

KY MULTISCALE

The NSF NNCI Multi-Scale Manufacturing & Nano Integration Node

“Converging Nanoscale Science with Emerging Advanced Manufacturing Technologies”



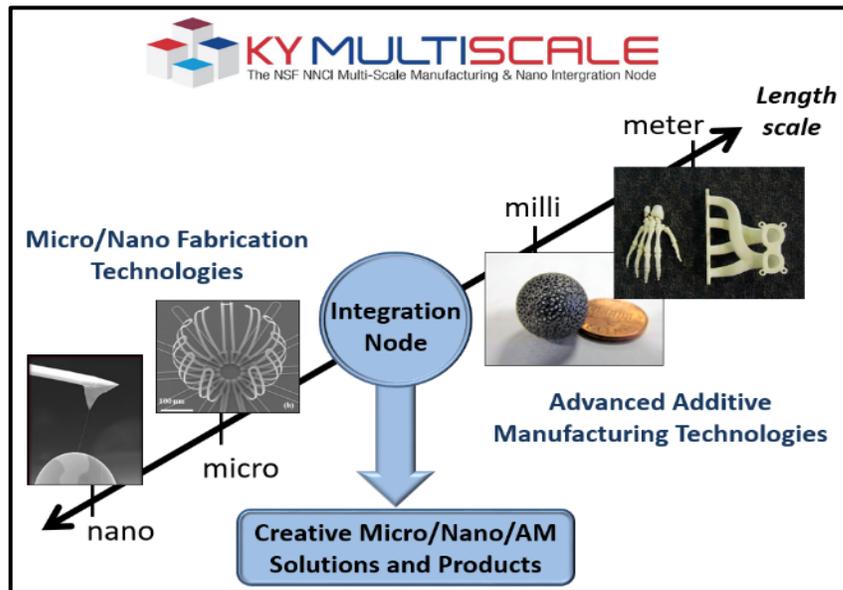
Year 7 NNCI Annual Conference
Oct 19-21, 2022
Ithaca, NY



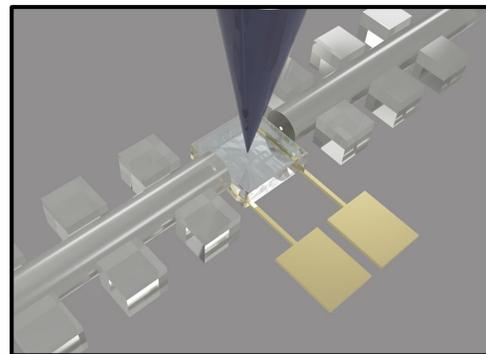
KY Multiscale – Overview and Focus

OVERVIEW - KY MULTISCALE (short for KY Multiscale Manufacturing and Nano Integration Node) is an NNCI site between the Universities of Louisville and Kentucky that provides users the ability to perform research and build prototypes over various lengthscales and in a variety of materials using diverse advanced manufacturing technologies.

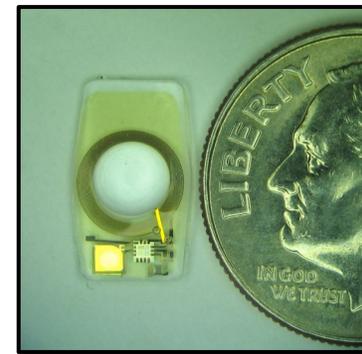
FOCUS – While our site offers core facilities and expertise for traditional microfabrication, MEMS technology, nanotechnology, imaging, and characterization, the **focus** of our site is the convergence of micro/nanotechnology with emerging advanced manufacturing processes (*direct write aerosol jet printing, 2-photon 3D lithography, additive manufacturing, 3D printing, fiber-weaving, roll-to-roll manufacturing, MEMS micro-assembly, etc*).



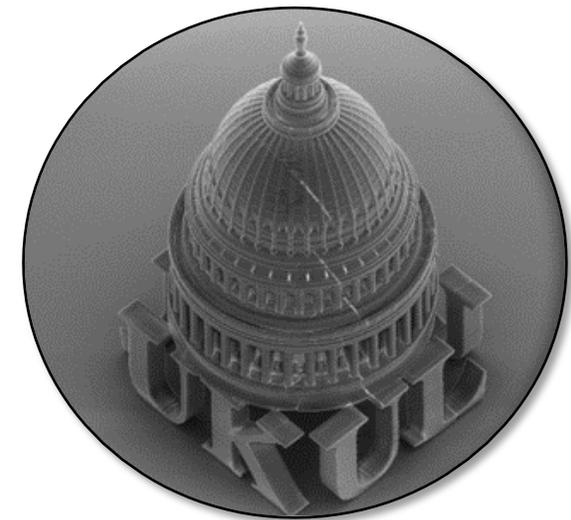
Our strength and focus is
MULTISCALE ADVANCED MANUFACTURING.



3D printed micro-reservoir for in-situ spectroscopy



Glaucoma sensor for a start-up company



KY Multiscale – Most Impactful Year 7 Activity

Hosting the *2022 NNCI REU Convocation*
and integrating it with our
Annual Nano+Additive Manufacturing Convergence Summit



www.nanoamsummit.com

Louisville, KY
August 9-10, 2022

Summit and Convocation Highlights

- **Record 260 Attendees** from Academia, Industry and Government
- **60 Top REU** students from the NNCI Network
- **5 World-renown Keynote Speakers**
- **38 Technical Presentations**
- **Record 113 Research Posters**
- **Record 20 Vendors and Sponsors**
- **Very Engaging Career Panel**

Presented a unique opportunity for the REU students to...

- a) listen to amazing keynote speakers
- b) interface with academic and industry professionals
- c) observe graduate level research, and
- d) socialize with their peers

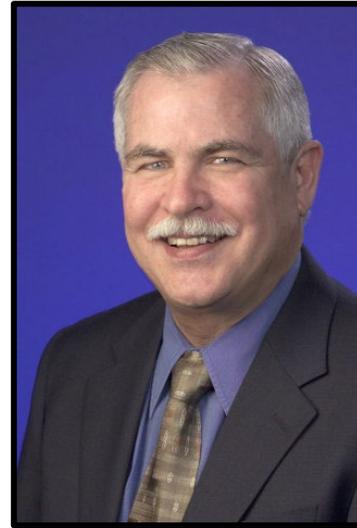
Keynote Speakers



Prof. John Rodgers
Northwestern
University



Dr. Gil Vandentop
VP Intel



Dr. Kurt Peterson
Silicon Valley
Band of Angels



Dr. Ola Harrysson
NCSU (CAMAL)



Dr. Khershed Cooper
National Science
Foundation

Keynote Presentations



- “Three Dimensional Mesostructures – from Neural Interfaces to Electronic Microfliers” by Prof. John Rogers
- “Semiconductor Research @ Intel Labs” by Dr. Gil Vanden-top
- “Micro/Nano/MEMS Entrepreneurship” by Dr. Kurt Petersen
- “The Role of Additive Manufacturing in the Medical Field - Today and in the Future” by Dr. Ola Harryson
- “Nanomanufacturing Research and Advanced Manufacturing at NSF” by Dr. Khershed Cooper.

Summit Leaders and Invited Speakers



General Chair Dr. Kevin Walsh & Technical Chair Dr. Shamus McNamara



UK NNCI KY Multiscale Co-Director Dr. Todd Hastings



UofL Exec VP for Research and Innovation Dr. Kevin Gardner



Director of NNCI Coordinating Office Dr. Oliver Brand



Summit Coordination and Logistics Ana Sanchez Galiano



Dean of UofL Eng Dr. Emmanuel Collins



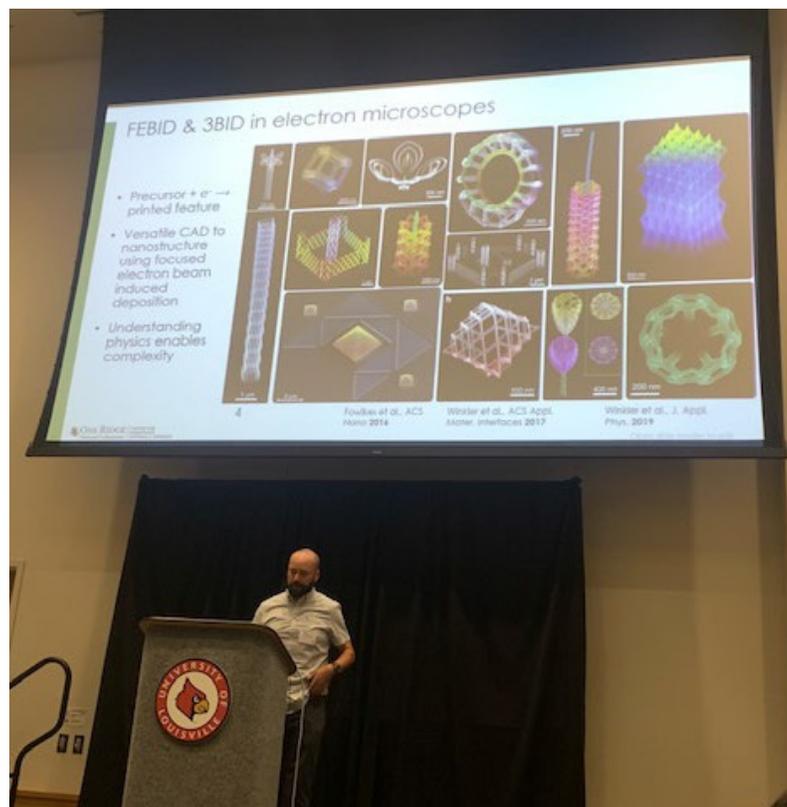
UK Exec VP for Research and Innovation Dr. Lisa Cassis



Cornell Nanoscale Facility Manager and NNCI REU Director Dr. Lynn Rathbun

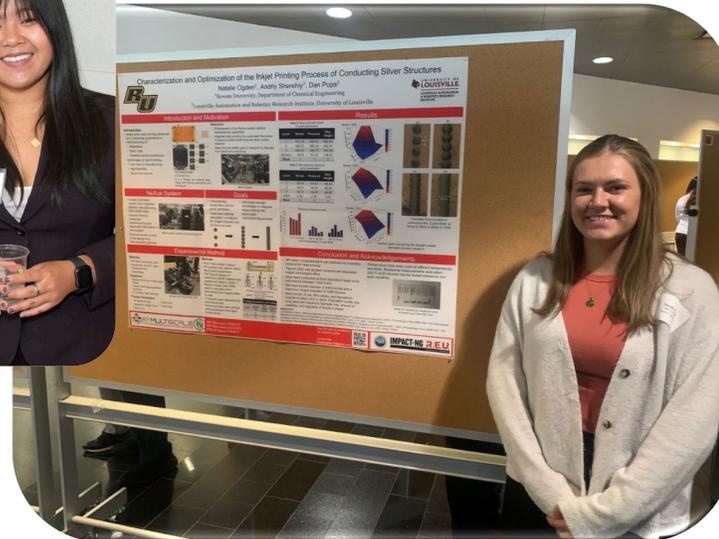
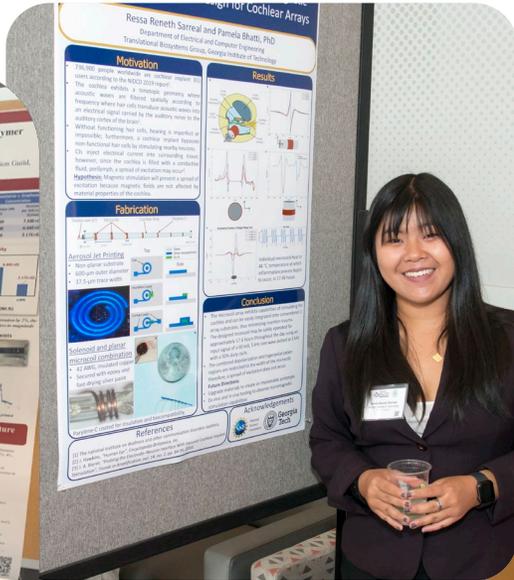
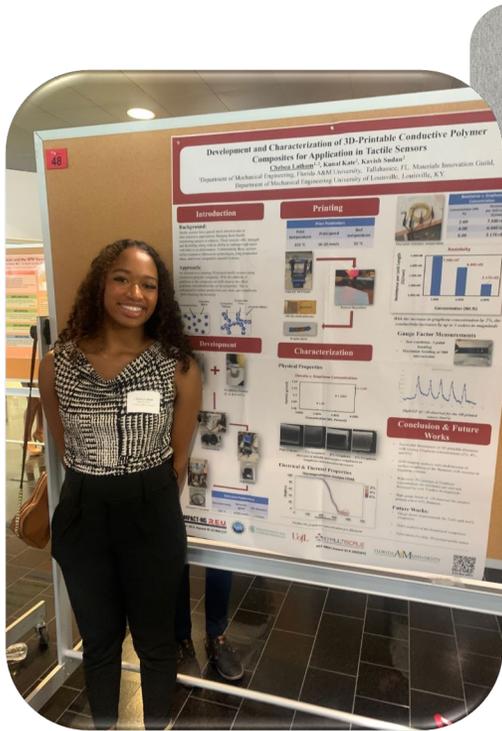
Two Parallel Technical Sessions

38 Peer-Reviewed Technical Talks from Academia, Government and Industry



Poster Presentation Showcase

113 Research Posters from Academia, Government and Industry (plus awards)



Vendors and Sponsors



Social Networking

Networking Opportunities Included:

- 2 Days Networking Breakfast/Lunch
- Poster & Evening Reception
- Facilities Tours (3 Core Facilities)
- Career Panel & After Discussion



REU Convocation Highlights

Reception at the KY Derby Museum



 **2022 NNCI REU Convocation**
Louisville, KY 



 **2022 NNCI REU Convocation**
Louisville, KY 



REU Convocation Highlights

10 NNCI Participating Sites (60 students)

CNF	The Cornell NanoScale Science & Technology Facility	Cornell University
CNS	Center for Nanoscale Systems	Harvard University
MANTH	Mid-Atlantic Nanotechnology Hub	University of Pennsylvania & Community College of Philadelphia
KY Multiscale	Kentucky Multi-Scale Manufacturing and Nano Integration Node	University of Louisville & University of Kentucky
NCI-SW	Nanotechnology Collaborative Infrastructure Southwest	Arizona State University, Northern Arizona U., Rio Salado College, & Science Foundation Arizona
RTNN	Research Triangle Nanotechnology Network	North Carolina State University, Duke University, and University of North Carolina at Chapel Hill
SENIC	Southeastern Nanotechnology Infrastructure Corridor	Georgia Institute of Technology & Joint School of Nanoscience and Nanoengineering
MONT	Montana Nanotechnology Facility	Montana State University & Carleton College
SDNI	San Diego Nanotechnology Infrastructure	University of California – San Diego
SHyNE	Soft and Hybrid Nanotechnology Experimental Resource	Northwestern University & University of Chicago

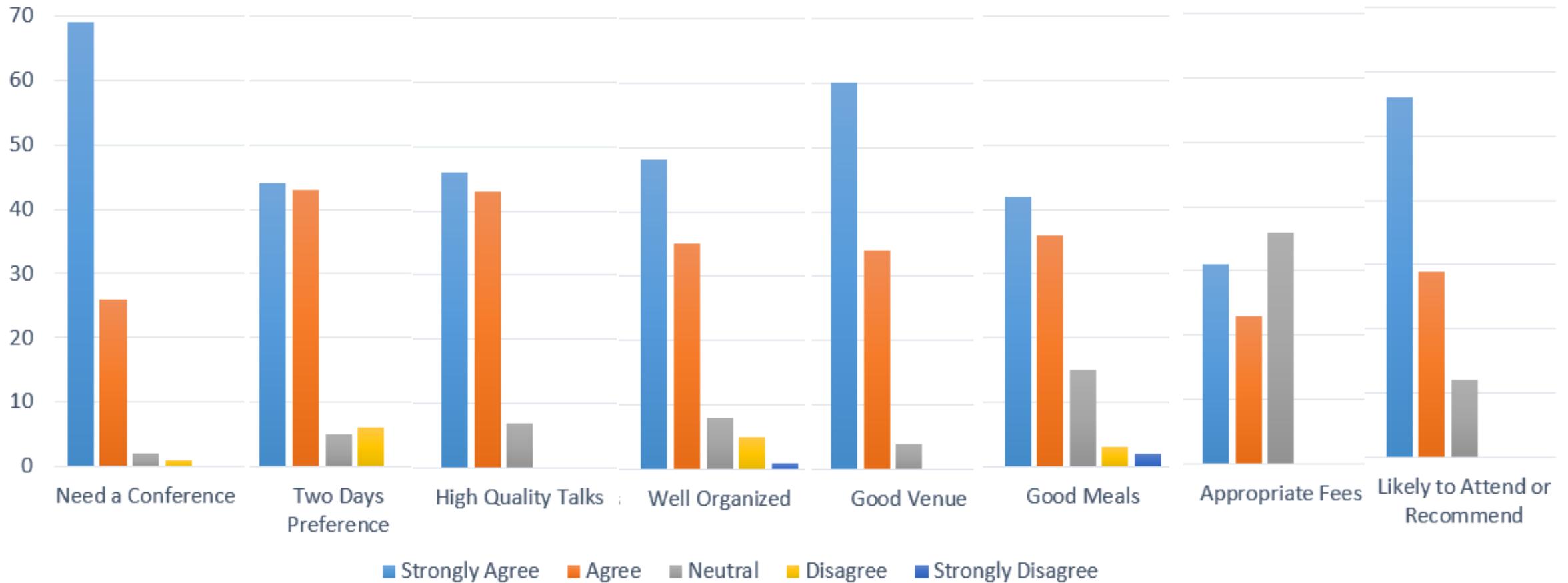


Thanks to our Participating NNCI Sites

- **CNF** – REU Presentation by Dr. Rathbun and REU Convocation advice
- **SENIC** – NNCI Presentation by Dr. Oliver Brand
- **RTTN** – Keynote Speaker Ola Harryson
- **SHYNE** – Keynote Speaker John Rogers
- **10 of the 16 NNCI Sites** - sent REU students
- **Several NNCI Sites** – presented oral talks or posters



Survey Results (Summit and REU Students)



Attendee Disciplines

Number	Discipline (self identified)	Number	Discipline (self identified)
11	Physics	2	Engineering
10	Additive Manufacturing	2	Organics
9	Mechanical Engineering	2	Microfabrication and Simulations
8	Electrical Engineering	1	Advanced Material Development
8	Material Science	1	Aerosol Science
8	Chemistry	1	Civil Engineering
8	Micro/nanotechnology	1	Electron Microscopy
7	Bioengineering	1	Safety and Health
6	Chemical Engineering	1	Semiconductors
3	Computer Science	90	TOTAL

Survey Comments

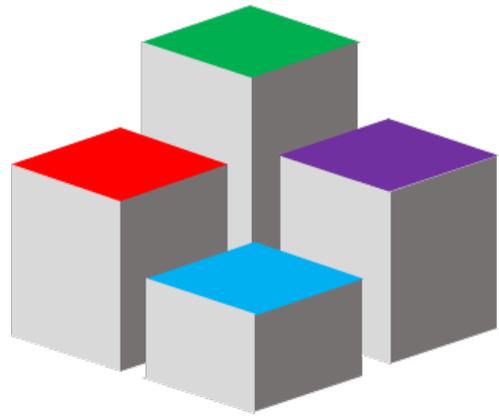
What Did You Like Best

- Summit Themes
 - Keynote Speakers
 - Poster Session
- REU Themes
 - Keynote speakers
 - Poster session
 - Networking opportunities

Areas of Improvement

- Summit Themes
 - More networking opportunities
 - Stay on schedule
 - Topic ideas (traditional 3D printing, medical, semiconductors, commercialization)
- REU Themes
 - Longer poster session
 - More networking/socializing opportunities
 - Food - label food for GF, vegetarian, vegan, etc., more substantial

Next Summit



Annual NNCI Nano + Additive Manufacturing

S U M M I T

July 25-27, 2023
Louisville, KY

- Starting to line up our Keynote Speakers NOW
- Special emphasis on the convergence of nano with additive
- Suggestions welcomed!
- Participation welcomed!

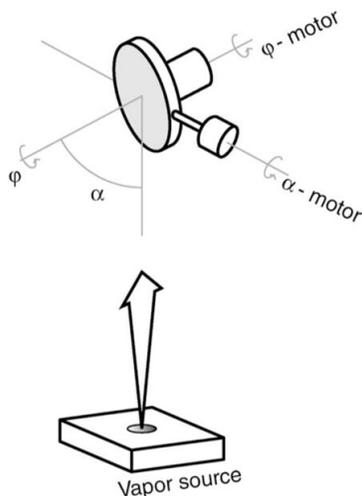
Exciting Research Example

KY Multiscale – Research Highlight

Anti-bacterial Surfaces using 3D Assembled Nano-structures

Dr. Chuang Qu (ECE) in collaboration with UofL Biology Department

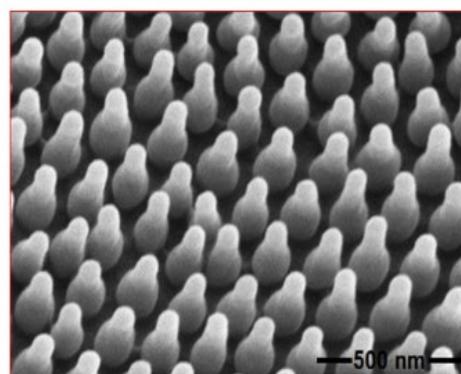
Research uses nano-sphere seeding, selective etching, and glancing angle deposition (GLAD) to mimic the nano-structures found on Cicada wings and produce anti-bacterial surfaces.



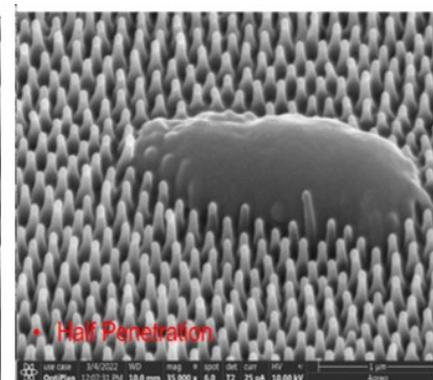
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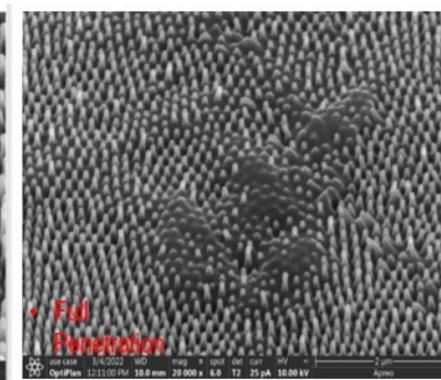
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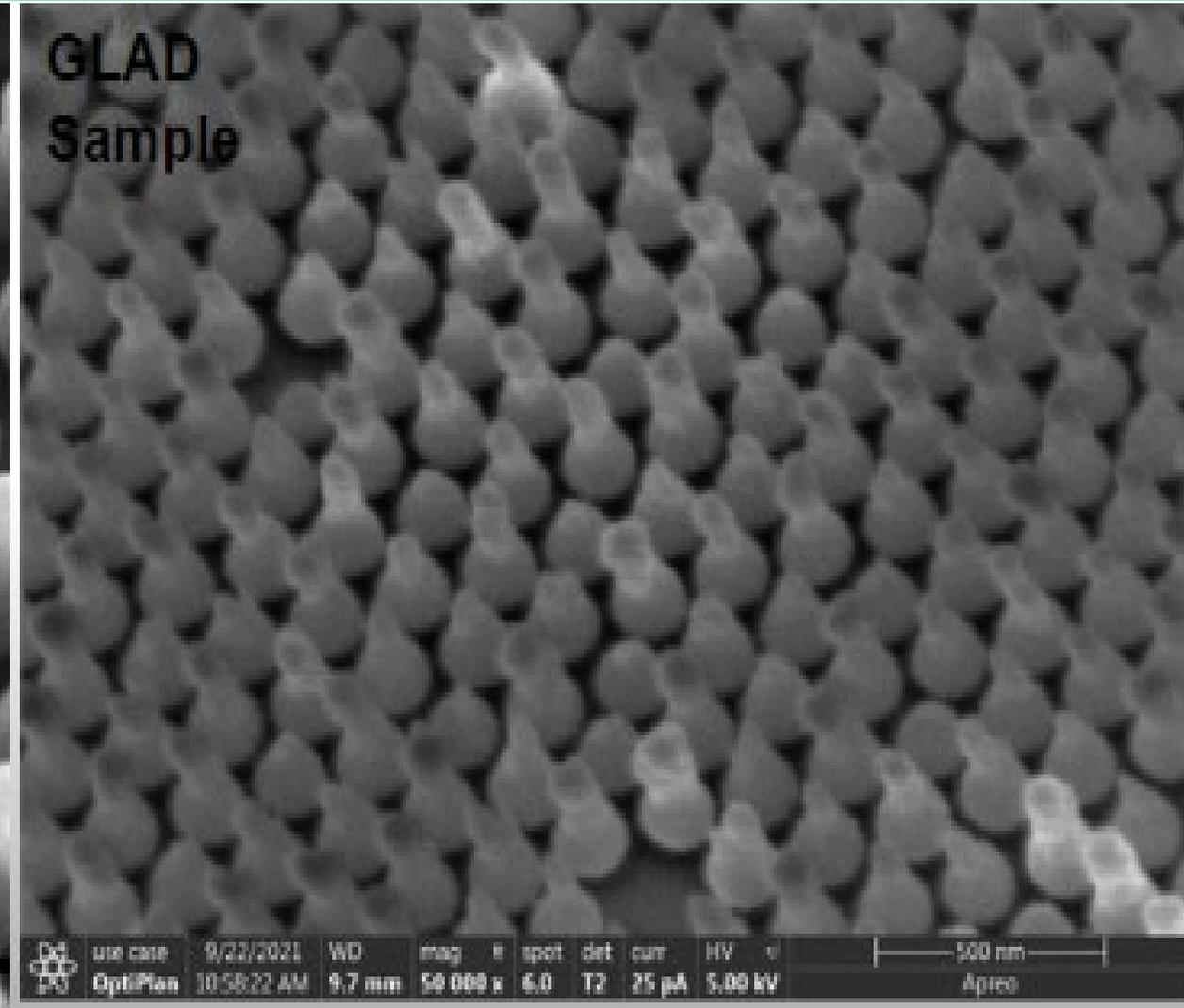
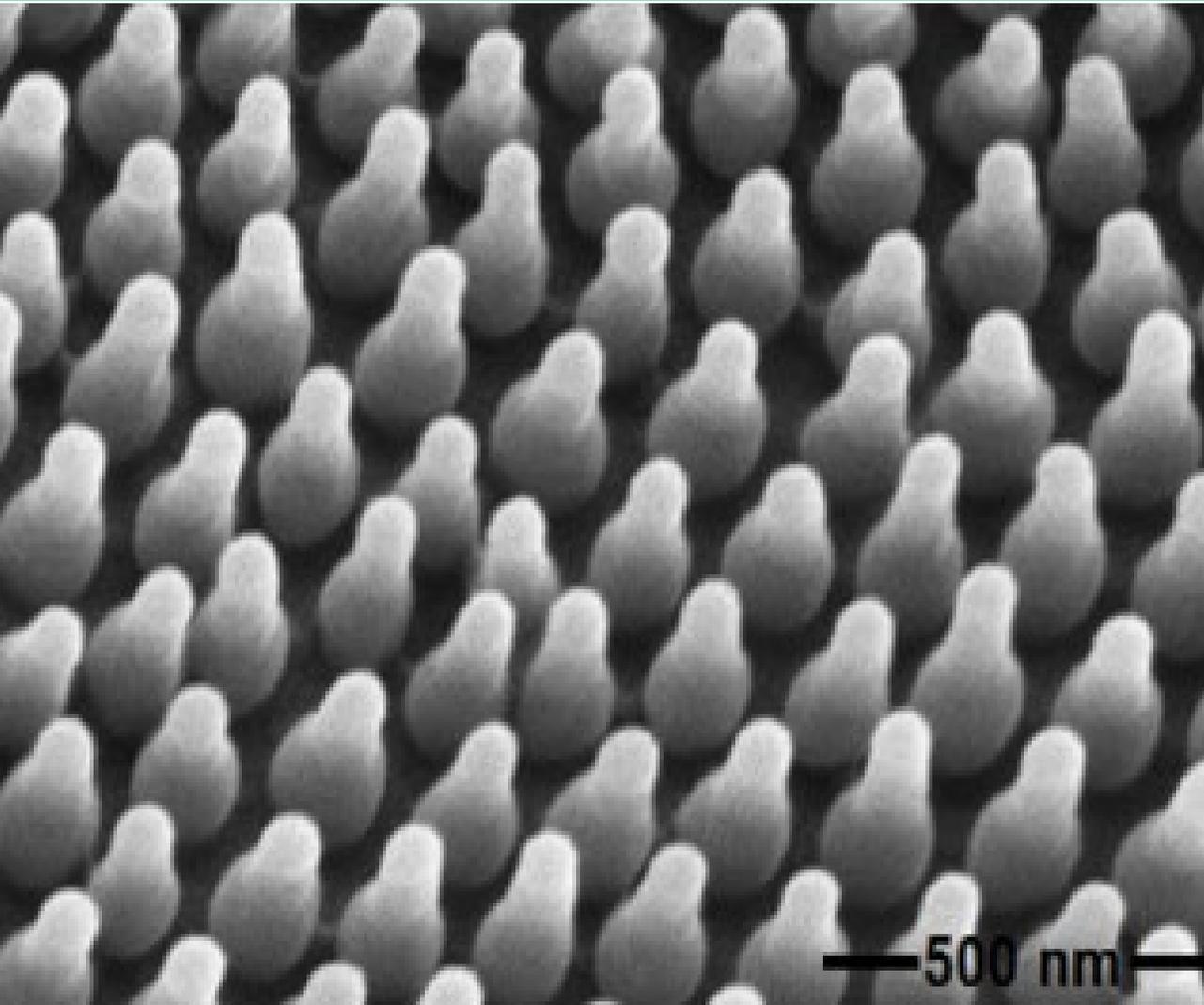


e

(a) Cicada insect, (b) hydrophobicity demonstration of the cicada wing, (c) SEM showing unique nano-structures, (d) initial stage of bacteria penetration, (e) latter stage of bacteria penetration

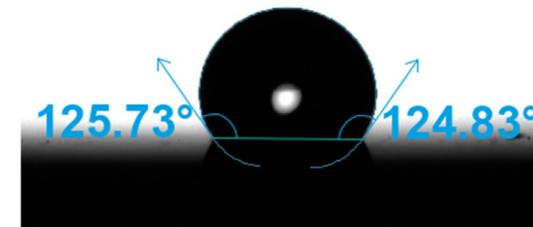
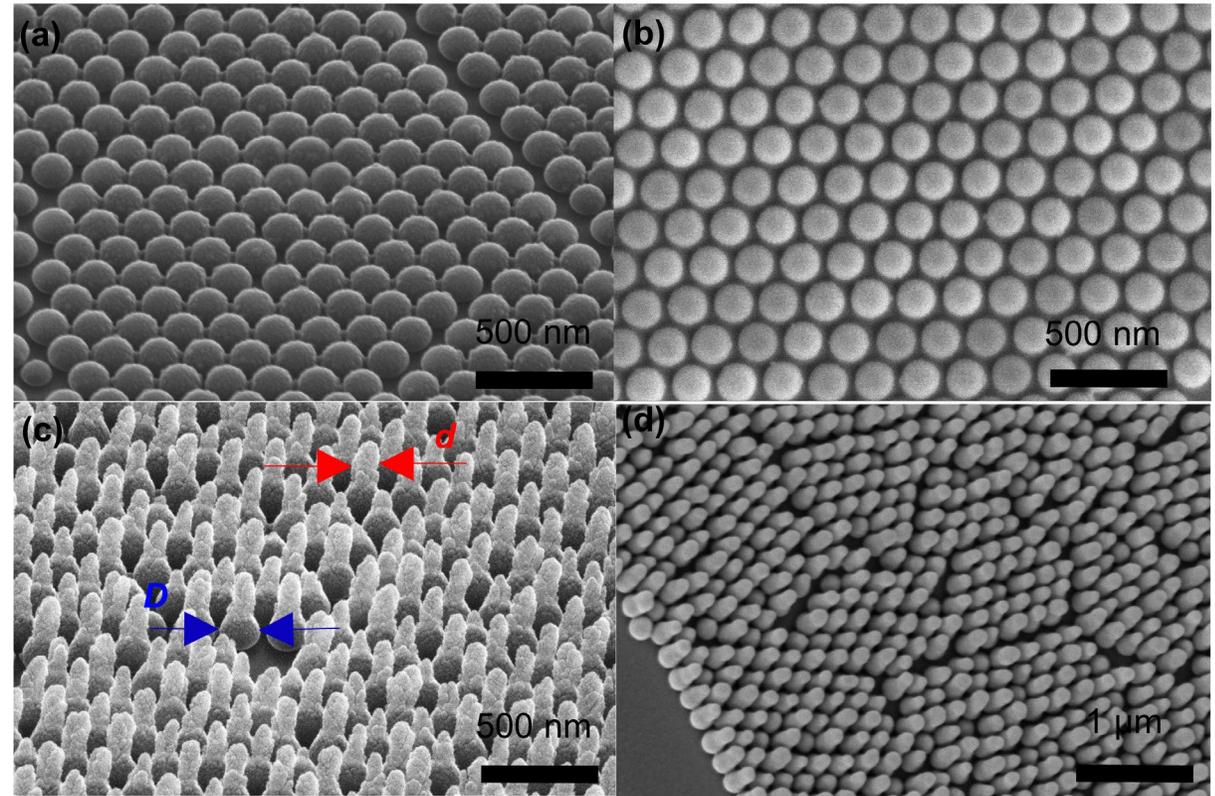
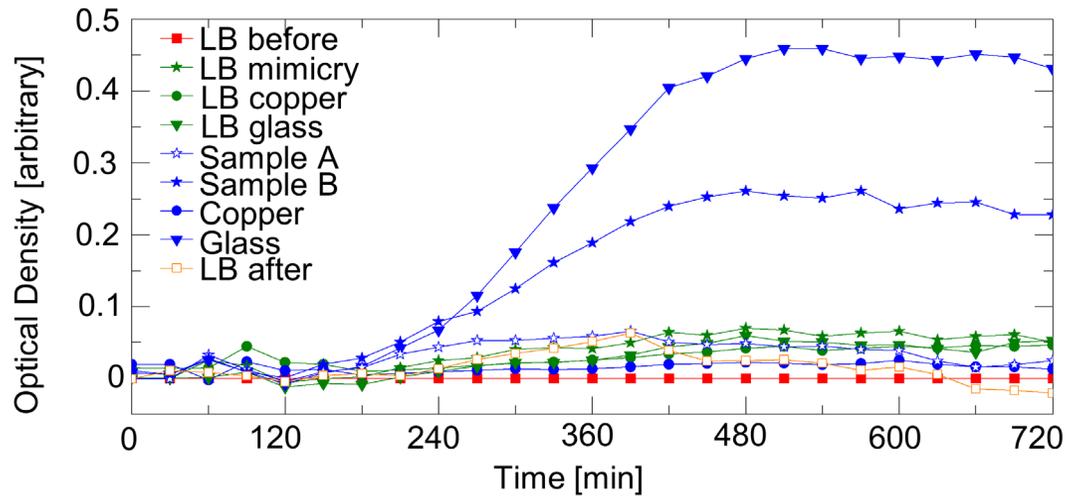
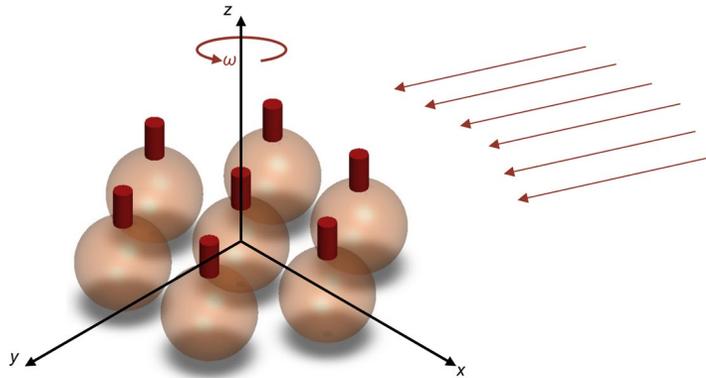
Dr. Qu's research has been published in the Journal of Vacuum Science Technology A and was presented at the *International Conference on Metallurgical Coatings and Thin Films (ITMCTF) Conference* in San Diego this past summer.

KY Multiscale – Research Highlight



KY Multiscale – Research Highlight

Synthetic Anti-bacterial Surfaces



Thank You

