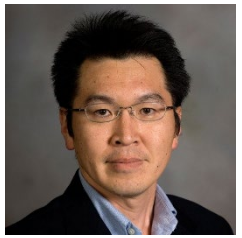
NanoEarth (Virginia Tech National Center for Earth and Environmental Nanotechnology Infrastructure)

NNCI Annual Conference, October 27, 2024



Murayama
Site Director

Michel
Deputy Director

Hochella
Director of User Development

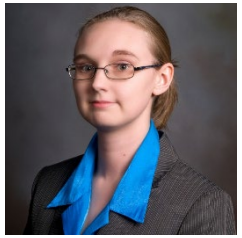
Hull
Facility Director; AD Innovation & Entrepreneurship

Marr
Technical AD

Pruden
Technical AD

Schreiber
Technical AD

Vikesland
Technical AD



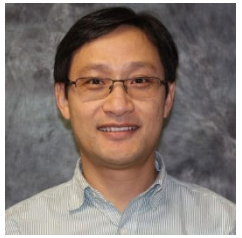
Pruitt
Assistant Director

Sowers
Facility Admin.

Velasquez
Diversity & Outreach Coordinator

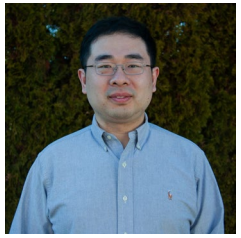
Lade
Postdoctoral Associate

Horn
Instrument Specialist



Leng
Instrument Specialist

McCartney
Instrument Specialist



Wang
Instrument Specialist

Wright
Instrument Specialist

National Nanotechnology Coordinated Infrastructure

NSF

NanoEarth

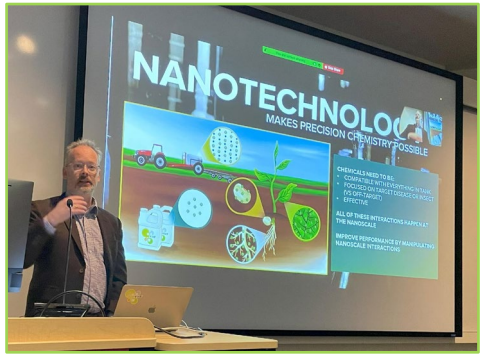
NanoEarth's Mission & Focus

Mission

The mission of NanoEarth is to stimulate discovery and innovation, and to share knowledge of Earth and environmental nanoscience and nanotechnology

Focus Areas

- Non-traditional areas of study
  - Geo and Earth Sciences
  - Environmental Sciences
  - Agricultural Sciences
- Diversity – MUNI (Multicultural & Underserved Nanoscience Initiative)
- Innovation & Entrepreneurship



National Nanotechnology Coordinated Infrastructure

NSF

NanoEarth

What are examples of programs and activities developed under NNCI that will be sustainable, independent of any continued NSF renewal funding, and what strategies or sources will be used to support them?

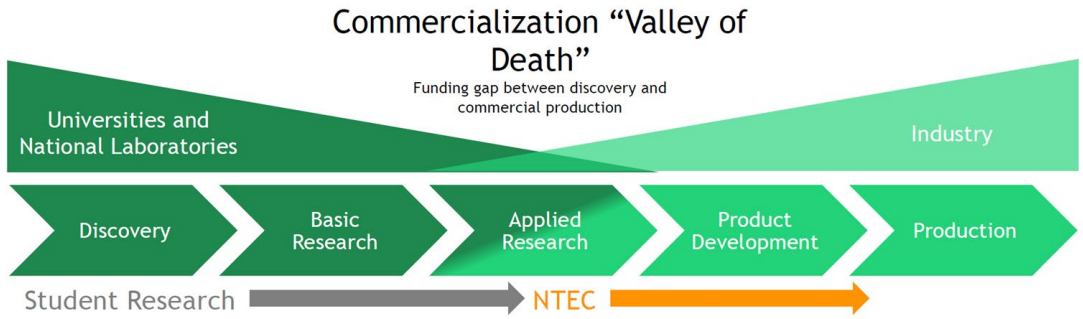
Nanotechnology Entrepreneurship Challenge (NTEC)

Developing a new generation of ”nano savvy” innovators and entrepreneurs who can help solve real-world problems using nano-enabled technologies.

- Supported 59 teams from NanoEarth & the NNCI so far
- Program needs:
  - Champion: Matt Hull to lead program and provide mentorship
  - between $500-$1,000 per supported team
- Future funding strategies:
  - Entrepreneurship focused organizations
    - Apex Systems Center for Innovation and Entrepreneurship
  - ICTAS (Institute for Critical Technology and Applied Science)

Week	MVP	Business Model Generation	Customer Discovery
1		Write your business thesis	
2		Customer segments and value propositions	
3		Channels and customer relationships	
4		Revenue streams	
5		Key resources, activities, and partnerships	
6		Cost structure	
7		NTEC Showcase	

Supported by Readings, Mentorship



NTEC is NOT the same as a lab research project!

Understanding the basic of lab research is great, but it’s not enough to be successful in NTEC or make it as an entrepreneur.

National Nanotechnology Coordinated Infrastructure

NSF

NanoEarth

NanoTrain (Nanotechnology Instrumentation Training Program)

- Co-developed with the Nanoscience Degree Program at Virginia Tech
- “Graduated” 5 students so far, 2 in the pipeline, and many more interested
- Program needs:
  - Champion: Marc Michel to lead program and provide mentorship
  - Funding for instrument training (time needed varies by student) and consumables
- Future funding strategies:
  - Academy of Integrated Sciences – home of the degree program
  - Looking for other opportunities to scale the program

National Nanotechnology Coordinated Infrastructure

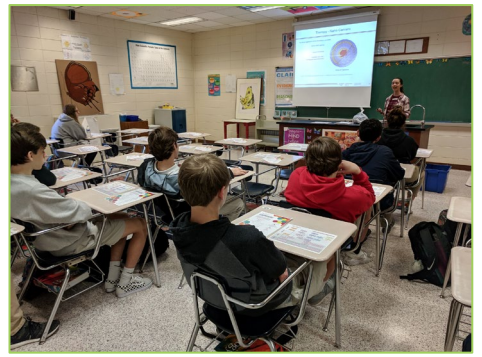
NSF

NanoEarth

Staff Time for Outreach, Lectures, etc.

Many activities do not require the direct investment of funds and need only allocation of staff time.

- Guest Lectures
  - REEU (Research & Entrepreneurship Experience for Undergraduates)
  - Contaminants of Concern
- Outreach Events
  - Facility tours
  - Science festivals
  - Class/school visits



NSF S-STEM award to J. Allen at Concord U.

- "Science Engagement and Active Mentoring to Build Science Identity among Students in Computer Science, Chemistry, and Geosciences"
- Provide funding support for class visits to NanoEarth to continue our success partnership

National Nanotechnology Coordinated Infrastructure

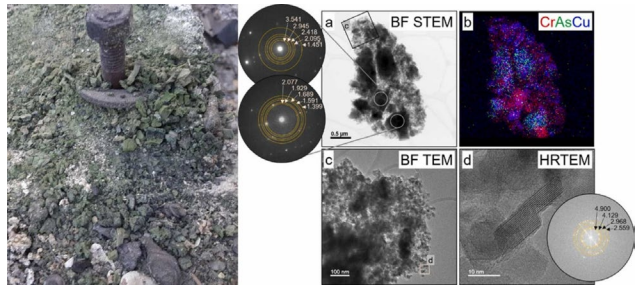
NSF

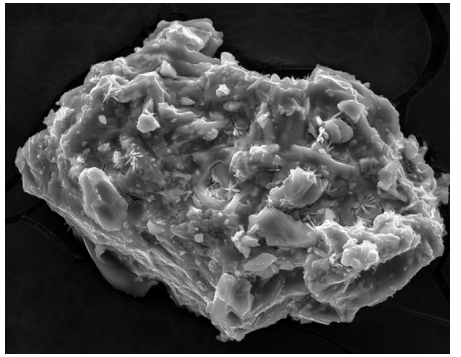
NanoEarth

Living on Beyond NanoEarth: External Projects

Seed funding through our Multicultural and Underserved Nanoscience Initiative (MUNI) has supported the initial work for many successful grant proposals for external users

- Selected recent examples
  - STaR Division: Science, Technology & Research (STaR) at the West Virginia Higher Education Policy Commission Research Challenge Grant (RCG) for C. Dumitrescu, et.al - “Synergistic Conversion of Captured C02 and Green H2 to Value-Added Products for a Decarbonized Economy.”
  - WVHEPC STaR RCG for O. Sanyal, et.al - “Metal-Embedded Carbon-based Catalytic Membranes for Co-production of Ammonia and Ethylene.”
  - NSF awards for J. Xu, Arizona State University, Elucidating Mechanisms of Metal Sulfide-Enabled Growth of Anoxygenic Photosynthetic Bacteria Using Transcriptomic, Aqueous/Surface Chemical, and Electron Microscopy Tools (NSF EAR-2311021 & DE-SC0021995)
  - NSF & USGS awards for M. Baalousha, University of South Carolina - Wildland-urban interface (WUI) fire ashes as a major source of incidental nanomaterials (INMs) (NSF CBET-2101983)
  - NASA award for A. Hornsby, Cornell University, Volcanic Ash and its impact on the Earth System
  - Multiple current SBIR and STTR with small local businesses





National Nanotechnology Coordinated Infrastructure

NSF

NanoEarth

NanoEarth's Legacy at Virginia Tech

Though NanoEarth funding is not used directly for internal users, the Earth and environmental expertise and the familiarity of working primarily with external users has resulted in significant new awards, initiatives, and programs at Virginia Tech

Research Centers	**CIP-CAR NRT** Convergence at the Interfaces of Policy, Data Science, Environmental Science and Engineering for Combating Antimicrobial Resistance NSF Research Traineeship	**MITAGATE FLU** Multidisciplinary InvesTIGation to Ease inFLUenza	**COMPASS Center** Community Empowering Pandemic Prediction and Prevention from Atoms to Societies
Governmental Research Priorities	**NSF Rules of Life / EPA Groundwater Availability & Quality / Clean Water** Phytoplankton & Water Quality Enhanced Aquifer Recharge Microplastics	**Nano4EARTH Challenge / Climate Change** Ocean fertilization for atmospheric CO_2 removal in collaboration with M. Hochella at PNNL and Circle Verde, TX Atmospheric Dust Minerology	
Operations	**GlycoMIP** NSF Materials Innovation Platform for Glycomaterials	**VAST** Virginia Alliance for Semiconductor Technology	**Center for Coastal Studies**

National Nanotechnology Coordinated Infrastructure

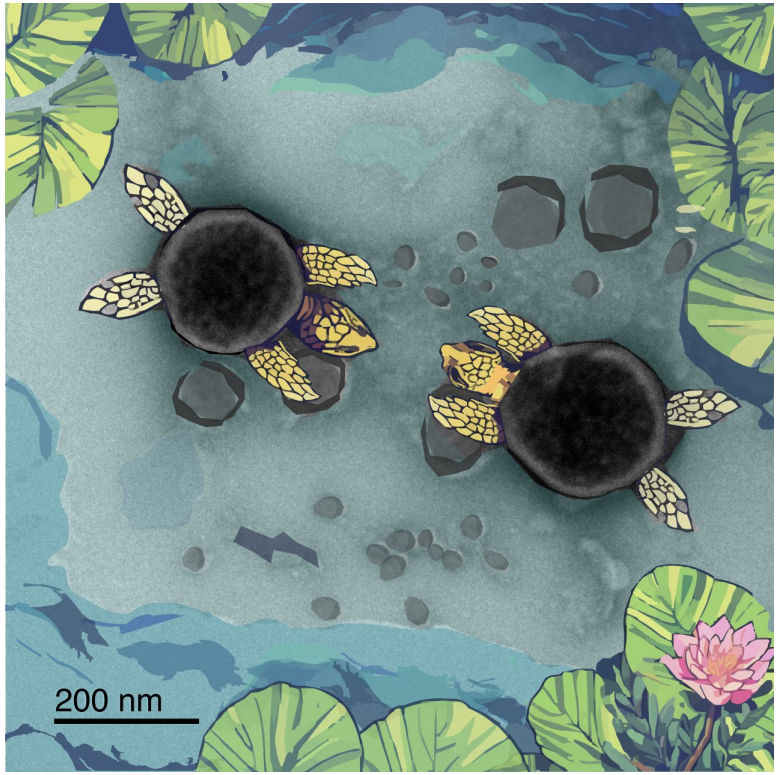
NSF

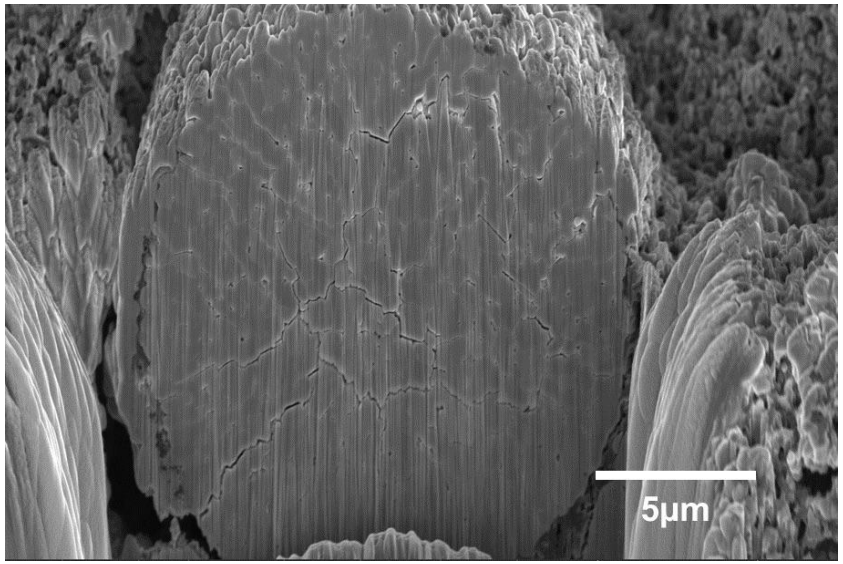
NanoEarth

Acknowledgements

- **NanoEarth**: Michael Hochella, Marc Michel, Matthew Hull, Linsey Marr, Amy Pruden, Peter Vikesland, Madeline Schreiber, Tonya Pruitt, Weinan Leng, Charis Horn, Bipin Lade, Sylvianne Velasquez
- **NCFL/ICTAS**: Susette Sowers, Steve McCartney, Hongyu Wang, Jarret Wright, Stefan Duma, Erin Poff, Lisa Stables
- **NanoEarth EAB**: Current: John Bargar, Anita Broach, John Chermak, Patricia Maurice, and, Former: Nancy Hess, James Howe, Helen Hsu-Kim, Tim Long, Nita Sahai, Don Sparks
- **Nano EES-RC**: David Mogk, David Dickensheets, Trevor Thornton, Carleton College, Monica Bruckner, Workshop Guest Speakers & Participants
- **NNCI Site Directors** (especially after each RSR)
- **NNCI Coordinating Office**: Oliver Brand, David Gottfried, Amy Duke
- **NNCO**: Branden Brough, Quinn Spadola
- **NSF**: Richard Nash, Larry Goldberg, David Lambert, Nora Savage

Questions?





National Nanotechnology Coordinated Infrastructure

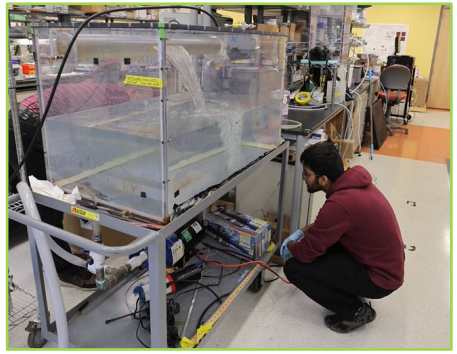
NSF

NanoEarth

Funded Research Projects – Internal Users

Though NanoEarth funding was not used directly for internal users, the Earth and environmental expertise brought together by the center has directly sparked several recently funded research initiatives

- NSF DBI-2412389 “PIPP: Phase II Center for Community Empowering Pandemic Prediction and Prevention from Atoms to Societies (COMPASS Center)” ($18M)
- NSF EFMA-2318093 “EFRI: Programmable Nano-Bio-Hybrid Living Systems for Continuous Monitoring of Airborne Pathogens” ($2M)
- NSF DEB-2327030 “LTREB: Integrating real-time open data pipelines and forecasting to quantify ecosystem predictability at day to decadal scales” ($450k)
- NSF EF-2318861 “URoL:ASC: Applying rules of life to forecast emergent behavior of phytoplankton and advance water quality management” ($2M)
- Wellcome Leap “Personal, Real-time Sensor for SARS-CoV-2 in the Indoor Environment” ($1M)
- NASA “From the Earth Surface to Atmospheric Aerosols: Understanding the Evolution of Dust Mineralogy and Geoschemistry” ($684K)
- EPA “Risk and Performance Evaluation of Enhanced Aquifer Recharge in the Coastal Plain” ($2M)
- Numerous microplastics and nanoplastics research programs



National Nanotechnology Coordinated Infrastructure

NSF

NanoEarth