

NCERA-101 STATION REPORT

North Carolina A&T State University (April 2018)

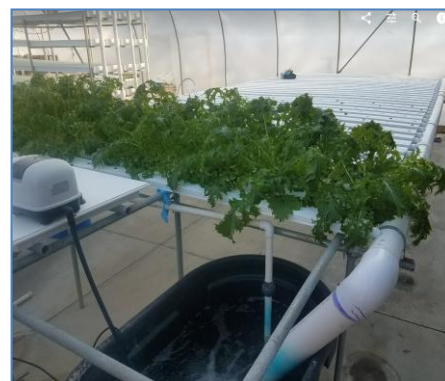
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1. New Facilities and Equipment.

Joint School of Nanoscience & Nanoengineering -The Joint School of Nanoscience and Nanoengineering (JSNN). An academic collaboration between North Carolina Agricultural and Technical State University (NC A&T) and The University of North Carolina at Greensboro (UNCG). JSNN is a \$56.3 million, 105,000 square foot state-of-the-art science and engineering research building with nanoelectronics and nanobio clean rooms, nanoengineering and nanoscience laboratories and extensive materials analysis facilities. JSNN builds on the strengths of the universities to offer innovative, cross-disciplinary graduate programs in the emerging areas of nanoscience and nanoengineering. Nanobiology uses engineered nanomaterials to enable diagnosis, imaging and therapy. JSNN also is actively engaged with K-12 outreach with schools.

Guilford County Prison Farm 2000 sq. ft state of the art greenhouses. In partnership with the Brothers Excelling with Self-sufficiency to Thrive (BEST- a non-profit), we use hydroponics to focus on addressing the concerns that affect males between the ages of 13 and 24 who have high-risk factors. We offer formal mentoring that takes a comprehensive, holistic, and collaborative that aggressively addresses issues with youth who have been determined could benefit from long-term support. Greenhouses were donated by Guilford County and located in Eastern Guilford County (approximately 2 miles north of Gibsonville, NC). This project has been made possible through a partnership grant with the Guilford County Sheriff's office and a grant from USDA/NIFA. Under the terms of the contract, we agree to maintain the property, use it only for the stated purposes, follow environmental laws and pay the cost of the propane needed for the program.



2. Unique Plant Responses

Dr. Dan Herr, Joint School of Nanoscience and Nanoengineering

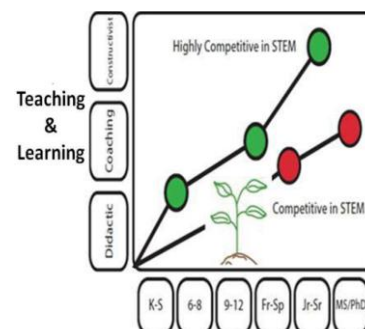
Topic: Hydroponic Routes to Nutritionally Enhanced Nutraceuticals and Functional Textiles. This work uses cotton and flax plants combined with nanosensors and "brightner" dyes in hydroponic nutrient solution. Example of applications could be cotton incorporated in hospital sheets that could analyze the sodium content of a patient's sweat.



3. Accomplishment Summaries

Dr. Gregory Goins, Dept of Biology NCA&T, collaborators NCCU

Title: Building Diverse and Integrative STEM Continua Using Socio-environmental Systems In and Out of Neighborhoods (DISCUSSION)
National Science Foundation (**\$300,000 over 2 years**) - Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in



Engineering and Science. **NSF INCLUDES** is a comprehensive initiative to enhance U.S. leadership in science and engineering discovery and innovation by proactively seeking and effectively developing science, technology, engineering and mathematics (STEM) talent from all sectors and groups in our society. By facilitating partnerships, communication and cooperation, NSF aims to build on and scale up what works in broadening participation programs to reach underserved populations nationwide.

Dr. Tonya Gerald-Goins, Dept of Chemistry and Biochemistry, NCCU, NCA&T and Bennett College
Bio-monitoring of Persistent Xenobiotic Contaminants in Natural and Constructed Wetland Ecosystems (NSF HBCU UP Excellence in Research –(\$1 million over 3 years)). This research investigates the bioremediation of xenobiotic contamination. We proposed the following research questions to address our hypothesis: The identification of GenX/HFPO-DA in the Cape Fear River has caused great concern in NC. Recent research suggests that duckweeds - small, simply constructed, floating aquatic plants, are well suited to addressing this concern.



- 1) Can model wetland organisms help remediate xenobiotic contaminated water sources by facilitating their removal?
- 2) Can model wetland organism serve as diagnostic biomarker agents for the presence of xenobiotics?

The ability of duckweeds to grow rapidly on nutrient-rich water and to facilitate the removal of many substances from aqueous solution comprises the potential of these macrophytes for the remediation of xenobiotic-polluted aqueous sources, while producing usable biomass containing the unwanted substances having been taken up. Their ease of cultivation under controlled and even sterile conditions makes duckweeds excellent test organisms for determining the harmful effects of xenobiotics to the ecosystems. Duckweeds are also valuable for establishing biomarkers for the harmful effects of xenobiotics on aquatic higher plants, but the current usefulness of duckweed biomarkers for identifying these xenobiotics is limited. The recent sequencing of a duckweed genome holds the promise of combining the determination of xenobiotic harmfulness with contaminant diagnostics by means of gene expression profiling of know biomarkers.

Dr. Adrienne Smith, Dept of Biology NCA&T

Google Innovation Award Automated Hydroponics with an Arduino in Desktop Deep Hydroponic Culture Systems

Students are incorporating high technology systems which are currently being used in new automated manufacturing facilities. Students are integrating use of robots and work cell components, switches, proximity, vision and photoelectric sensors, with the automated control and data gathering in hydroponic systems. Upon completion, students should be able to install, program, and troubleshoot an automated system and collect associated data with their cell phones with affordable small desktop hydroponic systems.



4. Impact Statements

We have used hydroponics to link university expertise to school systems that strengthens educational opportunities. This provides opportunities for students to envision and pursue careers in science. Hydroponics and controlled environments can help empower teachers with new approaches to increase science learning at minimal cost. We feel that this strengthens the education foundation for economic development and prosperity for underserved communities.

- G. Goins Awarded by the White House - Champion of Change for HBCUs – 1 of 11 People Recognized in the Nation.
- 4-H National Science Experiment Authors: Gregory Goins, Claudette Smith, and Stephanie Luster-Teasley, and. The first-ever 4-H National Science Experiment to originate from an 1890 Land-Grant University
- NSF Program Officer for Robert T. Noyce, IUSE, and S-STEM Programs.
- HHMI Constellation Studio Keynote Plenary Speech 2017 “Advancing Science Students Mastery of Quantitative Skills: A faculty Development Perspective” March 8-10, 2017
- National Academy of Sciences Data Science Committee Meeting May 1-3, 2017
- USDA NIFA AFRI Reviewer Panel, NSF IUSE Reviewer Panel



5. Published Written Works

- 1) Gerald-Goins, T. M. Allosteric Motivations for Biochemistry Online at NCCU. Online Approaches to Chemical Education, Vol 1261, Chapter 7, pp81-90 (DOI:10.1021/bk-2017-1261.ch007)
- 2) Goins, G.D., 2017 STEM Communication through Socio-environmental Systems In and Out of Underserved Localities. Arch Biol Eng. 1(1) 1-2. Archives of Biology & Engineering
- 3) Goins, G.D., T.C. Redd, M. Chen, C.D. White, and D.P. Clemence 2016. Forming a Biomathematical Learning Alliance Across Traditional Academic Departments. International Journal for Innovation Education and Research 4:16-23. <http://www.ijer.net/index.php/ijer/article/view/461/451>
- 4) Goins, G.D. 2016. An Essay on Integrative Biomathematical Learning Alliances Across Academic Departments. In Teaching Computation in the Sciences Using MATLAB®. Carleton College, NorthField, MN. http://serc.carleton.edu/matlab_computation2016/essays/159671.html
- 5) Goins, G.D. 2012. Promoting Diversity in Biomathematics-related Careers. pp. 20-22 In International Innovation. Educate to Innovate: How STEM Education is heralding a New Dawn for North American Research. Research Media Ltd. Bristol, UK. ISSN# 2041-4552 Issue 6, November 2012.
- 6) Goins, G., C. White, M. Chen, V. Kelkar, D. Clemence, and T. Redd, 2010. An Initiative to Broaden Diversity in Undergraduate Biomathematics Training CBE—Life Sciences Education. Vol 9. Special Biomathematics Issue.
- 7) Goins, G., S. Luster-Teasley, C. Smith. 2010. National Science Experiment 4-H20:4-H. United States Department of Agriculture Youth Science Day Facilitator’s Guide. 20 pgs.
- 8) Rhodes, S.J., Cheeseman, J., Canady, D., Spence, P.L., Delauder, S., and Gerald-Goins, T. M. (2017)/ “Organic contaminants found in local streams: Using gas chromatography/mass spectrometry approach” Household and Personal Care TODAY J. pg. 18-21.
- 9) Spence, Porché L. 2015. Using Caffeine as a Water Quality Indicator in the Ambient Monitoring Program for Third Fork Creek Watershed, Durham, North Carolina. Environmental Health Insights. (9) S2: 29-34. DOI:10.4137/EHIS19588