery across domains.

Science gateways are accelerating research and democratizing scientific discovery by bringing easy access to advanced computing and big data tools. That is exciting news to scientists who want to take their research farther, faster. We are talking about high-performance computing (HPC), and it can boost scientific discovery many times over. Research and analysis that once took months can be performed in weeks or even days.

Science gateways are user-friendly interfaces that simplify access to advanced computing resources.
For people who are not command-line savvy, but have some very complex requirements, science gateways solve a wide range of problems by allowing science & engineering communities to access shared data, software, computing services, instruments, educational materials, and other resources specific to their disciplines. Leading the Nation in gateway design is The Science Gateways Community Institute (SGCI http://sciencegateways.org). SGCI was one of the first two software institutes funded by the National Science Foundation's Office of Advanced Cyberinfrastructure in August 2016. SGCI is organized into five service areas: Incubator (Purdue University), Extended Developer Support (Indiana University), Scientific Software Collaborative, Community Engagement and Exchange (University of Michigan), and Workforce Development (Elizabeth City State University). The institute is led by San Diego Supercomputing Center (SDSC).

The ECSU Center of Excellence in Remote Sensing Education and Research (CERSER) designs and implements Workforce Development programs for the Science Gateways Community Institute (SGCI). For SGCI to transform the frontiers of science demands users and developers who are trained and motivated to tackle the difficult challenges of working in uncharted territory. Through ECSU, SGCI works to build the nation's capacity to generate the workforce needed to meet these challenges.

We provide NSF-funded, online and in-person resources, and services. Our goal is to facilitate—at little or no cost—the sharing of experiences, technologies, and practices of those working with science gateways.

If you're conducting technically-advanced science or engineering research, there's a good chance that you use or will need to use a science gateway. Whether you call it a gateway, hub, virtual research environment, or one of the many other terms used, a gateway is essentially a web-based, streamlined, user-friendly portal that provides access to advanced, often shared, resources for science, engineering, and beyond. Our student-focused programs run by

Workforce Development offers students access to the mentoring, career development, internships, and workshops that students need for pursuing a career building or using science gateways.

During the academic year, gateway training is available to ECSU faculty, staff and students on Tuesday and Thursday evenings from 5 PM to 7 PM in the CERSER laboratories. A Training schedule is available online at http://nia.ecsu.edu under upcoming events. Workforce Development offers workshops and other programs geared toward teaching students and educators about the use or development of science gateways. Some workshops are hosted at national conferences such as ADMI and PEARC and our own Gateways conference, while others are offered during the summer.

Each summer, we offer workshops that provide instruction about building and using gateways. In 2017, 2018, and 2019 we offered a four-week Coding Institute on the campus of Elizabeth City State University. The workshop covered the core skills needed to be productive in the design and maintenance of science gateways. The program was presented as short tutorials alternated with practical experiences, and all instruction was done via live coding.

Eligible applicants are undergraduate students majoring in computer science or computer engineering (or related fields) who have an interest in the design and maintenance of science gateways. Participants of the Coding Institute receive a weekly stipend plus funding for transportation and housing.

ECSU's Office of Sponsored Programs provides training on ethics for all Coding Institute participants. The Coding Institute students also learn other non-technical skills including orientation to the science gateway community; mentoring and oral/written communication skills.

Our Workforce Development team offers eight-week summer internships for students interested in developing their gateway development skills. The summer internship is intended to provide hands-on experience and to provide a unique opportunity for student engagement with the community. Participants are placed at one of the seven universities that form the SGCI partnership, or a specific site may be suggested by an SGCI client, partner, or others who are interested in hosting a student intern.

Interns are graduate students majoring in computer science or computer engineering (or related fields) at any level and undergraduates majoring in computer science or computer engineering (or related fields) who demonstrate strong programming and software engineering skills. Participants receive a stipend, plus housing and transportation. Interns are encouraged to participate in the annual Gateways conference, where they will report on their internship experience.

Working closely with the SGCI Hackathons was Je'aime Powell, a Senior Systems Administrator on The Large Scale Systems Group with the Texas Advanced Computing Center (TACC). TACC is the hub for the SGCI's Scientific Software Collaborative component lead by Maytal Dahan. Je'aime completed his Bachelor of Science and Master of Science from Elizabeth City State University. During that time, he worked in the CERSER laboratories on High Performance Computing projects. Je'aime makes significant contributions to the SGCI Workforce Development efforts by coordinating the SGCI Hackathons at PEARC and Supercomputing conferences. Je'aime Powell is an excellent example of the hundreds of CERSER students who are now at the cutting edge of High Performance and Cloud Computing and who continue to give back to their communities.

Participants in SGCI

Rosenwald School

Northeastern North Carolina African American Research and Cultural Heritage Institute

▷ **Dr. Melissa Stuckey**

The Rosenwald School located in Elizabeth City, North Carolina.

In recent months, Elizabeth City State University (ECSU) has been awarded two major federal grants, totaling over half a million dollars to rehabilitate two historic campus buildings, the Rosenwald School (1921) and the Principal's House (1923). These campus buildings, located within the "Elizabeth City State College Historic District," serve as a vital link between ECSU's auspicious roots as an African American teacher training school and its modern role as the educational hub and economic engine for all of Northeastern North Carolina. Over the years, the two structures have served many functions. Together, they have housed University presidents, educated neighborhood children, been a training facility for future teachers, and, over time, filled a wide variety of other university needs, both educational and administrative. As these buildings approach their centennial years, however, the time has come for them to receive a transformation that helps to tell the story of their role at ECSU and in Northeastern North Carolina. The two grants will aid the University in its long-term goal to create within these buildings, The Northeastern North Carolina African American Research and Cultural Heritage Institute. This proposed institute will serve as a research center and gathering space that will help tell to the story of ECSU, North Carolina Rosenwald Schools, and their shared roles in educating the people of Northeastern North Carolina.

The first grant, awarded in June 2019, is an Institute for Museum and Library Services Grant for African American History and Culture. This $50,000 award will be used to create a comprehensive interpretive plan for the future Institute. This preliminary planning process includes is centered on soliciting and processing feedback from various stakeholders. Among these stakeholders are University personnel, current students, ECSU alumni, Rosenwald school alumni, and local and regional partners. With this feedback in mind, a campus committee will then work with a professional team of interpreters and designers to develop and publish a complete vision for the look and usage of the two spaces.

The second grant, awarded in September 2019, is a The National Park Service's African American Civil Rights Award. This $498,872 grant which funds the rehabilitation of properties related to twentieth century African American Civil Rights, will be used to craft architectural plans, to perform critical repairs in the Rosenwald School building, and to refresh the exteriors of both the Rosenwald School building and the Principal's House.

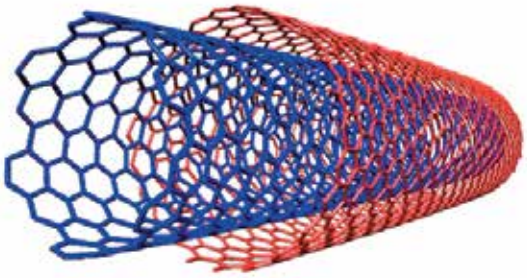
These grants signify the national significance of ECSU's educational mission from its inception through today. They are the culmination of several years of efforts by a large number of past and present ECSU leadership, faculty, and staff and partnerships across the state and region. Equally important, they are a call to action and a reminder of our collective responsibilities to be stewards and curators of our past.

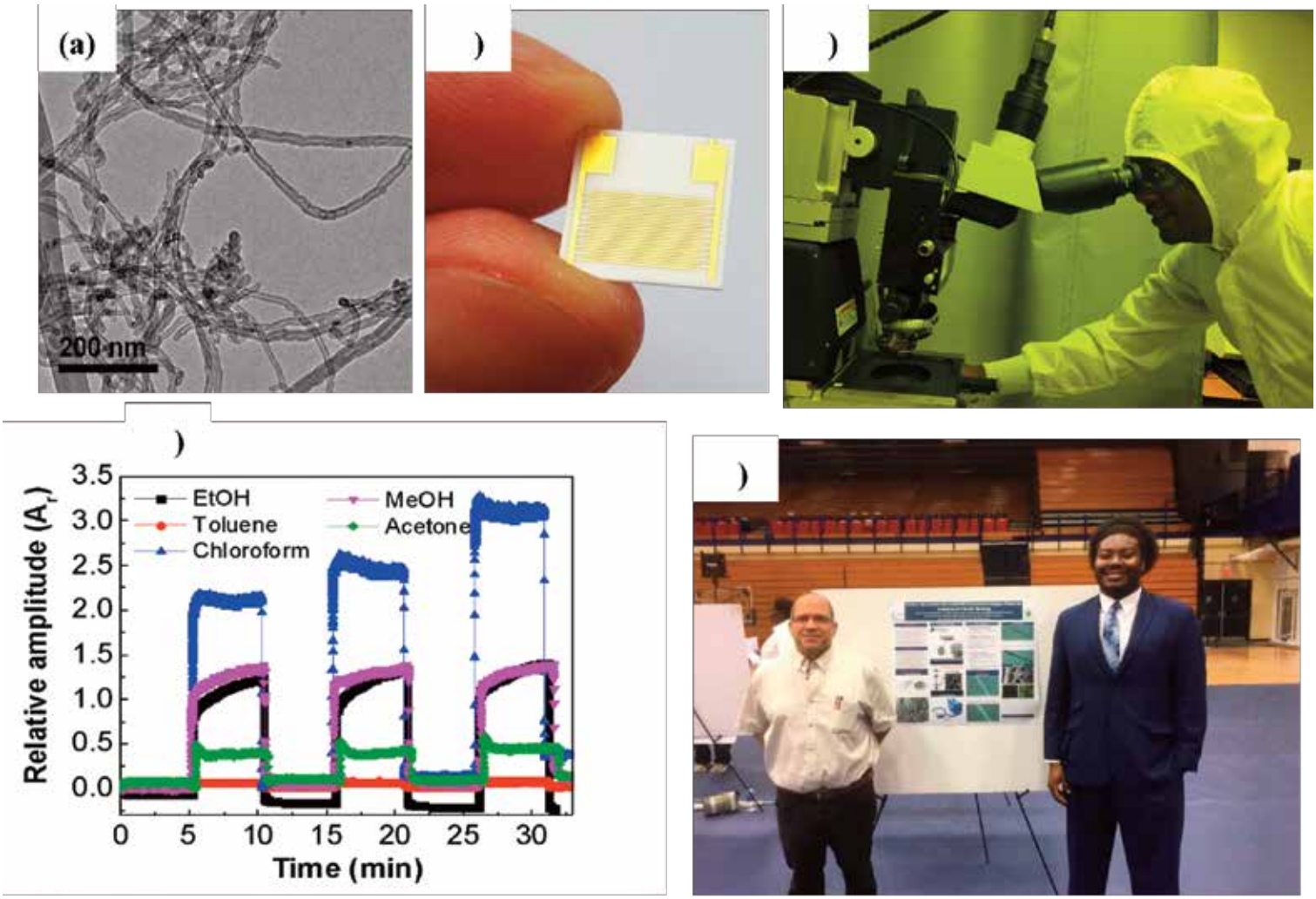
Chemical and Biological Sensing Research at ECSU

A Healthy human body generates more than one thousand types of volatile organic compounds (VOCs) in form of several bodily fluids such as breath, urine and skin secretions (figure 1). The generated VOCs profile can potentially be used for early stage detection of numerous invasive diseases. In particular, VOCs profile of exhaled breath characterized by the use of an electronic nose (e-nose) designed by combining multiple individual sensors together, have attracted immediate attention for early stage lung cancer detection and other diseases (e.g., tuberculosis, diabetes). However, the performance of e-nose is highly dependable on the use of individual sensors assembled in an array. The key challenges in designing an individual sensor include, but are not limited to, the detection limit, selectivity, drift in signal, etc. when tested in practical conditions.

Using Nanotechnology, the science of manipulating matter at the nanoscale (down to 1/100,000 the width of a human hair), scientists and engineers have been able to create new and unique materials with a vast range of applications in medicine, electronics, biomaterials energy production, and consumer products. One of popular nanomaterials is Carbon nanotubes (CNTs) which are cylinders of one or more layers of graphene (crystalline carbon with 2D properties) with diameters typically in the range of 0.8-2 nm for single-walled carbon nanotubes (SWNTs) and 5-20 nm for multi-walled carbon nanotubes (MWNTs) (figure 2). CNTs offer exceptional electronic and physical properties essential for sensing applications. The electronic properties of CNTs abruptly transform due to variation in the physical and chemical state of the surrounding environment. However, pristine CNT based sensors exhibit poor sensitivity and selectivity to different analytes due to lack of strong affinity to the CNT's surface. The sensitivity and selectivity of the CNT's devices can be enhanced by multiple ways e.g., modifying the surface of CNTs ("key/lock" principle) or fabricating CNTs random network-based vapor quantum resistive sensors (vQRS). The selectivity and sensitivity of vQRS can further be preferably introduced by functionalization (covalent/noncovalent) of CNTs with functional molecules. Another major advantage of vQRS over individual CNT based devices is that it can be easily fabricated using simple fabrication procedures such as drop casting and layer-by-layer spray deposition without requirement of cutting-edge fabrication techniques.

At ECSU, electrodes were fabricated using photolithography and metal deposition technologies (figure 4). In the next step, caffeine functionalized CNTs were drop casted on fabricated electrodes. These sensors were examined by exposing alternatively to analytes and air by using a homemade sensing platform in "Smart Nanomaterials and Clean Energy Laboratory (SNCEL)" at ECSU. (figure 3). We have investigated the VOCs sensing ability of caffeine functionalized MWCNTs (Caf-CNTs) vQRS. The close encounter of caffeine with CNTs not only enhances the sensitivity by an order of magnitude for selective VOCs [cancerous biomarkers (toluene, methanol, ethanol, and acetone) and chloroform] but also significantly improves selectivity patterns. Element diffraction scattering (EDS) with transmission electron microscopy (TEM) at nanoscale confirms the presence of caffeine molecules mainly embedded in groves of CNTs junctions. We suggest that the modulation CNT-CNT junction due to the absorption of analyte molecules at embedded caffeine originates higher sensitivity and selectivity. Additionally, the designed sensors are able to detect





sub ppm concentration of analyte with sub-second response time.

This performance is attributed to the modulation of CNTs junction due to absorbance of VOCs at embedded caffeine. The research was presented by Mr. Alton Turner, an Engineering Technology major, during the ECSU's 2019 research week (figure 4e).

Conclusion: Caf-CNTs sensors exhibit remarkably high sensitivity and selectivity, even at ppm level concentration, and thus have the potential to be used for a wide range of applications such as medical diagnostic (lung cancer detection, tuberculosis, and diabetes), environmental monitoring, chemical threat detection, food quality control, and chemical warfare agents' detection. The current system has been upgraded and we will be able to perform experiments at ppb (part-per billions) level with precisely controlled flow rates. In addition, glucose sensors are being developed for invasive health monitoring. Drs. Bijandra Kumar and Mehran Elahi, both faculty members in the Engineering Technology program, are currently collaborating with faculty members from chemistry, physics and biology at ECSU and material science faculty from other universities such as Old Dominion University and North Carolina Central University to further their research capabilities. Their research has provided a platform for several ECSU students majoring in STEM programs to learn cutting-edge research in the field of material science which would make them more competitive in the job market or in pursuing advanced degrees.

▷ Dr. Mehran Elahi

The U.S. Department of Education Trio Grants Serve Area High School and ECSU Students

Elizabeth City State University (ECSU) is home to two Trio programs that are funded through the U.S. Department of Education (USDOE). Trio programs began with Upward Bound (UB), which emerged out of the Economic Opportunity Act of 1964 in response to the administration's war on poverty. These programs were also established to assert the Nation's commitment to provide educational opportunities for all Americans to enter college and graduate. ECSU received a $776,421.00 grant for UB from the USDOE for five years, beginning 2018 through 2023. The program is funded to serve seventy (73) students from eight target area high schools located in Chowan, Gates, Pasquotank, Perquimans, Tyrell and Washington counties each year.

UB delivers fundamental support to participants in their preparation for college entrance. Opportunities are provided for participants to succeed in pre-college performance and ultimately in higher education pursuits. The goal of the program is to increase the rate at which participants complete secondary education as well as enroll in and graduate from institutions of post-secondary education. Projects provide students with a variety of services including instruction, tutoring and counseling. In addition to regularly scheduled meetings throughout the school year, projects also offer an intensive instructional program that meets daily for about six weeks during the summer.

ECSU's UB program staff also applied for and received an additional $40,000.00 Supplemental Stem grant from the USDOE for 2018-2019 to provide STEM related curricular and activities. This special funding was designated to increase participant's access to STEM coursework including computer science and hands-on learning opportunities through expanded course offerings, high quality online coursework, or other innovative delivery mechanisms. Funds were also used to provide professional development for UB instructors to equip them with the skills needed to revise curricula integrating STEM-based concepts and practices with a specific focus on problem-solving, inquiry-based applications/strategies, critical thinking skills, incorporation of science and mathematics concepts, and student-centered strategies.

The second Trio program on ECSU's campus is the Student Support Services (SSS) program. The purpose of this program is to provide opportunities for undergraduate academic development assist with basic college requirements and motivate students toward the successful completion of their post-secondary education. The goal of the SSS program is to increase the college retention and graduation rates of its participants and to help students make the transition from one level of higher education to the next.

ECSU received a $1,657,836.00 grant for SSS from the USDOE for five years beginning 2015 through 2020. The program is funded to serve 175 students annually who are enrolled at ECSU and are income restricted, first-generation college students (i.e., students whose parents have not received a bachelor's degree). Students receive a series of services in the areas of academic tutoring, supplemental instruction, academic advisement on course selection and degree completion, information on the full range of financial aid programs including public and private scholarships and education or counseling designed to enhance student's financial and economic literacy.

A variety of other services are offered such as personalized counseling services, exposure to cultural events, academic mentoring programs, and career exposure. Grant aid may be available to program participants receiving Federal Pell Grants during their first two years of post-secondary education. Grant aid may also be used to secure temporary housing for students who need a place to live (e.g., homeless youths and youths who have aged out of the foster care system). Degree-granting post-secondary institutions that are awarded Trio grants through a competitive process that occurs every five years provide intensive program services such as these.

Mrs. Quay Dozier, an ECSU graduate and former UB and SSS participant is Director of Trio programs on ECSU's campus.

▷ Mrs. Quay Dozier

GRAPHIC DESIGN APPLIED THEORY: North Carolina Problem Gambling Program

Mr. Clarence Goss, Jr. introduced a project-based learning assignment into the ART 498 Graphic Design Applied Theory course titled "Designing for the Greater Good." A concept that was the subject of the book "Designing for the Greater Good," by Peleg Top & Jonathan Cleveland. It was also based off of Mr. Goss' twenty-plus years working professionally as a graphic designer who was often contracted by numerous non-profit organizations on local, state, and national levels to assist with their promotion, marketing, and creative needs.

The project objective was to engage students to perform research and development of unique and creative design campaigns for 501(c)(3) status non-profit organizations which could partner with Elizabeth City State University. Use of the branding, mission, and purpose of the organization and institution; students were instructed to ensure the campaigns were targeted to ECSU students, faculty and staff, and/or the surrounding community. Students were suggested to find organizations that they have a personal connection with so that the work they did would have a deeper meaning to them. Non-profits over the years selected by students were ASPCA, Big Brothers & Big Sisters, Feed America, River City Community Development Corporation, Arbor Day Foundation, Alzheimer's Association, and many others. At the end of the semester each student would pitch their campaign to class, other Graphic Design peers, and sometimes to select University staff. The projects over the years were unique, interesting and so well-developed that some students continued to develop their projects beyond the course with the actual non-profit.

In 2016, Mr. Goss was approached by the North Carolina Department of Health and Human Services with a $5,000 mini-grant that the NC Problem Gambling Program has available for colleges to increase awareness of problem gambling and the services available. The North Carolina Problem Gambling Program was established to provide and support effective problem gambling prevention, education, outreach, and treatment programs throughout the state.

The Graphic Design Applied Theory students could build awareness by taking action and distributing information of the problem gambling issue. Projects could include graphic design of t-shirts, brochures, posters, giveaways, video PSAs, social media and other forms of creative digital media that students could develop using the tools, skills, and knowledge acquired in the graphic design courses. Students worked in groups called "agencies" that were structured like real advertising firms. Each member was given job titles like art director, designer, production manager, etc. and was giving production budgets, deadlines on project status, concept pitch, production, events, and final presentation and review. The agency/agencies were given a minimum of $1,000 budget to manage and use at their discretion to pay for items to promote the grant.

Over the course of the three years that Mr. Goss was awarded the grant, students have created animated and live-action PSA videos, posters, t-shirts, and flyers. They have hosted informational campus events where they sponsored problem gambling video conferences and distributed pens, drink bottles, t-shirts, and other promotional items. At the end of the semester, students received more than a grade, which was determined by their fellow agency members based on the amount of input, effort, and contribution to the group. They also received stipends. Any student involved with the grant whether they were in an agency, outside researchers/survey takers, or paid actors to appear in a video received a stipend that was supported by the grant.

As a major supporter or cross-curriculum collaboration, Mr. Goss incorporated the services of social work and criminal justice majors to conduct problem gambling surveys and statistics at the ECSU basketball games and, student center about ECSU student gambling awareness.

Mr. Goss's philosophy for the project is he believes that students should be engaged in their learning with assignments/projects that give them theoretical and practical experiences, a real-world education that will assist in preparing them for more than just passing the course but to aid in them being successful in their future careers. To answer the question that many students ask when taking a course, "how will I use this in the real world?"

PROBLEM GAMBLING FACTS:

Teens and college-age students have the highest rates of problem gambling. Research indicates children are engaging in gambling activities earlier than they are with drug or alcohol use. Similar to substance use, research also shows that parents with a gambling problem often have children with a gambling problem. In addition, youth with gambling problems are more likely to use tobacco, drugs, and alcohol. Many youths currently in treatment for substance use disorder may also have a gambling problem. What has been labeled the "hidden addiction" many times can only be exposed through problem gambling screening tools that are available for clinicians.

"Think Before You Gamble" The North Carolina Problem Gambling Program was established to provide and support effective problem gambling prevention, education, outreach and treatment programs throughout the state. For more information about no-cost treatment services visit www.morethanagamenc.com or call the helpline at (877) 718-5543.

▷ Mr. Clarence Goss

A Research Focus on Academic Interventions

▷ Dr. Eyualem Abebe

Dr. Abebe's research focus in the past ten years has been on exploring evidence-based academic interventions with an overarching goal of contributing towards enhancing academic performance, retention and graduation of students at Elizabeth City State University (ECSU).

ECSU continues to serve students that largely come from the surrounding rural counties of northeastern North Carolina. The overall level of high school preparation of most of those students, in relation to the expected rigor of college education, is generally wanted. As a result, first- year retention, especially in the STEM fields continues to be a major challenge to overall retention and graduation.

Although there is a broad consensus that success in first-year gateway courses is a pace-maker to academic success in colleges and further, hitherto research has not provided a panacea to the widely recognized chronic problem. Also, confounding factors such as student academic and non-academic background complicate the issue of first year success further, making a future possibility of a silver-bullet solution to the problem unlikely. Recognizing this complex issue and learning from the evidence-based Model Institutions for Excellence model, Dr. Abebe, initially, through support from the National Science Foundation Historically Black Colleges and Universities Undergraduate Program (2012-2017), piloted a comprehensive academic program (Applications of Lessons from Model Institutions for Excellence -ALEMIE) to impact high attrition in STEM gateway courses at ECSU.

The implemented pilot project had four main components that research showed to have a significant impact on first year student success: 1) Precollege initiative through summer bridge program, 2) Continued student support during academic year, 3) Providing support to participants so that they experience research as undergraduates, and 4) Assist participants in their exploration of and preparation for graduate school and/or science career. Through that pilot three-year project, Dr. Abebe's team was able to demonstrate those implemented academic support programs indeed enhanced retention at ECSU.

In a successive project (A comprehensive academic scaffolding to enhance retention of minority STEM students at Elizabeth City State University - CASER-ECSU) supported by the Department of Education Minority Science and Engineering Improvement Program in October 2018, Dr. Abebe expanded the pilot project to enable the support of a total of 118 ECSU students (90 participant and 18 coaches/mentors/tutors) for a duration of three years (2018-2021). The first cohort attended a pre-college, four weeks long summer bridge program from June 23 to July 19, 2019, and this first cohort joined ECSU in the fall of 2019.

This project each year supports 30 participant students and two graduate and four undergraduate ECSU students who serve as coaches/mentors/tutors to participants. Each coach monitors, guides and supports the academic progress of a team of five participants. Team building and the coach-participant linkage starts during the first week of the summer bridge program and continues through the summer and two semesters of the following academic year. During the academic year, participants will be provided with a minimum of five-hours per week academic support in the form of tutorials, face to face discussions with coaches and Dr. Abebe, and an overall assessment of academic progress among all coaches and participants. Furthermore, academic year tutorials, mentorship and workshops will be used to

strengthen a sense of learning community and focus on academic rigor. In addition, the program will encourage and prepare participants for summer research experience. The objective of this currently running project is, therefore, to build upon the successes achieved so far in the previous piloted project and scale up that pilot program with the goal of increasing retention and graduation in all STEM fields.

One of the tested academic interventions that has been demonstrated to have a long-lasting impact on students at every level is getting research experience and mentorship through research as undergraduates. As an integral component of both ALEMIE and CASER-ECSU participants either have received or are receiving guidance and support to participate, engage and contribute to research in their fields.

However, many ECSU students do not secure an undergraduate research position for a number of reasons. Realizing that such research opportunities are best when offered locally, as students feel at more relaxed in their home institution and afford flexibility to those who may prefer to stay close to home.

Dr. Abebe has most recently (June 2019) secured a two-year research project, supported by the National Science Foundation Research Initiation Award, to mentor through research two graduate and two undergraduate students in the framework of investigating the microbiome of free-living nematodes. Participant students will have the opportunity to attend trainings and workshops at research-intensive universities and present their research findings at local and national annual professional, scientific meetings.

Overall, since joining ECSU in 2006, Dr. Abebe has submitted grants to regional and national funding agencies with a total success of more than 2.2 million, more than 75% of which was used to financially support ECSU students participation in research and research-related activities.

Of the 33 students mentored by Dr. Abebe, nine have co-authored research papers published in professional, scientific journals such as *Journal of Nematology, Nematology, Russian Journal of Nematology, BMC Research Notes, NEMATODA, & Journal of North Carolina Academy of Sciences.*

UNDERGRADUATE RESEARCH WEEK

▷ Dr. Margaret Young

The Office of Undergraduate Research at ECSU aims to: 1.) serve as a liaison to the UNC System and to CUR (Council for Undergraduate Research; https://www.cur.org/); 2.) collect, store and disseminate all information regarding undergraduate research activities (including grants and conferences); 3.) maintain a website that links all these activities (www.ecsu.edu/academics/undergraduateresearch; and, 4.) coordinate all activities of ECSU's Undergraduate Research Week (coinciding with national events).

Dr. Margaret Young, Director of ECSU's Undergraduate Research Office served as the Chair with Dr. Coray Davis, Associate Vice Chancellor for Academic Affairs, as the co-Chair. The other members of the Committee for 2018 – 2019 were: Drs. Victor Adedeji, Kimberley Bazemore, Malcolm Dcosta (webmaster), James Goar, Tim Goodale, Gary Harmon, Krishna Kulkarni, Bijandra Kumar, Peter Loebach, Adam McKee, Lloyd Mitchell, Andre Stevenson, Walter Swan, Kungpo Tao, Jingbin Wang, Ali Unal, Mr. Orestes Gooden, Clarence Goss (graphic designer), Russel Haddad and Ms. Annemarie Delgado and Jacinta Dillard. The Committee also coordinates the event with the Offices of the Chancellor, Academic Affairs, Sponsored Programs, Student Affairs, University Advancement, Business and Finance, Communications and Marketing, Information Technology, and Facilities Management.

ECSU's Undergraduate Research Week was held April 1st to 5th, 2019. The theme for this past year was "Equipping Today's Students for Tomorrow's Challenges". Each day of the week had presentations centered on that department/division. Monday (April 1st) was declared as Education Day; Tuesday (April 2nd as STEM Day); Wednesday (April 3rd) as Business, Economics, Kinesiology and Public Health Day; and Thursday (April 4th) as Fine Arts and Humanities Day.

Special guest speakers on Monday, April 1st included: Dr. Malcom Dcosta, assistant professor of Computer Science who spoke on the "Dissecting Driver Behaviors Under Cognitive, Emotional, Sensorimotor, and Mixed Stressors" as part of the Welcome Ceremony.

Dr. Falcon Rankins, External Evaluator for several funded NSF projects (PRISSEM Academic Services) also visited on Monday and spoke to faculty on "Tips for Strengthening your STEM- and STEM Education Research Grant Submissions". This event was planned with the Office of Sponsored Programs.

The Plenary Session keynote speaker was Ms. Margaret Woods of the Institute of Emerging Issues, who gave a talk on "How Local Business can ReConnect to Community". This event was also coordinated with the Chamber of Commerce of Elizabeth City.

Dr. Falcon Rankins (second from right) meets with ECSU faculty and staff.

Throughout the week, there were twenty-eight faculty and student oral presentations, five guest lectures and one workshop.

Friday, April 5, 2019 was declared as University Day. Activities included a university-wide poster session (35 ECSU's undergrads participated as well as 4 NEAAAT Academy middle and high school students); poster judging coordinated by Dr. Coray Davis (with 1st, 2nd and 3rd places awarded); the Mobile STEM Lab (by Mr. Orestes Gooden); and Planetarium shows (by Dr. Mr. Raynard Townsel). Other activities were departmental interactive outreach sessions led by ECSU's students and faculty (Drs. Victor Adedeji, Clarence Goss, Eric Luchian, Walter Iriarte, James Goar, Confidence Amadi, Kevin Kupietz, and Jay Fortenberry). Middle and high school students and teachers attended from the NEAAAT academy.

The week culminated in a Poetry session at Page after Page Bookstore in Downtown Elizabeth City.

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