



**nano@illinois**<sup>TM</sup>

*nano solutions for mega problems*

# nano@illinois Research Experiences for Teachers

**Carrie Kouadio, Irfan Ahmad, Lynford Goddard, and Xiuling Li**  
**University of Illinois at Urbana-Champaign**

National Science Teachers Association Conference  
Minneapolis, MN  
October 27, 2016



**CNST** University of Illinois Center for Nanoscale Science and Technology



# Objectives

- The Center for Nanoscale Science and Technology (CNST) was created as a campus-wide initiative to facilitate research and education in nanotechnology
- To facilitate development efforts to commercialize patentable ideas, processes, and products; through collaborative efforts between academia, industry, and policy makers



# Micro and Nanotechnology Laboratory



Brian Cunningham, Director,  
Micro and Nanotechnology Lab.  
Irfan Ahmad, Executive Director, Center for  
Nanoscale Science and Technology

# Center for Nanoscale Science and Technology

- **STEM outreach: synergy with research**
- **Strong efforts through entire educational pipeline**
- **Commitment to increasing STEM diversity**

➤ Nano-CEMMS (2003-2013)

➤ NanoSTRuCT (2013-2016)

Booker T. Washington STEM Academy

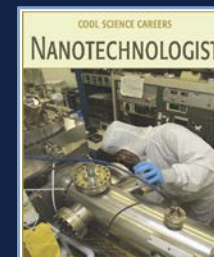
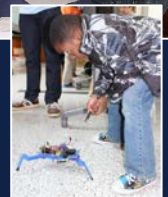
Engineering Open House

Science at the Market

➤ nano@illinois RET (2014-2017)

➤ nano@illinois REU (2014-2016)

➤ EBICS REU (2011-2020)



ENGINEERING AT ILLINOIS

nano@illinois

RET/REU Programs	2003-16
Nano-CEMMS RET/REUs	101
nano@illinois RETs	27
nano@illinois REUs	30
EBICS REUs	91
<b>TOTAL</b>	<b>249</b>

**CMMB:** Cellular for Molecular Mechanics and Bionanotechnology-NSF

**EBICS:** Emergent Behavior of Integrated Cellular Systems- NSF

**M-CNTC:** Midwest-Cancer Nanotechnology Training Center- NIH/NCI

## NanoSTRUCT: Nanoscale Science and Technology Resources for Community Teaching



Training the next generation of leaders in STEM will begin long before students step foot onto a university campus. Excitement about STEM fields is built as children learn about science. To that end, the Center for Nanoscale Science and Technology Student Initiative (CNST-SI) has partnered with Booker T. Washington STEM Academy (BTW) to engage the 3<sup>rd</sup> grade level with a six-week long program of nanotechnology and STEM themed activities. (2014-16)



Student from University of Illinois

The REU: Research Experience for Undergraduates students are become engaged in cutting-edge research in nanotechnology, to solidify their interest in graduate research and education, train them in critical elements of leadership, ethics, teamwork, mentoring, outreach, and improve their ability to communicate their research results to professional and lay audiences. (2014-2017)



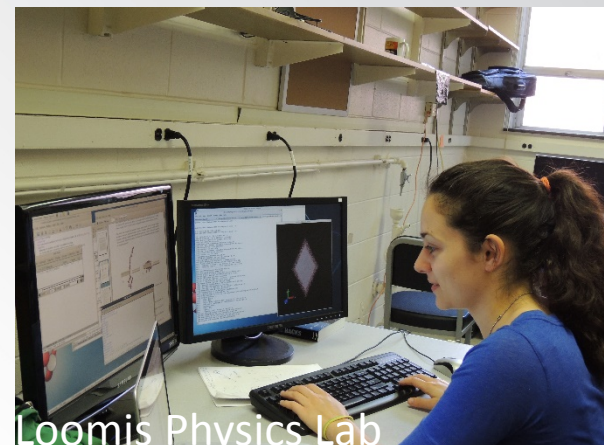
Student from University of New Mexico



Student from Louisiana State University



Student from Franklin W. Olin College of Engineering



Student from McGill University

The *nano@illinois* Research Experience for Teachers (RET) at the University of Illinois at Urbana-Champaign annually exposes a diverse set of in-service and pre-service science, technology, engineering, and mathematics (STEM) teachers and community college faculty from across the nation to cutting-edge research in nanotechnology.

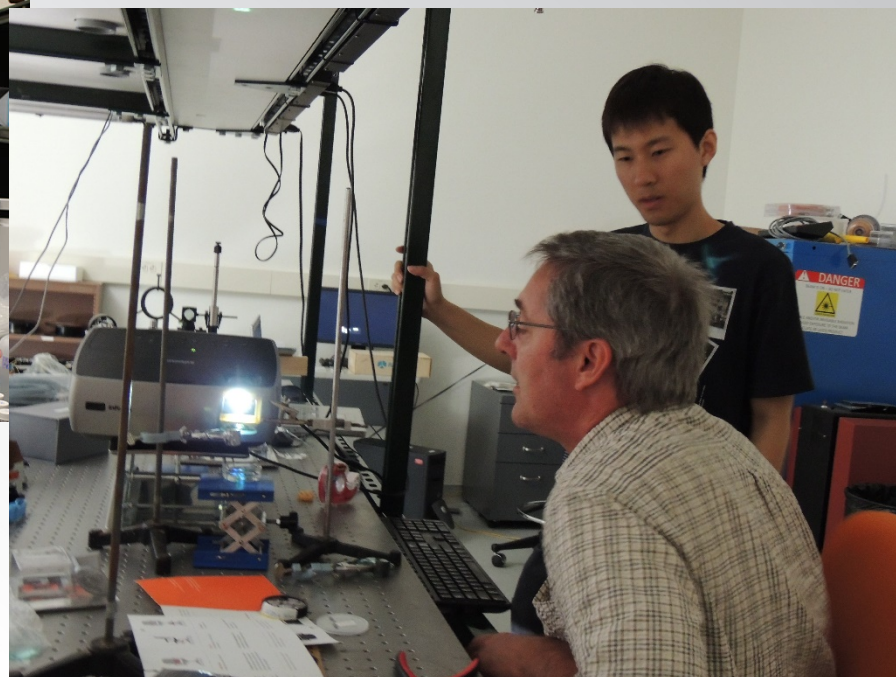
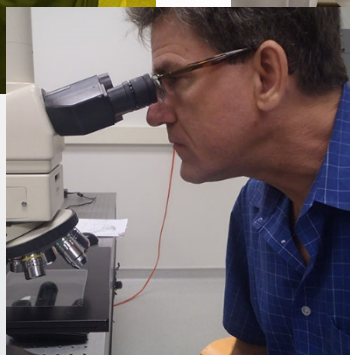
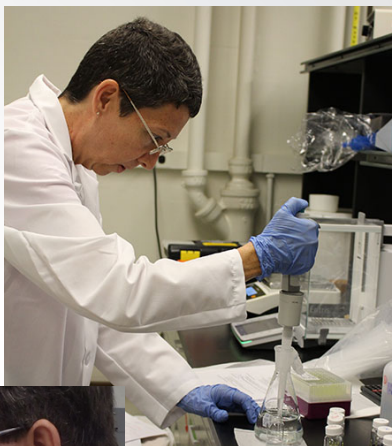
<http://nano.illinois.edu/education/nanoret.html>





Participants conduct research in world-class labs and engage in other activities over 6 weeks on a full-time basis, with 4 follow-up sessions during the school year.





The **nano@illinois RET: Research Experience for Teachers** participants are mentored and trained in broad areas of nanotechnology, as they delve deeper into their chosen area of interest, including nanoelectronics, nanophotonics, nanomanufacturing, nanomaterials, or nanobiotechnology. These participants connect their research experiences and programmatic experiences to their content areas, including physics, chemistry, biology, math, and engineering. The teachers develop high-quality modules based on their experiences.





Xiuling Li, PI, Participating Faculty, Electrical and Computer Engineering



Lynford Goddard, co-PI, Participating Faculty, Electrical and Computer Engineering



Irfan Ahmad, Executive Director, Center for Nanoscale Science and Technology



Carrie Kouadio, Program Coordinator, Center for Nanoscale Science and Technology



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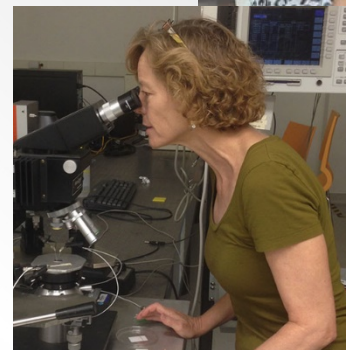
### Overview

- nano@illinois RET runs 2014-2017
- 6 week program: June 28-August 8, 2017
- 8:30 am-6:00 pm generally; other times as well
- Coordinated by the Center for Nanoscale Science and Technology
- Managed and coordinated by the Center for Nanoscale Science and Technology (CNST)
- Micro and Nanotechnology Laboratory (MNTL) provides the research and mentoring resources
- Rich professional development activities
- Lab research and related activities, hours determined by mentors



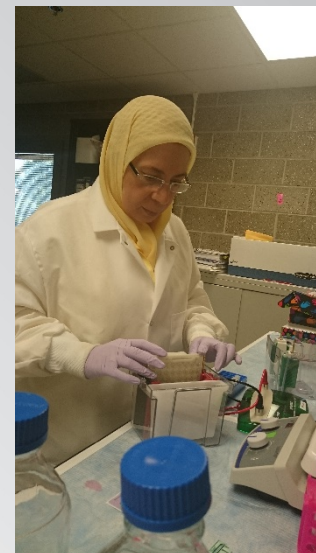
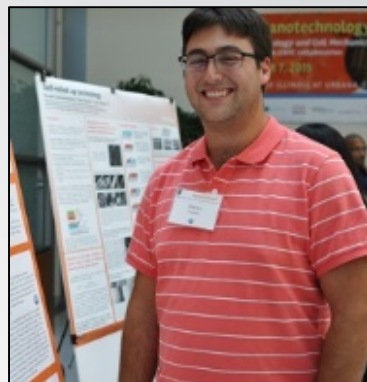
## Logistics

- Stipend: \$7000 for practicing teachers, \$3500 for pre-service teachers
- \$500 directly to school for materials and supplies
- Lab trainings included
- Professional development credits
- Wireless access given
- Participants bring laptop every day



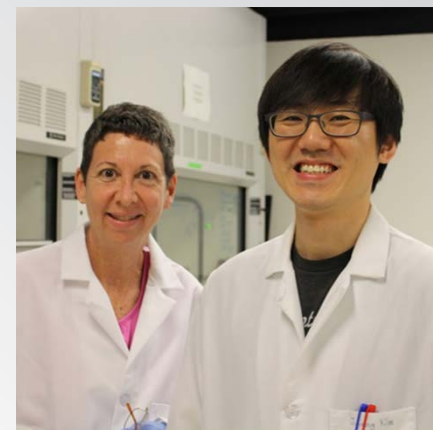
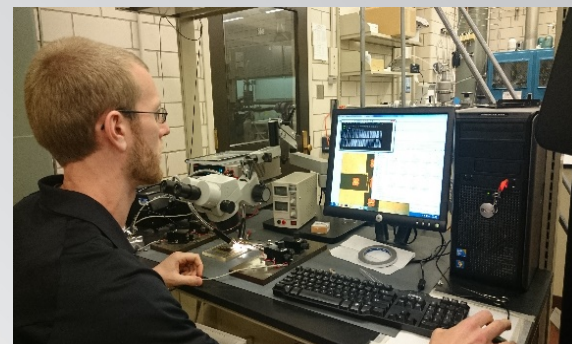
## Program benefits

- Hands-on research
- Faculty/peer mentoring
- Professional development
- Networking/social events
- Lab training
- Generous stipend, to be disbursed over duration of program, with final payment after completion of all required responsibilities
- \$500 materials support for classroom activities



## Requirements

- Work in lab as long as required
- Participate in all program activities
- Products: module, poster, and presentation
- Integrate module into curriculum/use with students
- Gather data about integration
- Create all teacher/student resources for module to disseminate nationally



## Products

- Poster: end of summer 2017
- Presentation: end of summer 2017
- Final Module: due fall 2017
- Final Session Presentation, TBD, fall 2017  
(videoconference attendance for non-local participants)





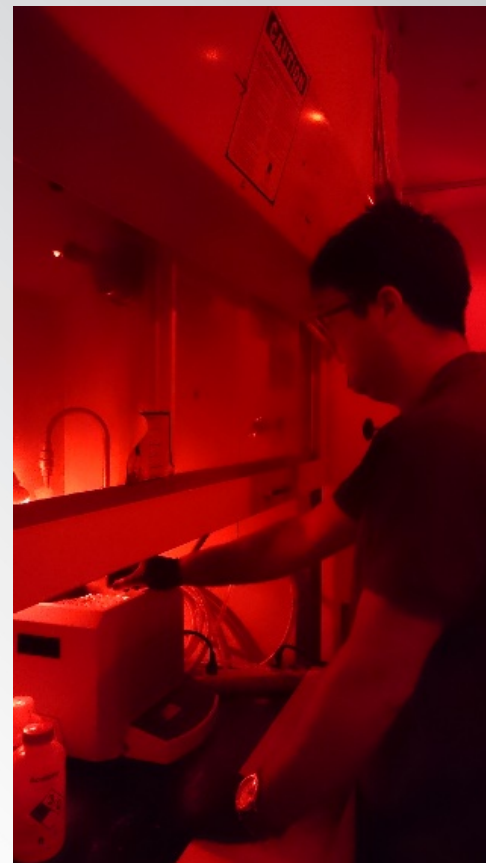
## Module

- A high-quality multi-day instructional module with associated instructional resources that is grounded in the research you conducted throughout the summer and research area you worked in



## Resources will include:

- Presentation
- Teacher Guide
- Student Guide
- Worksheet(s)
- Assessment(s)
- Video
- Purchases List



- The Creation of a MNTL Educational Database Using 4Ceed
- Releasing Self-Rolled-Up SiN<sub>x</sub> Membranes with H<sub>2</sub>SO<sub>4</sub>/S<sub>2</sub>O<sub>8</sub><sup>-2</sup>
- Using Gold Nanoparticles for Bioimaging Cell Membrane Lipids in Stroke-Related Ischemia
- LED's Lighting Up the Future
- Crumpled Graphene Strain Sensor
- Effects of Flow Rate on the Synthesis of Gold Nanoparticles
- Self-Assembled Gold Triangular Nanostructures
- Effects of Temperature on Synthesis of Gold Nanoparticles
- Growth and Transfer of 2D Materials
- Low-Cost and Convenient Photoelectrochemical Etching with a Projector (PECEP) Setup for High School Use
- Synthesis of Metal Organic Frameworks Shells on Gold Nanorods Using a Layer by Layer Technique



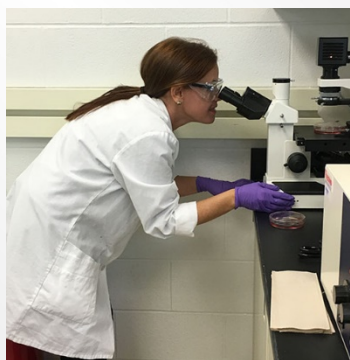
**Interviews:  
nano@Illinois RET Program (2014-2017)**



Beth Koplinski, Booker T. Washington STEM Academy, Champaign, IL



Antonio Gamboa, Garey Senior High School, Pomona, CA



Diana Rodriguez, CROEM School (El Centro Residencial de Oportunidades Educativas de Mayagüez ), Mayaguez, Puerto Rico

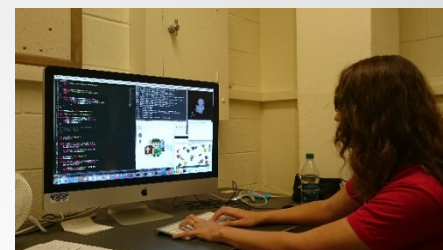


Lessons and modules that are developed will be published through the TeachEngineering online website, a digital library at <http://teachengineering.org>, nanoHub ([www.nanohub.org](http://www.nanohub.org)), and will also be accessible through the University of Illinois Center for Nanoscale Science and Technology (CNST) Resource page ([www.nano.illinois.edu](http://www.nano.illinois.edu)). CNST staff will add modules to these websites.



## Opportunities

- Contribute to research and discoveries
- Rich program
- Professional growth this summer
- Development of modules
- Contributing to STEM education publications
- Presenting at conferences
- Grant-writing
- Social and networking activities



## Contact information

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Urbana, IL 61801  
ckouadio@illinois.edu  
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### Summer 2017 Program:

- June 28-August 8, 2017
- Applications will open in January 2017
- Due date in March 2017



**ILLINOIS**  
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

### nano@illinois Research Experience for Teachers (RET)

*a 6-week nanotechnology  
research experience at the  
University of Illinois at Urbana-Champaign  
June 28 – August 8, 2017*










**Bionanotechnology**   **Computational and theoretical nanotechnology**   **Nanoelectronics and nanophotonics**  
**Nanomaterials and nanomechanics**   **Nano-electrical/mechanical systems (NEMS)/Micro-electrical/mechanical systems (MEMS)**   **Societal and Ethical Implications of Nanotechnology and Assessment**

#### Who should apply?

- ❖ Applicants must be practicing science, technology, engineering, or mathematics (STEM) teachers/community college faculty who have bachelor's degrees or higher in STEM (science, technology, engineering, and math) education or a STEM-related field OR pre-service STEM teachers who are currently enrolled in an undergraduate STEM education program (as a rising junior or higher).
- ❖ Applicants must be U. S. citizens, U. S. nationals, or permanent residents.
- ❖ Applicants must have an average technical grade point average of 3.0/4.0.
- ❖ The selection committee supports diversity among RET participants and their school populations.

**Benefits Include:**  
 \$7000 Stipend (teachers)  
 \$3500 Stipend (pre-service)  
 Partnership with Summer Research Opportunities Program  
 Materials stipend  
 Travel support (non-local)  
 Room and board  
 Hands-on research  
 Faculty/Peer mentoring  
 Professional development  
 Networking



**Applications open Jan. 2017**  
[www.nano.illinois.edu](http://www.nano.illinois.edu)  
We will begin to review applications before due date, (semi-rolling applications), so it is best to submit as soon as you are able.

**Contact**  
 Carrie Kouadio  
 RET Coordinator  
[ckouadio@illinois.edu](mailto:ckouadio@illinois.edu)  
 217-244-1353

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We would like to thank all RET participants, faculty mentors, research mentors, and staff for their contributions to the nano@illinois RET.

Questions?



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Twitter

<https://twitter.com/NanotechIL>

Center for Nanoscale Science and Technology Website

<http://nano.illinois.edu/>

