

N.C. A&T Research Capabilities

Board of Trustees Meeting

Chancellor's Report

November 14, 2014



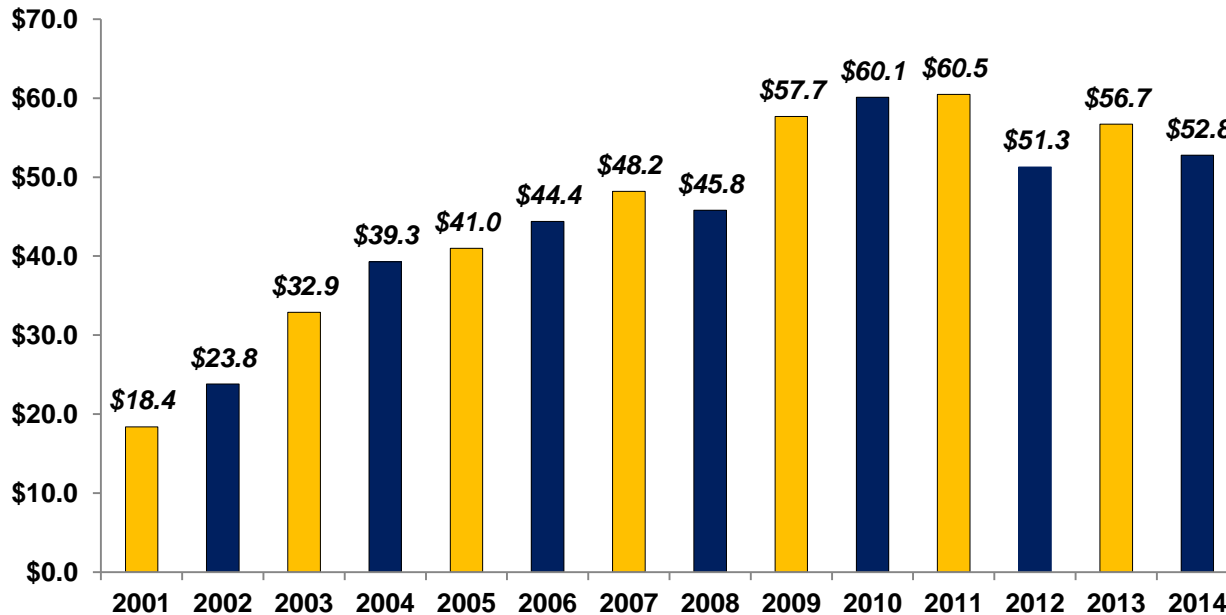
North Carolina Agricultural and Technical State University



Sponsored funding

Total awards by fiscal year, 2001-14

- Since 2005 NC A&T has ranked third in the UNC system (dollar figures in millions)





FY 14 distribution by schools & colleges

Unit	Total	Percentage
School of Agriculture & Environmental Sciences	\$21,569,052	40.89
College of Engineering	\$11,468,522	21.74
Division of Academic Affairs	\$12,474,877	23.65
College of Arts & Sciences	\$3,106,442	5.89
School of Education	\$1,141,299	2.16
Joint School of Nanoscience & Nanoengineering	\$861,242	1.63
School of Technology	\$87,191	0.17
Division of Student Affairs	\$765,727	1.45
School of Business & Economics	\$664,777	1.26
School of Nursing	\$0	0.00
Division of Research and Ec. Dev.	\$605,389	1.15
Graduate School	\$6,600	0.01
Total	\$52,751,117	100.00



Sponsored Funding

FY14 Awards by Agency (7/1/2013 - 6/30/2014)		
US Department of Agriculture	\$	19,186,741.00
National Science Foundation	\$	7,845,998.00
US Department of Education	\$	12,402,977.00
Department of Defense	\$	1,960,134.00
NASA	\$	1,067,211.38
US Department of Energy	\$	519,600.00
US DHHS - NIH	\$	2,836,514.00
UNC Schools	\$	783,319.00
Other Federal	\$	105,240.00
Associations	\$	128,861.00
Business and Industry	\$	1,019,858.25
Educational Institutions	\$	3,624,938.70
Foundations	\$	621,697.58
Local Government	\$	47,000.00
Nonprofit and Other Organizations	\$	51,295.00
NC State Government	\$	549,731.65
GRAND TOTAL	\$	52,751,116.56



Aerospace and Transportation Systems

■ Focus areas

- » Sensors & non-destructive evaluation
- » Computational fluid dynamics
- » Conventional and fuzzy logic controls and avionics
- » Human factors
- » Systems engineering
- » Small satellite systems

■ Representative projects

- » **Center for Aviation Safety**
- » Supersonic injection, mixing and combustion for hydrocarbon-fueled scramjets
- » Thermal management for high heat flux components using spray cooling and surface enhancement techniques
- » Structural performance of affordable composites for stealthy naval ships
- » Ultra-lightweight microsystems mechanics
- » Integrated topology and multi-scale optimization of protective structures
- » Quantitative acoustic emission technique for monitoring hot spots in aging aircraft structures
- » Overcoming communication time-delays in spacecraft formation flying



Biomedical Research

■ Focus areas

- » Alzheimer's disease
- » Health disparities
- » Nanomedicine
- » Drug-delivery systems
- » Mechanical scaffolding for tissues
- » Metabolomics
- » Proteogenomics
- » Biodegradable medical implants

■ Representative projects

- » **Engineering Research Center for Revolutionizing Metallic Biomaterials**
- » **Center for Outreach in Alzheimer's, Aging and Community Health**
- » Direct-write based micro and nano manufacturing fabrication of diverse applications, including functionally gradient materials, regenerative tissue scaffolds, and bio-chem sensors that lead to next-generation devices and systems
- » Merging quantitative proteomics with agricultural & environmental sciences
- » Bioactive food compounds with applications in prevention and management of diabetes
- » Wheat bran for colon cancer prevention: A targeted metabolomic approach



Biotechnology and Biosciences

■ Focus areas

- » Bioengineering
- » Bioinformatics
- » Sustainable agriculture, conservation agriculture
- » Natural resources management

■ Representative projects

- » **Natuculture: Mimicking nature in Cambodia and the Philippines**
- » Evaluating the potential of winter legume and grass cover crops for carbon sequestration
- » Enhancing urban sustainability through the application of permaculture principles
- » Genetic transformation and use of applied plant biotechnology techniques for economic development, rescue of endangered species, and mass-propagation of rare species
- » Rapid multiplication of plant species with high economic value
- » Tissue culture techniques to produce bioactive compounds, plant-based medicines, and nutraceuticals
- » Genetic transformation for biofuel production and value-added crops



Computer and Computational Science

■ Focus areas

- » Big data
- » Social networking
- » Evolutionary biology of organic and inorganic systems
- » High-performance reconfigurable computing
- » Computational modeling in non-physical domains and in physical and engineering sciences
- » Data center operations and efficiency

■ Representative projects

- » **DataBridge: A sociometric system for long-tail science data collections**
- » Ph.D. program in computational science and engineering
- » Social network analysis and simulation systems
- » A novel framework for community detection in large networks
- » Improving the availability, reliability, and cost efficiency of data centers
- » Remote and reconfigurable computing environment



Defense and National Security

■ Focus areas

- » Cybersecurity
- » Biometrics
- » Information assurance
- » Food security
- » Border security
- » Infrastructure protection
- » Autonomous agents
- » Modeling and simulation
- » Network survivability
- » Humanitarian logistics

■ Representative projects

- » **Center for Advanced Studies in Identity Sciences**
- » Understanding network survivability under WMD attack
- » Immunological techniques for food security
- » Development of integrated food protection and defense education
- » Engineering efficient and equitable food distribution under uncertainty
- » Quantifying vulnerability in food supply



Energy and the Environment

■ Focus areas

- » Sustainable agriculture and natural resources management
- » Bioremediation and waste management
- » Energy efficiency, conservation and control
- » Advanced multi-scale computational algorithms
- » Climate change
- » Sustainable energy
- » Bioenergy and bioproducts
- » Hydrogen fuel and fuel cells
- » Solar power

■ Representative projects

- » **NSF CREST Bioenergy Center**
- » Center for Energy Research and Technology
- » Ph.D. program in Energy and Environmental Systems
- » Waste Management Institute
- » Interdisciplinary research in climate change and its social and economic impacts



Food Science

■ Focus areas

- » Global food security and hunger
- » Metabolomics
- » Food processing
- » Food safety
- » Food science and nutrition
- » Functional foods
- » International agricultural trade

■ Representative projects

- » **Center for Excellence in Post-Harvest Technologies**
- » Bioactive food compounds for prevention and management of diabetes
- » Ginger extract: Bioavailability and lung cancer preventive effect
- » Carnosic acid enriched rosemary extract and its active components reduce weight gain and type 2 diabetes
- » Controlling viral foodborne disease
- » Use of ginger extract for cancer prevention
- » Grape pomace as a potential functional food ingredient for obesity prevention and weight control.



Human Health, Nutrition and Wellness

■ Focus areas

- » Counseling
- » Health disparities
- » Childhood obesity
- » Health and education Interventions
- » Health disciplines
- » Health promotion and disease prevention
- » Substance use

■ Representative projects

- » **Center for Behavioral Health & Wellness**
- » Center for Outreach in Aging and Community Health
- » Ph.D. program in rehabilitation counseling
- » Genetic epidemiology of Alzheimer's disease
- » Six sigma in public health clinics: Improving health outcomes
- » White Paper: Access to comprehensive health care in Guilford County



Leadership and Community Development

■ Focus areas

- » Business development
- » Economic development
- » Economic empowerment
- » Housing and infrastructure
- » Leadership development
- » Leadership for young African American men

■ Representative projects

- » **Community Empowerment Network of North Carolina**
- » Ph.D. program in leadership studies
- » Community empowerment and sustainable workforce development initiative
- » Urban Education Institute (annual conference)
- » Enhancing land stewardship by socially disadvantaged beginning farmers and ranchers
- » Sustainable energy and economic development of rural communities: The green alternative



Nanotechnology and Multi-Scale Materials

■ Focus areas

- » Nano-, bio-, electronic, composite, polymeric, smart, and metallic materials
- » Materials characterization and testing
- » Modeling and simulation
- » Nano and composite manufacturing
- » Advanced and smart materials
- » Biomaterials and regenerative engineering
- » Nanoengineered materials
- » Nanoscience and nanoengineering cross-cutting applications

■ Representative programs

- » **Joint School of Nanoscience and Nanoengineering**
- » Ph.D. program in nanoengineering
- » NSF Engineering Research Center for Revolutionizing Metallic Biomaterials
- » High performance computing and enabling technologies for nano- and bio-systems and interfaces
- » Cell-based toxicity assay-on-chip for next-generation CMOS technology



Social and Behavioral Sciences

■ Focus areas

- » Cognitive science
- » Cultural studies
- » Ethics
- » Interactive research in the arts
- » Rehabilitation counseling
- » Social systems
- » Socio-economic, cultural, and political disparities
- » Teaching tools and practices

■ Representative projects

- » **Rehabilitation counseling Ph.D. program**
- » Academy of Teaching and Learning
- » Culturally responsive instruction: Lesson design and delivery - A national dialogue
- » Workforce development and addiction counseling
- » Racial identity themes in television situation comedies
- » Changing societal attitudes toward water scarcity
- » Civic, community and political engagement among emerging adults



Transportation and Logistics

■ Focus areas

- » Disaster relief
- » Global transportation
- » Manufacturing logistics
- » Resource scheduling
- » Supply chain strategy
- » Warehousing and distribution
- » Planning for disasters affecting transportation systems

■ Representative projects

- » **Transportation Institute**
- » Maritime domain awareness and coastal/port security
- » A supply chain management view of the humanitarian relief chain
- » Engineering efficient and equitable food distribution under uncertainty
- » Interactive simulation model for evaluating the impact of port disruptions
- » Quantifying vulnerability in food supply
- » Small Business Transportation Resource Center
- » Economic contributions of N.C. ports



Technology Transfer

- **Recent Companies spun off from N.C. A&T research**
 - » **Bioadhesive Alliance:** Produces a low-cost and durable adhesive that reduces the amount of petroleum needed in asphalt. It is a green product, obtained from swine manure. It gives pavement greater water resistibility and temperature tolerance. And it provides a use for one of the state's most problematic waste materials.
 - » **Alrqn Bio:** Commercializes process developed at NC A&T that removes allergens from peanuts.

- **Total patents owned by NC A&T = 23**
 - » After 4 FYs with no new patents issued, university inventors were issued two patents in FY 2013 and two more in first half of FY 2014
 - » Currently, 12 patent applications pending at the U.S. Patent Office
 - » Several foreign patent applications also are in progress



Selected Key Facilities and Equipment

■ **Joint School of Nanoscience and Nanoengineering**

- » Carl Zeiss Orion Helium-Ion Microscope
- » Agilent 5600 LS Atomic Force Microscope
- » Burker AXS Inc. 400EDS Energy Dispersive X-Ray Spectrometer for Auriga
- » Hitachi S-4800-I FESEM w/Backscattered Detector INCA
- » Magnetic resonance imaging: Siemens Magnetom Verio 3T MRI System

■ **Engineering Research Center**

- » GE Nanotomography Imaging System
- » Hitachi SU8000 Electron Microscope
- » Hitachi H-600 Electron Microscope
- » Integrated Nano-Bio Manufacturing Laboratory

■ **N.C. Research Campus**

- » Center for Excellence in Post-Harvest Technologies: Biosafety level three lab.

■ **Research farm**

- » 492-acre research farm produces crops and livestock, used for research and education, testing and demonstration of new crops and farming practices.



Undergraduate Research

■ Representative programs

- » Collaborative Earth systems science research: Atmospheric modeling, sensing and societal impacts
- » Undergraduate Research Scholars Program (School of Agriculture and Environmental Sciences)
- » Innovation Challenge (annual competition for undergraduates)
- » North Carolina Louis Stokes Alliance for Minority Participation (faculty-mentored research in STEM fields and annual conference)
- » Minority Access to Research Careers Program (biomedical and behavioral sciences)
- » MBRS Research Initiative for Scientific Enhancement (research in biology, chemistry and psychology for students interested in graduate studies in biomedical sciences)
- » iBLEND (biomathematical research)
- » iCUBED (systems biology)
- » iGEM (synthetic biology)
- » Ronald E. McNair Research Symposium (annual event)



Contact Information

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College of Engineering

Department of Civil, Architectural and Environmental Engineering
Department of Chemical and Bioengineering

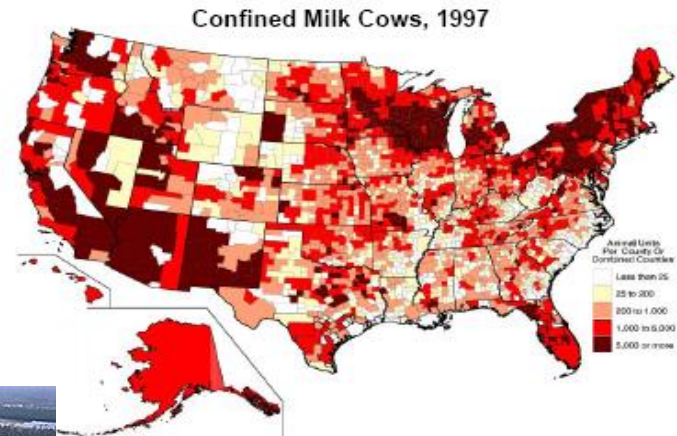
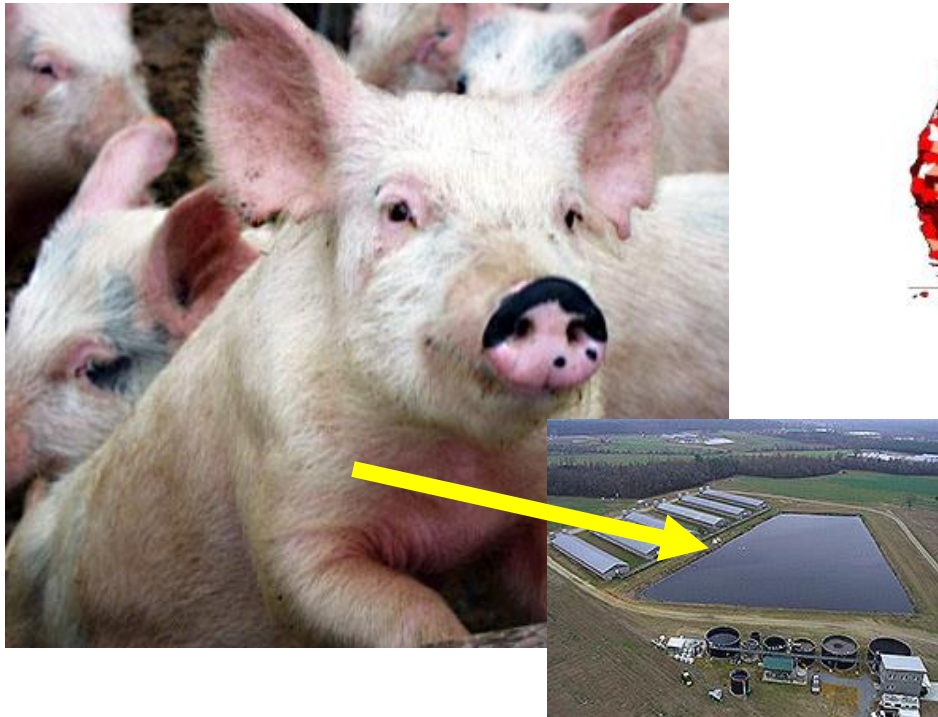
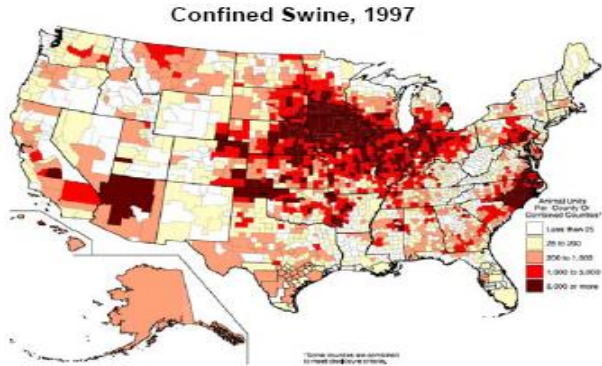
Dr. Stephanie Luster-Teasley



North Carolina Agricultural and Technical State University



How can we improve wastewater treatment?



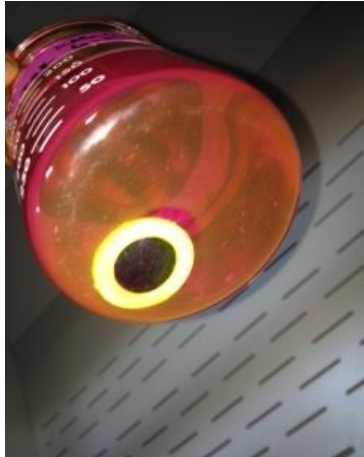


Controlled Release Oxidation Polymers

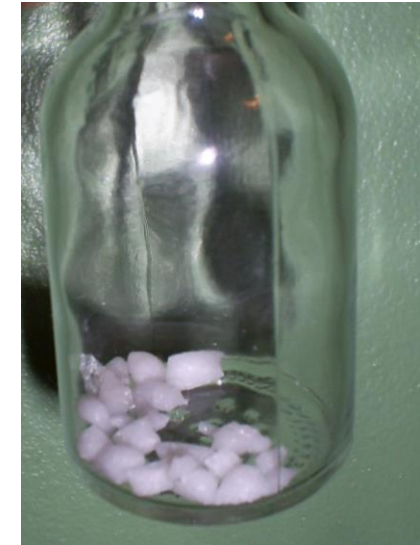
KMnO_4 CRP



Oxone CRP



“Designer” CRPs are prepared with a combination of polymer-polymer or polymer-clay composites



School of Agriculture and Environmental Sciences

Food and Nutritional Sciences

Dr. Jianmei Yu



North Carolina Agricultural and Technical State University



Post-Harvest Technology for Peanut Allergen Reduction

Overview

- Background information of peanut allergy
- Cause of peanut allergy: Allergenic proteins in the peanuts
- Focus of our study: reducing the allergenic proteins from peanuts by an enzymatic process
- Results and impacts
- Funding source: USAID and USDA-NIFA-AFRI
- Collaboration: School of Medicine, UNC Chapel Hill

College of Engineering

Department of Industrial and Systems Engineering

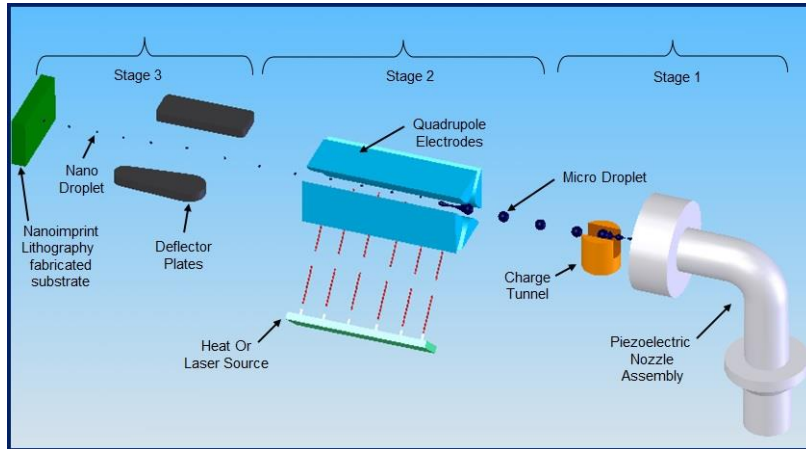
Dr. Salil Desai



North Carolina Agricultural and Technical State University

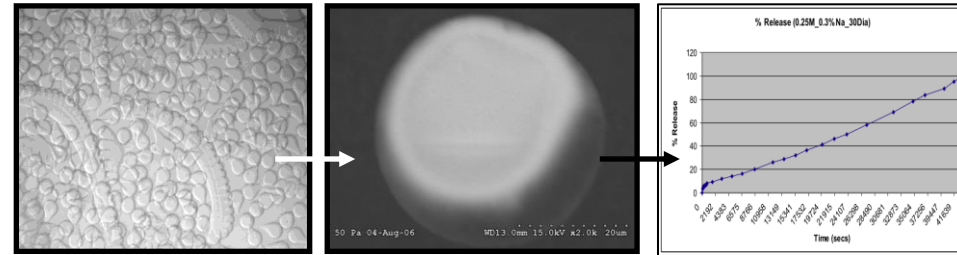


Direct-Write Based Nano and Bio Manufacturing

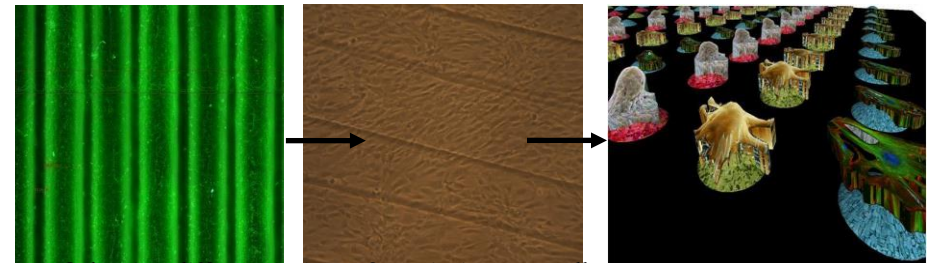


US Patent – 8,573,757: *Desai S., Method & Apparatus of Manufacturing Scalable Micro & NanoFeatures, 2013.*

Collaboration: Wake Forest Institute of Regenerative Medicine Tunable Drug delivery carriers (Inv. Dis.: EN 0046 0307)

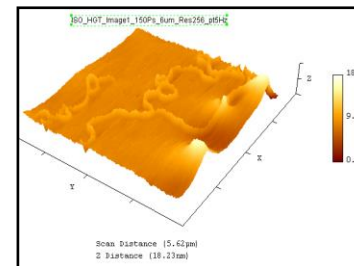


Stem cell based tissue regeneration

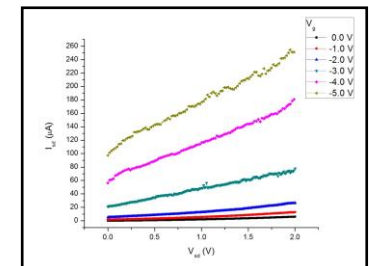


Selective differentiation of amniotic stem cells based on growth factor patterning

Air Force STTR: NanoTech Labs Inc.: Nanotube based Thin Film Transistors



AFM image showing network of SWNTs



Transport characteristics of TFT

