

NC A&T BOILERPLATE FOR PROPOSALS (updated June 2019)

[North Carolina Agricultural and Technical State University](#), the nation's largest public HBCU, had an enrollment of 12,142 in Fall 2018. The University has the largest College of Agriculture and Environmental Sciences among 1890s land-grant institutions. N.C. A&T leads the nation in the number of undergraduate, masters, and doctoral engineering degrees awarded to African-Americans and is the leading producer of African-American female engineers at the baccalaureate level. It is also the largest producer of African-American psychology undergraduates. In addition, N.C. A&T is among the largest producers of African-American certified public accountants (CPAs).

True to its heritage, N.C. A&T is home to the largest agricultural school among HBCUs and is the nation's second largest producer of minority agricultural graduates. It has a 600+ acre main campus and a 492-acre farm.

In 2008, the university was awarded a National Science Foundation Engineering Research Center grant for biomedical engineering and nano-bio applications research—the first and still the only [NSF ERC](#) led by an HBCU.

[Vision:](#) North Carolina Agricultural and Technical State University is a preeminent land-grant institution, where high-achieving scholars are engaged in transformative teaching and learning, civic outreach, interdisciplinary research and innovative solutions to global challenges.

[Mission:](#) North Carolina Agricultural and Technical State University Advances knowledge through scholarly exchange and transforms society with exceptional teaching, learning, discovery and community engagement. An 1890 land-grant doctoral research institution with a distinction in STEM and commitment to excellence in all disciplines, North Carolina A&T creates innovative solutions that address the challenges and economic needs of North Carolina, the nation and the world.

To achieve its vision and mission, N.C. A&T has set its long-term course via its university-wide strategic plan, [A&T Preeminence: Taking the Momentum to 2023](#).

In addition, a recent [academic reorganization](#) has positioned the University to meet the strategic plan's objectives and increase its competitiveness in the global marketplace while preparing its graduates for 21st-century careers.

Corporate Structure:

- Second Morrill Act (1890 land-grant) university, established in 1891; Historically Black University (HBCU)
- Constituent member of the University of North Carolina (UNC) system
- Leadership = Chancellor Harold L. Martin, Sr. and the Chancellor's Executive Cabinet; they are advised on management and development by a 13-member Board of Trustees and advised on quality and university enhancement by a Board of Visitors

Data for Proposals ([additional data](#) are also available):

Applicant Organization: North Carolina Agricultural and Technical State University
Authorized Signing Official: Dr. Sanjiv Sarin, PhD, Interim Vice Chancellor for Research and Economic Development

DUNS Number: 07-157-6482
Federal EIN Number: 56-6000007

Certificates, Registrations, Accreditations: N.C. A&T is [accredited](#) by the Southern Association of Colleges and Schools Commission on Colleges (SACSCOC) to award baccalaureate, masters, and doctoral degrees. In 2015, the University was awarded [Community Engagement](#) Classification by the Carnegie Foundation for the Advancement of Teaching.

Academic Programs: The University offers [117 undergraduate degree programs](#) (with 29 minors) and [45 master's degree programs](#).

Six of its nine [Ph.D. programs](#) are in engineering (mechanical, electrical, industrial, computer science, computational science and engineering, and nanoengineering). Its doctoral programs in Computational Science and Engineering and in Nanoengineering are the only such stand-alone doctoral programs in the UNC system and among the nation's HBCUs.

The university's graduate programs in nanoengineering are offered through the Joint School of Nanoscience and Nanoengineering in collaboration with the University of North Carolina at Greensboro. The school is located at the Gateway University Research Park's south campus. Gateway is another joint initiative of N.C. A&T and UNCG. It consists of two campuses, both of about 75 acres.

The remaining three Ph.D. programs are in applied science and technology, leadership studies, and rehabilitation counseling and rehabilitation counselor education. The University's masters and Ph.D. programs are described in the [Graduate Programs](#) section of The Graduate College's website.

Further points of academic distinction are listed below:

College of Agricultural and Environmental Sciences (CAES) – N.C. A&T's College of Agricultural and Environmental Science is the largest among all HBCUs with six nationally accredited programs.

College of Arts, Humanities, and Social Sciences (CAHSS) – N.C. A&T is one of the largest producers of undergraduate degrees awarded to African Americans in the visual and performing arts, with two of its programs having been nationally accredited for more than 25 years. N.C. A&T is also one of the top campuses for master's degrees awarded to African Americans in English literature and letters. N.C. A&T's Department of Journalism and Mass Communication is one of only two accredited programs in the UNC system and is one of only seven accredited programs at the nation's HBCUs.

College of Business and Economics (COBE) – N.C. A&T is one of the largest producers of certified public accountants in the nation. The College of Business and Economics has the first AACSB-accredited accounting program at an HBCU.

College of Education (CED) – N.C. A&T leads the nation in the number of African-Americans awarded in teacher education and master's degrees in counseling, adult education, instructional technology and leadership. Its PhD in Rehabilitation Counseling is one of only two in the UNC system and in the state of North Carolina, as well as the only one at an HBCU in the country.

Further, it is the only CACREP-accredited PhD in Rehabilitation Counseling program at an HBCU in the nation.

In 2018, N.C. A&T was ranked 5th in the nation among “Top 50 HBCU Education Schools” by the HBCU Colleges website (<https://hbcu-colleges.com/education>).

College of Engineering (COE) – N.C. A&T leads the nation in the number of African-American students who receive bachelors, masters, and doctoral degrees in engineering and technology. In particular, we have been the leading producer of African-American female engineers at the undergraduate level for nine consecutive years. Its doctoral programs in Computational Science and Engineering and in Nanoengineering are the only such stand-alone doctoral programs in the UNC system and among the nation’s HBCUs.

College of Health and Human Sciences (CHHS) – The School of Nursing posted a 95% pass rate for the National Council Licensure Exam in 2016, achieving above the state nursing exam standard (85% pass rate) for the second consecutive year.

College of Science and Technology (COST) – Capitalizing on its existing undergraduate and graduate strengths and programming as well as its significant history of success in producing technically skilled, team-oriented problem-solvers, COST is proud to offer two new professional science master’s programs: one in Technology Management (with a concentration in Construction Science and Management) and another in Industrial Biosciences (to begin Fall 2017).

Joint School of Nanoscience & Nanoengineering (JSNN) – The Joint School provides a unique opportunity for professional development via inter- and cross-disciplinary graduate programs at various intersections of science, engineering, and the nanoscale.

To support its undergraduate and graduate programs, N.C. A&T has robust research programs (several of which are described below).

Sponsored Research: N.C. A&T is a doctoral research institution and has been ranked third in the UNC system in sponsored program awards since 2005. FY 2018 funding was \$64.3 million; for further information, visit DORED’s *2018 Annual Report* at <http://online.fliphtml5.com/laie/kdym/>.

Among the University’s advanced research centers are an Engineering Research Center for Revolutionizing Metallic Biomaterials (NSF ERC), a Bioenergy Research Center (NSF CREST), and a Center for Testing, Evaluation, and Control of Heterogeneous Large-Scale Systems of Autonomous Vehicles (TECHLAV, funded by DOD/AFRL). N.C. A&T’s Center for Cyber Defense is designated as a National Center of Academic Excellence in Information Assurance/Cybersecurity.

Also, through its Joint School of Nanoscience and Nanoengineering, N.C. A&T is part of the Southeastern Nanotechnology Infrastructure Corridor, a collaboration among Georgia Institute of Technology’s Institute of Electronics and Nanotechnology, N.C. A&T, and the University of North Carolina at Greensboro (NSF NNCI).

In addition, N.C. A&T conducts cutting-edge research to improve the quality and safety of food in its Center for Excellence in Post-Harvest Technologies (CEPHT) at the North Carolina Research Campus, administered by the CAES. CEPHT works in post-harvest technologies and

food science in a continuous effort to find new ways to make food safer, extend shelf life and preserve health-promoting nutrients.

A university center that integrates research, education and technical assistance to provide community-focused, culturally-competent health services is the Center for Outreach in Alzheimer's, Aging and Community Health (initiated via a North Carolina GlaxoSmithKline Foundation grant).

Intellectual Property: Since 2001, seven companies have launched based on N.C. A&T innovations, with breakthrough inventions licensed by the university spanning engineering, biotechnology and manufacturing.

In FY 2018, N.C. A&T received more than \$42,000 from licensed technologies. In the same fiscal year, the university had three patents issued and two licenses executed (one with BioSolar).

N.C. A&T owns intellectual property stemming from research in a wide variety of technology spaces relating to:

- Ground water remediation (licensed);
- Paper-based magnesium batteries;
- Carbon nanotube sheets with metal centers;
- Aspirin conjugates;
- Derivatives of ginger metabolites;
- Micropropagation of Alexandrian laurel and of black cohosh;
- Heat vacuum assisted resin transfer molding process for complex materials;
- Controlled 3D drop on-demand printing of micro and nano-scale features;
- Production of carbon nanofibers from alkali lignin;
- Antifungal nanofibers
- Preparation and uses of bio-adhesives (licensed);
- Green epoxy resin with biobinder;
- GaAsSbN core shell nanowires;
- Multi-phase structured cathode material for lithium ion batteries;
- Prelithiation of silicon particles for lithium ion batteries;
- Differential constructive wave oscillator device;
- Preparation of reduced allergen peanuts; and
- Folded sheets of material for use as a structural member

FACILITIES, EQUIPMENT, AND OTHER RESOURCES

NC A&T's research capacity stems from our personnel, space, and facilities. Following are relevant representative listings:

JOINT SCHOOL OF NANOSCIENCE AND NANOENGINEERING

The Joint School of Nanoscience and Nanoengineering (JSNN), a 100K+ sq. ft. user facility, is partially funded by the NSF NNCI program. JSNN is also one of the sites for the NSF NNCI program and part of the "Southeastern Nanotechnology Infrastructure Corridor (SENIC)." Furthermore, every lab at the JSNN user facility (see the lists below) has its own lab manager or faculty-in-charge to train users, manage scheduling and maintenance and to establish standard operating protocols and procedures.

JSNN contains 12 laboratories as well as offices and classrooms. The labs include: Nanoelectronic and Biopharma cleanrooms for fabrication and integration of nanobiosensor and microfluidic system; Nanobiology laboratory (BSL2 and BSL3 labs) with full suite of cell/tissue culture resources; nanofabrication facility with nanostructure synthesis; High Performance Computing Facility including access to multi-processor computing resources; nanochemistry lab; NMR facility; Analytical facility and Microscopy facility, with state-of-art Helium ion microscope, FIB, SEMs, TEM. Detailed descriptions of labs follow:



The JSNN Building at Gateway University Research Park.

Nanoelectronic and Biopharma Cleanrooms at JSNN

The Joint School of Nanoscience and Nanoengineering (JSNN) facilities provide a rare design of adjacent nanoelectronic and biological cleanrooms. This fully integrated lab enables a fusion of the top-down (physical) directed assembly approach and the bottom-up (biological) self-assembly approach to nanotechnology. The nanoelectronic and microfluidic fabrication and processing capabilities that are available in this cleanroom include micro and nanolithography, wet processing, plasma and reactive ion etching, including Deep RIE, chemical and physical vapor deposition processes, characterization, testing and metrology. The biological cleanroom includes BSL-2 cabinets, incubators, shakers, microscopes, environmental SEM and direct-write ink jet lithography tool. This non-contact, microdispensing tool is useful to print variety of "inks" including biological materials

Photolithography

Brewer Science CEE 100 Spin Coat System; Newport Corporation R-31425 Laser HeNe; OAI 8808 Mask Aligner with DUV Upgrade; Ultron Systems UH 102-8 Ultron UV Curing System; Yield Engineering Systems Vapor Prime HMDS; Ink-Jet Direct Writing

Dry Etching

Lam Research Corp. 4400 Series Etch System (2); Plasma Etch Inc. PE-100-RIE Plasma Etch System; STS Multiplex Etch System ICP STS; Ulvac NLD-6000 Demo ICP Etch System

Thermal Processing

SemiTherm VTP 1500 LPCVD Reactor Furnace

Wet Processing

Air Control Wet Bench with Carboy (2); Americhem Eng Svcs Polypro wet bench 60"x30"; Hamo LS-1000 Glassware Washer; Reynolds Tech Wet Bench; Santa Clara Plastics Stainless Steel Wet Bench 60"x40"

Deposition

Novellus Concept II Plasma Enhanced Chemical Vapor Deposition System; Physical Vapor Deposition; Kurt Lesker PVD75 E-beam Evaporator System; Lesker PVD 75 RF/DC Sputtering System, Veeco CNT Savannah Atomic Layer Deposition System

Metrology

Carl Zeiss Imager Z2m Axio Imager Microscope; Carl Zeiss Microscope with photomicrographic camera; Creative Design Engineering RESMAP168 4 Point Probe Resistivity Mapping System Gaertner LSE-WS Ellipsometer; KLA-Tencor P-10 Profilometer with Air table;

Post-processing

IPEC 472 Chemical Mechanical Polishing System; Lam Research Corp DSS-200 Series II CMP Brush Cleaner; Reynolds Tech Gold Plating Bench and Retrofit; Tousimis Critical Point Dryer

Bio-lithography

BSL2 cell culture, DoD Inkjet Printer Carl Zeiss EVO LS SEM with Patterning; Eppendorf 5810 Benchtop Centrifuge, Laurell Technologies Spin Processor in WS-1000M Wet Station; VWR/Shel-Lab 2310 CO2 incubator

Advanced Microscopy and Sample Preparation Capability

Cytoviva Hyperspectral/Dark-Field Microscope, Agilent Technologies 5600 LS Atomic Force Microscope; Burker AXS Inc. 400EDS Energy Dispersive X-Ray Spectrometer for Auriga; Carl Zeiss Auriga-BU FIB FESEM Microscope Carl Zeiss Axio Observer A1 Microscope; Carl Zeiss Axio Observer Z1, Microscope-Spinning Disc Confocal; Carl Zeiss Libra 120 Plus EFTEM Microscope; Carl Zeiss Orion Helium Ion Microscope; Fisher Scientific FS30D-4QT Digital Ultrasonic Unit (Sonicator); Fisher Scientific Isotemp 2.5cf Forced Air Oven; Harrick Scientific SEA-D18 Variable Angle Reflection Accy with Wire Grid Polarizer and Sample Hitachi S-4800-I FESEM with Backscattered Detector INCA; Energy 250 EDX Microanalysis System Microscope Detector & INCA; South Bay Technology Inc. PC2000 Plasma Cleaner. Denton Vacuum Inc. Desk II Sputter Coater

Nanoprocessing/Fabrication Lab

Stratasys J750 FDM printer, Fusion 3D printer, Electrospinning setup, Barnstead/Thermolyne F6038CM High Temp Furnace, Brutus 61024 24" Professional Tile Saw w/10 Diamond Blade, Fisher Scientific 280A Isotemp Vacuum Oven (2), Flow International M2-1313b Water jet Cutting Table, Fusion 3Design F306 3D Printer, Labconco Glove Box 11 Protector SS w/ base stand, TBJ 36-61-DD-BD Dual Draft Workbench, TBJ 60-10-BD-CT Countertop Backdraft, TSI 3785 Water-based Condensation Particle Counter.

Analytical and Magnetic Resonance Imaging

ThermoFisher Escalab 250Xi X-ray Photoelectron Spectroscopy (XPS), Siemens Magnetom Verio 3T MRI System, Agilent Technologies 400 NMR 400 Mhz NMR Spectrometer, Agilent Technologies 700 NMR 700 Mhz NMR Spectrometer w/ Liquid Solid & Cryo Probe Capability, Agilent Technologies Oxford Gemini X-Ray Diffractometer, Harrick Scientific SEA-D18 Variable Angle Reflection Accessory for FTIR, Horiba XploRA One Raman Confocal Microscope System, Horiba FluoroMax-4 Spectrofluorometer, Memmert IPP500 Incubator, Varian 240 MS/GC Ion Trap Mass Spectrometer, Varian 320 MS GC/LC Triple Quad Mass Spectrometer, Varian 500

MS LC/MS Ion Trap Mass Spectrometer, Varian Cary 6000i UV-Vis Spectrophotometer, Varian 670 FTIR Spectrometer, Varian 670 FTIR/610 Spectrometer w/Single Point Detector, Varian 710 ES ICP Axial Spectrometer, Varian 920 LC Liquid Chromatography System, Varian Cary Eclipse Fluorescence Spectrophotometer (2)

Nanochemistry and NanoBiology with BSL2 and BSL3 Labs

BD Biosciences FACS Aria III Flow Cytometer System, Bio-Tek 1536 Microflo Select Microplate Dispenser, Bio-Tek 384 Microflo Select Microplate Dispenser, Bio-Tek PRC384 Microplate Sample Processor, Bio-Tek Synergy MS/Mono Microplate Reader Haz-Mat, Bio-Tek MX Mono-Based Multi-Function Microplate Read, Bio-Tek MWX200R Power Wave XS, Branson ultrasonics S450A Cell Disrupter, Eppendorf 5418 Microcentrifuge, Lab-Line Instruments Inc. Imperial II CO2 Incubator Malvern Instruments ZEN 3600 Zetasizer Nano-ZX, MSE Mistral 3000i Centrifuge, Nanosight LM10-HSBF Nanoparticle Characterization, New Brunswick Sci. Excella E24 Incubated Shaker, Nexelom Bioscience Cellometer Vision Cell Profiling System, Olympus IX51 Research Inverted Microscope with Fluorescence, Quantum Design Magnetic Property Measuring System 3 Squid VSM 7.0 TESLA Magnet, TA Instruments Q200 Differential Scanning Calorimeter with Mass Flow, TA Instruments Q200 Modulated Differential Calorimeter with Mass Flow and Thermogravimetric Analyzer with High Resolution and Modulation Modes, TA Instruments Q500 Thermogravimetric Analyzer

Nanochemistry Lab

CEM 908005 Microwave Reactor Discovery System, Horiba SPRI-LAB+ Surface Plasma Resonance System, Innovative Tech. Inc. PureLab HE Four Glove Box, Labconco A2 Logic with Canopy Bio Safety Cabinet 6' with Stand, Labconco Free Zone 6 Freeze Dryer, Microtrac Inc. NPA 152-31A-0000-000-11M Zetatrac, Sorvall Legend XFR Floor Model Centrifuge (2), Sorvall Legend Micro 21R Centrifuge.

High Performance Computing Facility

JSNN established a High-Performance Computing Facility (HPCF) for engineering, scientific computing and research on parallel algorithms at North Carolina A&T State University. A Cray XC-30 supercomputing system is a major part of our computational program. At present, it includes 8 computer blades with 4 compute nodes per blade, resulting in a total of 32 computing nodes. Each node is configured with two intel Ivy Bridge 10-core processors of 2.5 GHZ speed. Each processor has 8GB DDR3 memory. The total number of compute nodes thus equal to 640. In order to facilitate state of the art GPU based calculations, the CRAY XC-30 is also equipped with 3 accelerated GPU blades, each with 4 compute nodes, resulting in a 12 GPU nodes in total. Each GPU nodes is configured with a single NVIDIA K20x Kepler GPU (1.3 TF) with an 8GB DDR3 processor memory. Thus the Cray XC-30 has 240 GPU cores and 640 CPU cores. It also has 3 I/O blades for input/output with similar configuration to that of a CPU node, but with a dual port FDR Infiniband connection for I/O array. The computation facility is also equipped with a 180TB Lustre raw storage capacity in a RAID6 configuration. The storage system utilizes a dual-port quad data rate infiniband storage infrastructure for faster data retrieval purpose. At present, the computational facility is actively used by approximately 10 faculty and staff researchers and more than 30 student users from nanoscience and nanoengineering divisions.

Gateway Material Test Center

Materials Test Center specializes in testing of Polymer Matrix Fiber Reinforced Composites, Fully equipped to serve all of other material testing needs - ASTM Testing, Instron 3384 Materials Testing System w/Env. Chamber, Instron 8802 Dynamic Testing System, Instron 9250G Impact Test System, LR Technologies ST867TUL240V90KW Walk in Oven,

PerkinElmer DMA 8000 Dynamic Mechanical Analyzer, PerkinElmer DSC 6000 Differential Scanning Calorimeter, Rame Hart 260-F4 Goniometer/Tensiometer, South Bay Technologies 650 HC Diamond Saw, Tenney C-Evo Environmental Test Chamber 10 cu. ft., ThermTest Inc. TPS2500S Thermal Property System w/Anisotropy & Slab Modules, Quantum Design Magnetic Property Measuring System 3 Squid VSM 7.0 TESLA Magnet

Nanophysics

Nanoscience Instruments STM; 590 Tripod Polisher, TEM; Agilent 429A Impedance Analyzer Agilent 54624A Oscilloscope with Gpib Interface; Boekel Microcooler II Benchtop Refrigerated Bath; DNR MiniLumi Bio Imaging System; DNR MF ChemiBIS Image Analysis System; FisherBiotech Scientific AMPSD/TS3-LED Binocular Microscope with integrated digital/video; FisherBiotech Ultraviolet Transilluminators; GE Medical System CASE "Performance" ECG Stress Testing System; GE Medical System Treadmill; Kiethley 2400 Digital Source Meter; Kiethley 2602A Dual Channel Source Meter; LabNet Int'l Spectrafuge 24D Mini Centrifuge; Labconco A2 Logic with Canopy Bio Safety Cabinet 6' with Stand; Molecular Devices 200B Axopatch Clamp (2) Oakton pH 2100 Benchtop pH/Ion Meter; Princeton Applied Research VersaStat4 with FRA Potentiostat/Galvanostat; Thermo Scientific Multisegment Tube Furnace; Thermo Scientific Nanodrop 2000c Spectrophotometer; Thermo Scientific ST75925 Tabletop Stem Sterilizer

COLLEGE OF ENGINEERING

Stratus Rapid Prototyping Machine

List of centers led by COE researchers (alphabetical order):

- Center for Advanced Materials and Smart Structures (Dr. Shivakumar)
- Center for Advanced Studies in Identity Sciences (Dr. Yuan)
- Center for Aerospace Research (Dr. Ferguson)
- Center for Aviation Safety (Dr. Shivakumar)
- Center for Composite Materials Research (Dr. Shivakumar)
- Center for Cyber Defense (Dr. Yuan)
- Center for Energy Research and Technology (Dr. Monty)
- Center for Human Machine Studies (Dr. Smith-Jackson)
- Institute for Autonomous Control and Information Technology (Dr. Homaifar)
- NSF Engineering Research Center for Revolutionizing Metallic Biomaterials (Dr. Sankar)
- Science and Technology Center for Academic Excellence in Advanced Biometrics (Dr. Yuan)
- Visualization and Computation Advancing Research Center (VICAR) (Dr. Bikdash)

Listings of facilities, equipment, and instrumentation available in various centers:

Engineering Research Center (ERC) / Center for Advanced Materials and Smart Structures (CAMSS)

The ERC/CAMSS, led by Dr. Jagannathan ("Jag") Sankar, is housed in the Fort Interdisciplinary Research Center, occupying 10,000 square feet of the building. The twelve current ERC/CAMSS laboratories and facilities are interconnected and span four of the five floors, providing a seamless, high tech research infrastructure for advanced and nano-biomaterials research activities.

Materials Processing and Preparation Facilities

- Wabash Genesis Extrusion Machine
- Gallini Centrifugal Casting Machine
- Differential Speed Rolling Machine
- Witboy KL-850 Injection Molding Machine
- Custom Built Electrospinner for polymers and biomaterials
- American Laboratories Hot Isostatic Press
- Sodick VL400 Wire EDM machine (installation in progress)

Significant Imaging and Analysis Capabilities

- Hitachi SU8000 Electron Microscope with EDS and Oxford X-Max^N and Oxford Symmetry EBSD Capabilities
- Hitachi S-3000N Variable Pressure SEM with Chamber scope, Low Temperature Stage and Backscatter Detector
- GE Phoenix X-Ray Computed Tomography Imaging System
- Perkin Elmer Quantum GX in vivo X-ray CT for small animal models
- MTS Nanoindenter XP with Continuous Stiffness Measurements and Test Works 4 System
- NT-NDT Integra Scanning Probe Nanolaboratory with AFM, STM, EFM and related capabilities
- Horiba LabRAM-Aramis Micro-Raman System
- Teledyne/Photon-Machines Analyte G2 Laser Ablation coupled with an Agilent 8800 Ion-Coupled Plasma Triple Quad Mass Spectrometer
- Zeiss LM-710 Two-photon Confocal Microscope
- Horiba XGT-7200 X-Ray Fluorescence Spectrometer

Additional Materials Preparation, Imaging, and Analysis Tools

- Crossington SEM Coating System
- Fischione 1010 Low Angle Ion Milling Machine and 1061 SEM Mill
- CETR UMT-2 Microtribometer
- KLA-TENCOR Alpha-Step IQ Surface Profiler
- WYKO RST 500 Optical Profiler
- Leco M-400-H1 Microhardness Tester
- Zeiss Axiovert-10 Optical Microscope with Insight CCD Camera
- Nikon Epiphot Inverted Microscope with CCD Camera
- Meiji Optical Microscope with CCD Camera
- Various sample preparation equipment (LECO and Buehler)
- VCR Group Inc. D500i Dimpler
- Chemical and Biohoods, Scales, Centrifuges, Freeze Dryer, and related laboratory infrastructure

Static and Dynamic Material Testing

- Instron 5566 (10 kN) mechanical testing frame
- 500 N Instron 5542 testing frame
- MTS 311 110-kip hydraulic mechanical testing frame with Instron High Capacity Grips
- MTS 22-kip hydraulic mechanical testing frame with Instron 8511 Controller and HT furnace for testing at temperatures up to 1350°C
- Custom designed hydraulic Instron 8510 10-kip mechanical testing frame for tensile and fatigue testing ceramic materials at temperatures up to 1600°C

Coatings Synthesis Facilities

- Pulsed Laser Deposition Facility
- Magnetron Sputtering Facility
- Contact Mask Aligner
- PVA TePla M₄L Plasma Etcher
- Integrated Nano-Bio Manufacturing Laboratory with Direct Write Capability
- 3D Visualization and Computing Facility

Center for Composite Materials Research

- Processing and Fabrication Lab
- Low-temperature plasma machine
- Custom-built electrospinning apparatus
- Burn-through test facility
- High-capacity servo hydraulic testing systems
- Dynamic test facility for high strain rate testing and low-velocity impact testing
- Digital Image Correlation System
- High speed camera (up to 500,000 frames per second)

Autonomous Control Lab

- DARwIn-OP humanoid robots
- Adept Viter 6-Axis Robot arms
- Pioneer 3-AT and 2-DX mobile robots

COLLEGE OF SCIENCE AND TECHNOLOGY

Chemistry Department

- NMR: Varian VNMR NMR 300 MHZ spectrometer
- Mass spectrometry: Varian and HP GC
- X-ray: SMART X2S Automated X-ray Diffractometer
- Sample purification and analysis: HPLC, IR, and UV-visible spectrophotometers; Mattson 20/20 Galaxy FTIR; gas chromatographs; high-speed centrifuges; electrochemical set-ups; impedance analyzer
- Econotherm oven
- Muffle furnaces (Barnstead, Thermolyne 1300, and four-stage programmable muffle furnace)
- Tube furnaces (Thermcraft Inc. and Lindberg Blue M)

College of Agricultural and Environmental Sciences

Highlights of available equipment (by building)

Carver Hall

Plant Tissue Culture Biotechnology Laboratory (Rm B)

- OHAUS analytical balance
- Eppendorf centrifuge 5414C
- Sterilmatic Autoclave
- Three thermolyne stirring hot plates
- Maxima vacuum pump
- Cryo-fridge

- Orion pH meter
- Enviroco laminar flow hoods
- Oxford micro pipettes
- Baxter sterile loop bacteriology incinerator
- Fisher vortex genie shakers

Plant Biotechnology Laboratory (116)

- Laminar flow hood
- Centrifuge
- Gel electrophoresis apparatus
- Bactincinerator
- Biolistic particle bombardment device
- Autoclave
- Deep freezer
- Gel drier
- Controlled environmental chamber
- Light banks, etc. to implement basic and applied plant banks

Food Research Laboratory (163)

- Mineral analysis (ICP spectrometer)
- Surface area analysis
- Freeze-drying and dehydration of samples
- Hydraulic Press
- Kjeldahl distillation
- 15 unit stirring system

Food & Nutrition Laboratory (164)

- Gas chromatography
- Visible spectroscopy
- Supercritical carbon dioxide fluid extraction
- Automatic titration system
- Chemical sample preparation and analysis

Analytical Services Laboratory (168, 170)

- Gas chromatography and mass spectrometry
- Nuclear magnetic resonance spectroscopy
- Ion coupled plasma/atomic emission spectroscopy
- High performance liquid chromatograph

Food Chemistry/Biochemistry and Product Development Lab (172)

- Chromatography: HPLC and GC
- Spectroscopy: UV/VIS, Minolta color analyzer
- Microplate readers: visible and flourometer
- Protein analyzer
- Ozone generator
- Texture analyzer
- Water activity meter
- Viscometer

- Polytron homogenizer
- Micro balance and analytical balance
- Centrifuge

Bioremediation and Nitrogen Transformation Laboratory (268, 270)

- CHNS analyzer
- Incubators, shakers, balances
- Spectrophotometer
- Autoclave
- Sample digester
- Biological respirometer

Sockwell Hall

Bioprocessing and Fermentation Laboratory (137)

Anaerobic digester (bench-top).

Designing and testing pilot-scale digestion systems.

Webb Hall

Bioinformatics Learning Facility (239)

Molecular biology, including gene microarrays scanning, PCR amplification, cell culturing, gel electrophoresis for protein and nucleic acids

Gene microarrays scanner

Coulter electronic particle counter

Multiporator for transformation of eukaryotic and prokaryotic cells

Respiratory Biology and Toxicology Lab

- Millipore Water Filtration system
- Colony Doc-IT Imaging System
- HuLa Mixer
- EMS Tissue Slicer
- Biorad CFX 96 real-time PCR

Ruminant Nutrition Lab

- Reach-in incubator
- Ankom Fiber Analyzer
- Soxhlet Extractor
- Kjeldahl apparatus
- pH meter

Poultry Immunonutrition Lab

- Biosafety Level 2 (BSL 2)
- Incubators
- Centralized autoclave
- Stomacher Lab Blender 400
- Spiral Plater and Colony Counter
- 4 CampyGen Chambers

Center for Excellence in Post-Harvest Technologies (CEPHT)

CEPHT is located on the North Carolina Research Campus (NCRC) in Kannapolis, a little over one hour from the main campus in Greensboro. It is a \$1.5 billion world-class research center dedicated to making ground-breaking discoveries in nutrition and human health. CEPHT is administered by NC A&T's School College of Agriculture and Environmental Sciences and it houses laboratories that are part of the Institute for Advanced Nutrition Research. Additionally the Center shares laboratory facilities with other research-intensive universities, giving CEPHT a valuable opportunity to work with other NCRC partners.

The facilities at CEPHT includes dedicated spaces for: 1) Functional Food Bioactive Components Laboratory; 2) Food Process Engineering Laboratory; 3) Human Nutrition and Proteomic Laboratory; 4) Phyto-pharmacology and Immunology Laboratory; 5) Food Microbiology and Molecular Epidemiology Laboratory and 6) CDC Certified Select Agent Biosafety Level Three Animal (ABSL3) and Research Laboratory (BSL-3). Selected major equipment in these laboratories includes:

- 3-CEAS HPLC system consisting of refrigerated auto samplers, two-pump solvent delivery system, ESA Model 5600 coulchem electrode array system with 8 channels, and a 528 UV/Vis detector
- Waters Associates analytical and preparative HPLC systems with 2489 UV/VISIBLE DETECTOR W/CS
- LC/MS: Varian 500-MS LC Ion Trap Mass Spectrometer with ESI, APCI and PDA detectors and Finigan LTQ Velos Quadrupole Ion Trap Mass Spectrometer with UPLC (Accela) system, ESI and APCI detectors
- High resolution NMR
- Savant High Speed Vacuum System
- 4- rotary evaporators with pump and cooling system
- Synergy MX Multimode Plate Reader from BioTek Instruments
- Twin screw extruder, tensiometer, soxtec fat extractor, microfluizer, environmental chamber
- 6- laminar flow hoods, two flow cytometers (3 and 10 color), cell sorter, tissue homogenizer, UV-spectrophotometer; Varian GC/MS spectrophotometer; Anaerobic chamber
- 3- Mammalian Cell Tissue Culture Laboratories

UNIVERSITY-WIDE COMPUTATIONAL RESOURCES

Computational Science and Engineering Cluster

- 3 Sun 6000 chassis, total 1 TB memory
- 26 dual-socket 6-core AMD blades
- 1 8-socket 6-core AMD blade
- Storage system, approximately 48 TB
- Parallel application support using MPI and OpenMP distributed and shared memory programming models
- Communication fabric: Infini-Band, supporting NFS over IB