

The Research Triangle Nanotechnology Network

Convergence Nanotechnology Hub

Executive Committee: Jacob Jones (NC State), Nan Jokerst (Duke), Jim Cahoon (UNC), David Berube (NC State), Nina Balke (NC State), Mark Walters (Duke), Phil Barletta (NC State), Bob Geil (UNC), Phillip Strader (NC State)



THE UNIVERSITY
of NORTH CAROLINA
at CHAPEL HILL

Duke
UNIVERSITY

NC STATE
UNIVERSITY

- What new program have you introduced recently? What issue/objective does this program address? What are the benefits of this program?
- What steps has your site taken to expand access of your site facilities and expertise to underrepresented students, faculty, and research disciplines?

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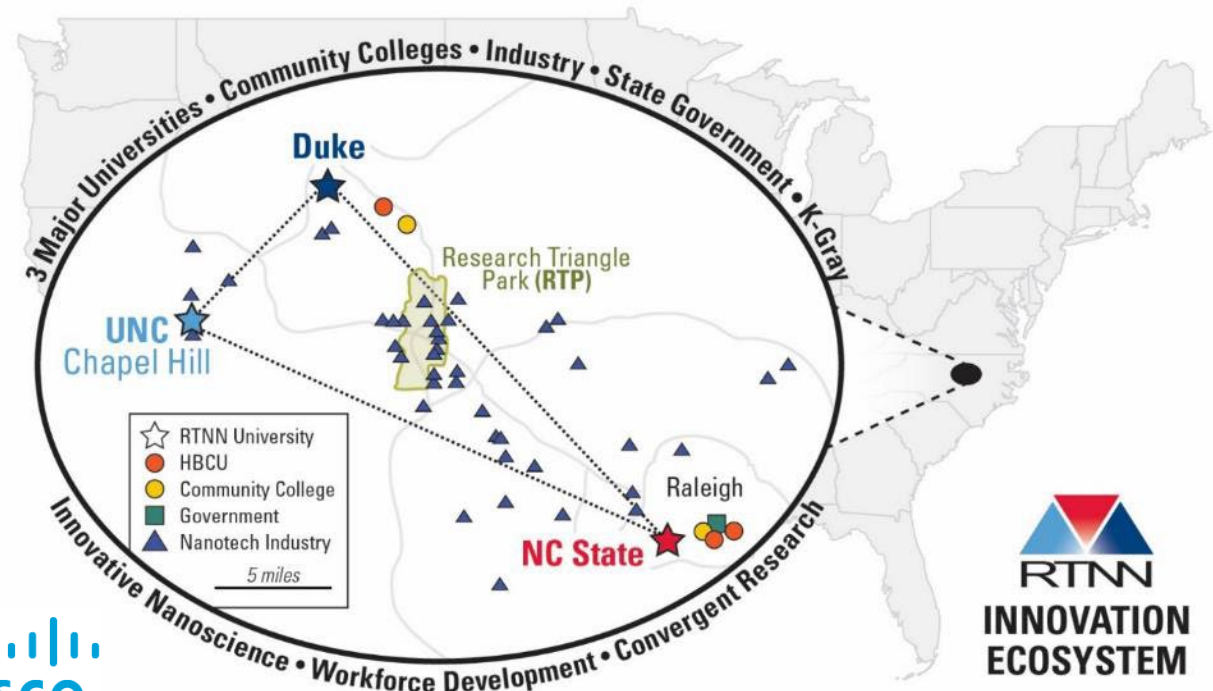
Anchored by 3 Research-1 Universities, with 2 Community Colleges and 3 HBCUs, producing large number of STEM graduates

Triangle cities rank in the top 10 nationally in percentage of workers in STEM fields

Significant number of high-tech, nano-tech, and start-up companies

Research Triangle Park (RTP) is the largest and the most prominent research park in the U.S., currently hosting **over 300 companies** and institutes with **~50,000 employees**

RTNN Affiliates Network brings together facilities across the Triangle to connect researchers, communicate opportunities, and strategize on emerging needs



Education, Engagement, and Outreach: Impacting New Communities and Engaging Users

Programs to address known barriers to access:

Awareness, Distance, Cost

In-person activities at schools and museums, libraries, and events

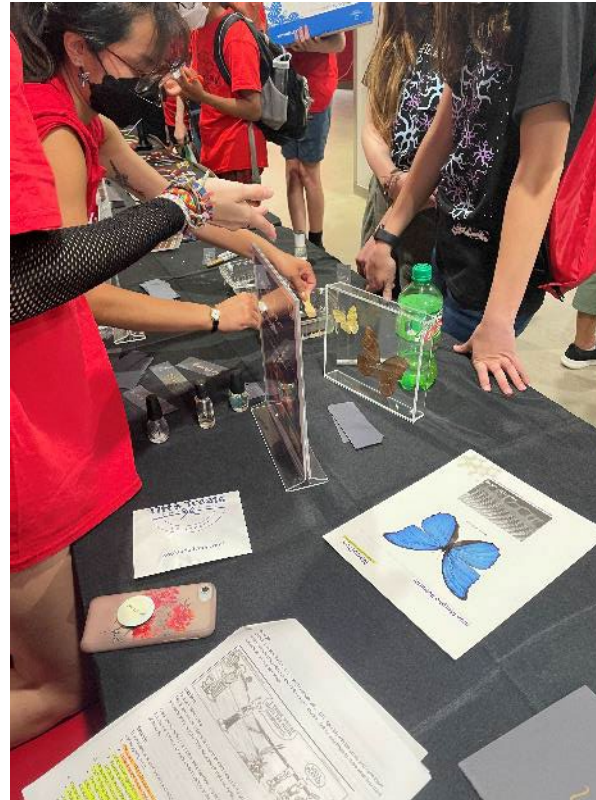
Facility visits for hands-on activities, demonstrations, and tours

Online courses and resources including Coursera and YouTube

Virtual outreach to the public through online interactions

Workforce development

Kickstarter program



NC Science Olympiad



Durham Museum of Life and Science



High School Cleanroom Tour

Relaunched RTNN Student Ambassadors Program

RTNN Student Ambassadors program engages students in the RTNN's mission to bring nanotechnology tools and expertise to new researchers and the public

>15 students across all three RTNN institutions served or currently serve

Since relaunching, ambassadors have already helped with **multiple events totaling >1,200 participants**

Student Ambassadors:

- Give facility tours to a variety of audiences, gaining experience interacting a diverse user base
- Host student groups in facilities and activities, developing leadership skills
- Participate in RTNN university-wide events, learning to work collaboratively with other students
- Travel to local schools for events and activities, engaging with their own communities
- Run remote access sessions for equipment use



Kickstarter Program Draws New Users and Leads to Returned Use

“Accelerator” program to overcome barriers of entry for new and non-traditional users, providing free time on tools

Up to \$1,000 of use at internal rate, plus travel support

Enables first or preliminary results for follow-on proposals

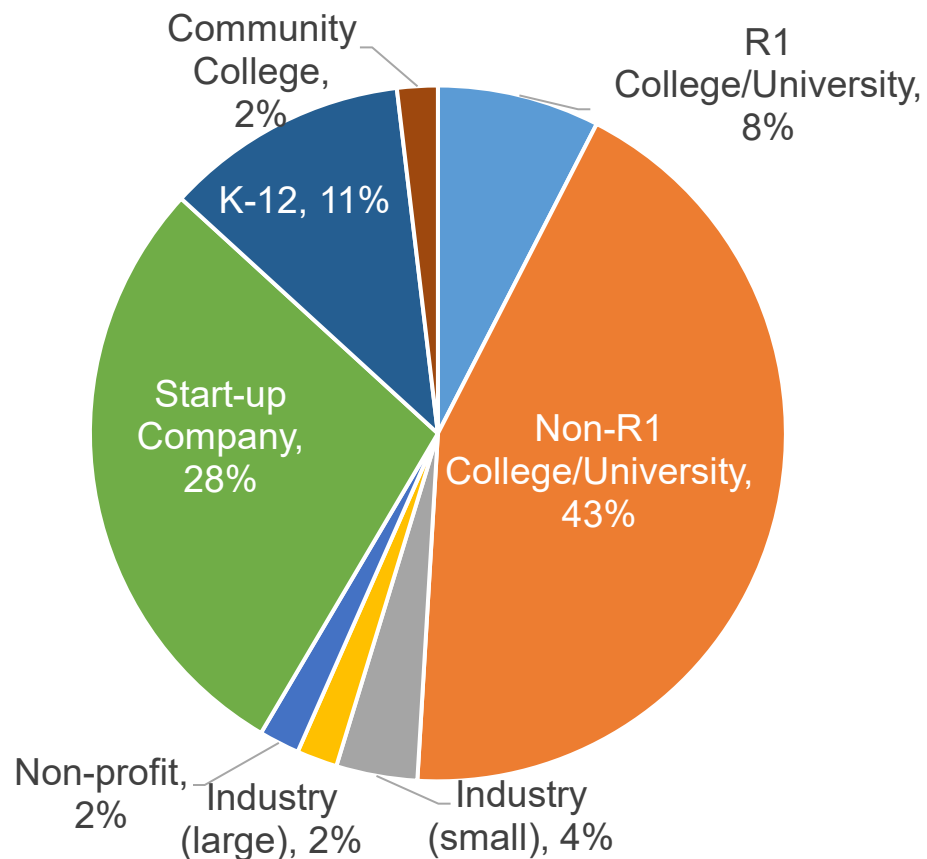
New expansion of program eligibility to include researchers adversely affected by COVID-19 pandemic and help with user travel costs

88 projects since program launched in 2016 (>1,490 hours of use), 7 projects in Year 7

>71% participation by start-up companies and non-R1 universities

>40% of participants who have completed program have returned to facilities with own financial support (>\$302,000 in facility fees)

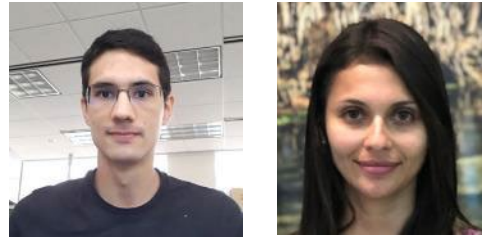
Evaluation with semi-structured interviews (n=29)



“I just think the whole experience for me was great. It was what I needed to get done. And I thought the staff was really professional and helpful.”

Kickstarter Highlight: Sensors based on a Carbon-Copper Composite for the Detection of Glyphosate

Post-doc: David Bahamon-Pinzon
PI: Diana Vanegas
Clemson University

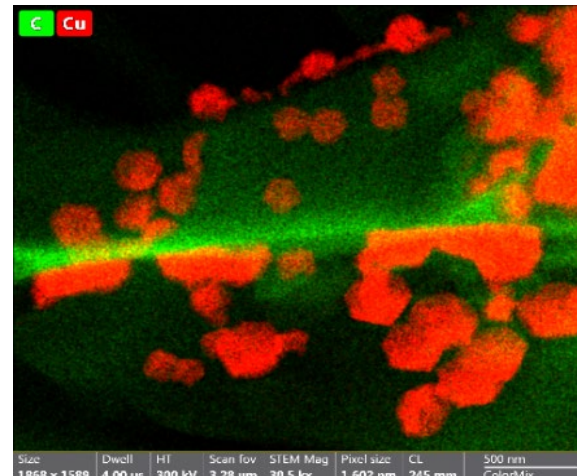
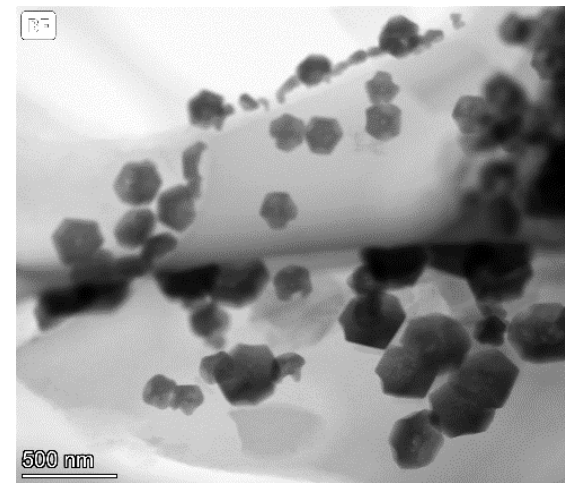
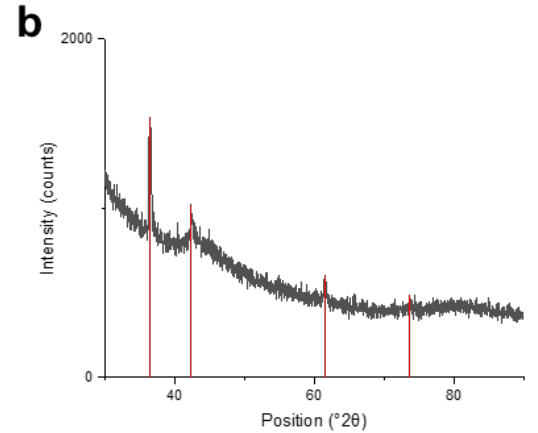
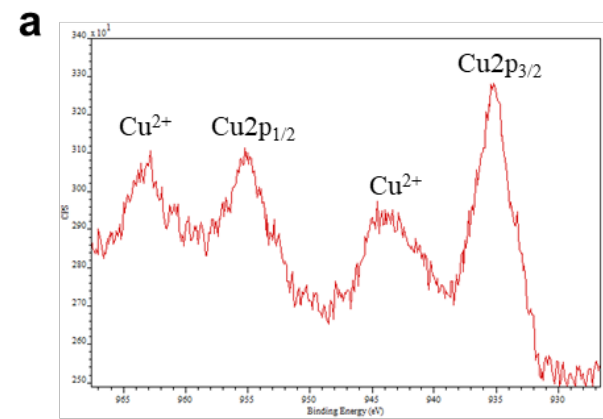


Glyphosate is a widely used herbicide. However, residues in the environment can cause negative effects to non-target organisms and humans.

This work proposes **a sensor based on turbostratic graphene decorated with copper nanoparticles**

This project characterized laser inscribed graphene electrodes (LIG) and LIG modified with copper nanoparticles (LIG-Cu) in terms of morphology and elemental

Publication: Bahamon-Pinzon, D., Moreira, G., Obare, S., & Vanegas, D. (2022). Development of a nanocopper-decorated laser-scribed sensor for organophosphorus pesticide monitoring in aqueous samples. *Microchimica Acta*, 189(7), 1-11. <https://doi.org/10.1007/s00604-022-05355-w>



Top Left: X-ray photoelectron spectroscopy (XPS) spectrum of LIG-Cu electrodes. Top Right: X-ray Diffraction of LIG-Cu electrodes. Red lines indicate peaks corresponding to the spectrum of copper oxide., Bottom: STEM image of particles and accompanying EDS image (right)

Kickstarter Highlight: Magnetic Control of the Endothelium Permeability via Magneto-Mechanical Actuation using ND-PEGylated Iron Oxide Nanoparticles



Post-doc: Mohammad Kanber
PI: Juan Beltran-Huarac
East Carolina University



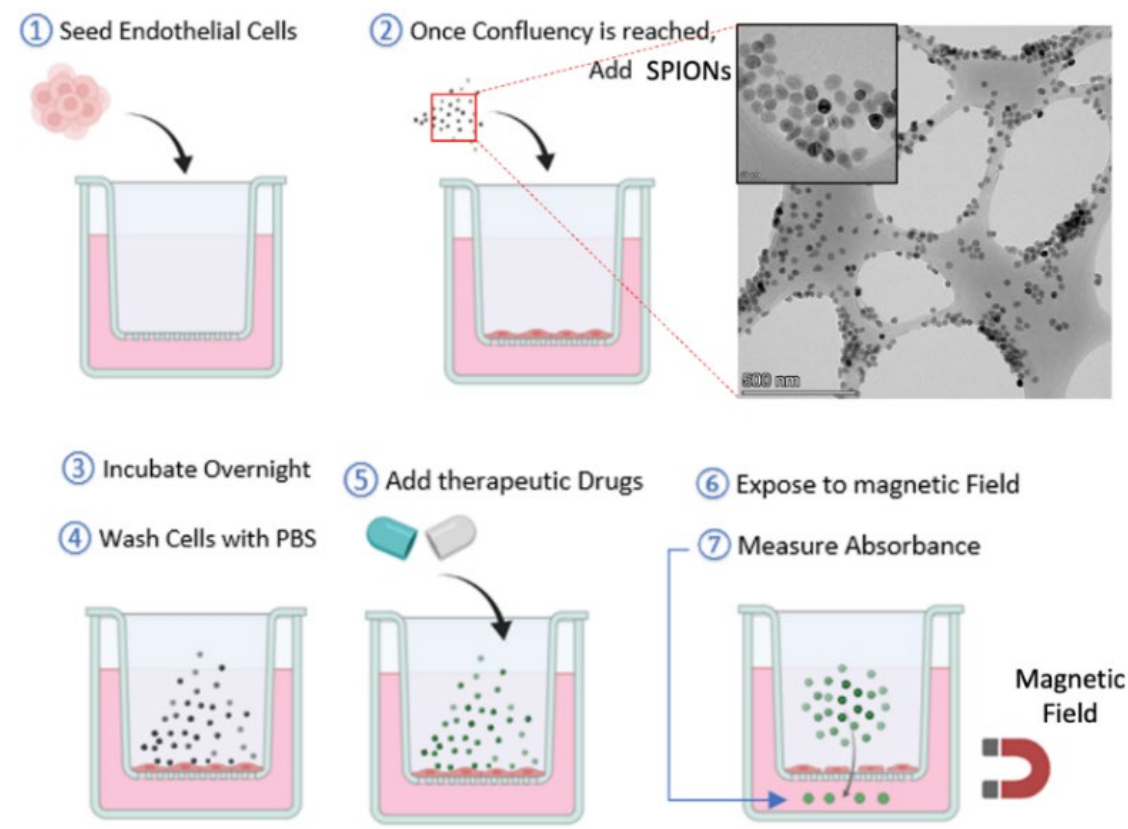
Magnetic particles can be used as a non-invasive approach for therapeutic drug delivery

ND-PEGylated superparamagnetic iron oxide particles (ND-PEG SPIONs) can be actuated inside endothelial cells (HMVECs) by magnetic field

Kickstarter project allowed TEM imaging of this novel delivery method

Potential implications in treating cancer remotely and advancing cancer nanotech and drug delivery

Not yet published, TEM work ongoing



Magnetic control of the endothelium permeability and TEM imaging of sample from CHANL (top right)



Diversity in RTNN Leadership and Programs

RTNN sustains its commitment to inclusion and promoting diversity in all activities

Enhancing diversity in RTNN leadership and staff in Year 7:

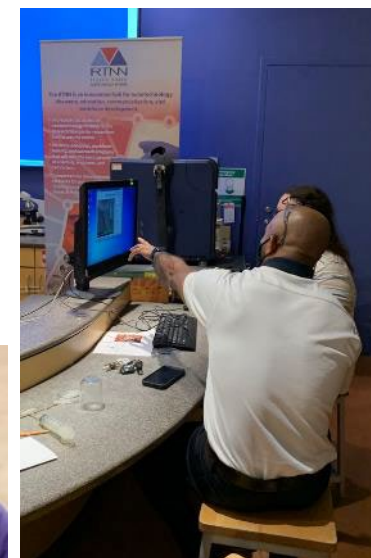
Nina Balke (AIF Director), Anne Njathi (PCOST Assoc. Dir. of Assessment), Jenny Forrester (XRD Lab Manager, AIF), Keyon Kemp (Educational Programs and Project Manager), Emily Moreno-Hernandez (Program Coordinator)

2022 REU participants: 5/12 URM/AAPI, 7/12 female, and two transferred from HBCUs to NCSU

Coursera 1.0 and 2.0: diverse presenters and demonstrators

Outreach programs that engage directly with diverse communities (URM, women, indigenous) and socioeconomically disadvantaged students, including:

*Girl Scouts STEM Day @ Duke & Girl Scouts Virtual Power Hour @ Duke
NC SciFest with Currituck County MS (Title 1) Community
STEM Days at a Waccamaw-Siouan Tribal communities*



In-Person and Virtual Outreach Programs

In-Person Events have resumed, including:

Girl Scouts STEM Day @ Duke (>140 in-person participants, >150 virtual participants, >80 parents/volunteers; ~95% URG)

NC SciFest (98 participants. ~48% URG)

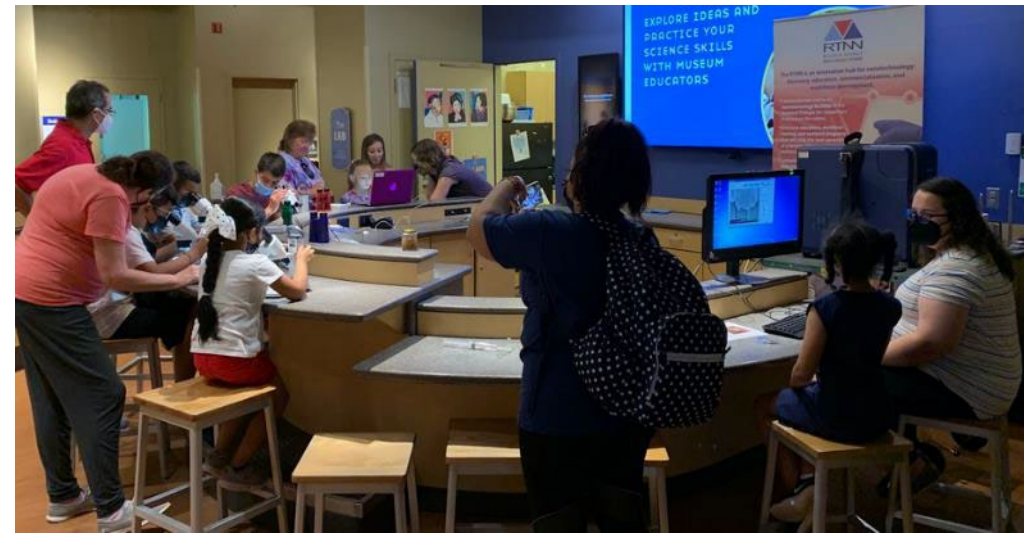
Super Scientist Saturday (128 participants, ~50% URM)

Rural Outreach: Ram Camp @ Franklinton Middle School (38 students)

NC Science Olympiad (>200 participants)

Waccamaw-Siouan Tribal Community STEM Day (95 participants, all URM)

Virtual Outreach options remain valuable in reaching larger audiences, *especially with rural and indigenous communities* (upcoming events include remote SEM sessions via RAIN, and Community Science and Power Hours via Zoom)



Super Scientist Saturday (>120 participants with at least 50% URM/female)



Girl Scouts STEM Day



Remote SEM Session for High School

Visions for the Next Network

RTNN Executive Committee Thoughts/Questions

1. Isn't NNCI even **more necessary** today, as evidenced by the CHIPS Act?
2. Should NNCI expand beyond “nano,” which could better represent **convergence** but possibly endanger a rallying focal point?
3. Should NNCI more embrace “**characterization**” as an equal to “fabrication”?
4. Could dedicated (satellite) facilities be added for **undergraduate education and workforce development** with dedicated staff support?
5. Could a **two-track program** (like the MRI) allow Sites to commit to differing levels of effort?
6. **HBCU** and **MSI** engagement is critical.