

CNST 10th ANNUAL NANOTECHNOLOGY WORKSHOP 2012

MAY 2-3, 2012

Venue: National Center for Supercomputing Applications; and
Micro and Nanotechnology Laboratory
[University of Illinois at Urbana-Champaign](#)

Wednesday, May 2

Venue: National Center for Supercomputing Applications

7:30-8:15 AM Registration and Breakfast at NCSA Atrium

Plenary Session at NCSA Auditorium

8:30-10:00 AM Plenary Session Chair: Rashid Bashir, Co-Director, CNST/; Prof ECE/BioE

8:30 Center for Nanoscale Science and Technology
Introductory Remarks

Irfan Ahmad, Executive Director, CNST; and
Acting Assistant Dean for Research, College of Engineering

8:35 **Welcome Remarks**

Phyllis Wise, Vice President and Chancellor, University of Illinois

Ilesanmi Adesida, Dean, College of Engineering; Founding and Co-Director, CNST,
University of Illinois

nano@Illinois: Center for Nanoscale Science and Technology (CNST)
Rashid Bashir, Co-Director, CNST, Director, MNTL and
Irfan Ahmad, Executive Director, CNST

9:00 **Keynote:**
**Promises and Challenges of Using Nanotechnology in Medicine –
View from the NCI Alliance for Nanotechnology in Cancer**
Piotr Grodzinski, National Cancer Institute/National Institutes of Health

10:00 Coffee Break

10:20-12:00 Plenary Session II: Session Chair: Joseph Lyding, Professor ECE/Beckman

10:30 **Keynote:**
Nano-enabled Systems: From Materials to Devices to Systems
Tayo Akinwande, Program Manager, DARPA; and Professor of Electrical Engineering and Computer Science, Massachusetts Institute of Technology

11:15 **Keynote:**
Nanotechnology at NIST: Measurements, Standards, and Shared Resources
Lloyd Whitman, Deputy Director, National Institute of Standards and Technology

12:00 to 1:00 Lunch and Performance

1:00 to 2:30 Poster Session <CNST Graduate Students Initiative>

Nanotechnology Career Pathways and Future
2:30-4:00 Panel Discussion: Moderator: CNST Graduate Students Initiative

Panelists: Tayo Akinwande, DARPA; Piotr Grodzinski, NCI; Lloyd Whitman, NIST; Nobel Laureate Anthony Leggett, Physics, Illinois; and Beniamino Barbieri, ISS, Inc.

4:00-4:15 Coffee Break

Nanoelectronics, Nanophotonics, Nanomaterials, and Nanomanufacturing Session

4:15-5:15 Session I: Session Chair: S.L Chuang, Professor, ECE <to be confirmed>

4:15 **Properties of Nanosilicon as a Platform for Functional Devices**
Nobuyoshi Koshida, Tokyo University of Agriculture and Technology

4:35 **Making Mid-Infrared Photonics Nano with Plasmonics and Metamaterials**
Daniel Wasserman, Electrical and Computer Engineering, Illinois

4:55 **III-V Semiconductor Nanowire Array-based Transistors**
Xiuling Li, Electrical and Computer Engineering, Illinois

5:15 **Imparting Electrical Connectivity into 3D Micro/Nanostructures with Additive Nanomanufacturing**
Min-Feng Yu, Mechanical Science and Engineering, Illinois

5:35-7:00 PM Reception and Poster Session

7:15-9:00 PM **Dinner/Performance (by invitation)**
I-Hotel, University of Illinois Research Park

Thursday, May 3, 2012

Venue: Micro and Nanotechnology Laboratory

8:30-9:00 AM Breakfast at MNTL Atrium

BioNanotechnology and Nanomedicine

9:00-10:20 Session II Chair: Paul Kenis, Head, Chemical and Biomolecular Engineering

9:00 Applied Nanotechnology for Foodborne Pathogen and Toxin Detection
Bosoon Park, United States Department of Agriculture-ARS

9:20 Physicochemical Property and Reactive Oxygen Species (ROS)-generating Capacity Relationship of Engineered Metal Nanoparticles
Hong Yang, Chemical and Biomolecular Engineering

9:40 Nanotechnology-mediated Sensing of Angiogenesis: Quantitative Characterization of the Vascular Microenvironment
Princess Imoudkhuede, Bioengineering

10:20 Coffee Break

10:40-12:00 Session III Chair: Su-A Myong, Bioengineering

10:40 Gold Nanoparticles In, On, and Around Cells
Cathy Murphy, Chemistry, Illinois

11:00 Nanostructured Silicon Optical Materials as Multifunctional Cell Culture Substrates
Kris Killian, Materials Science and Engineering, Illinois

11:20 Translational Research on Micro and Nanobionics Devices for Mobile and Social Sensing Applications
G. Logan Liu, Electrical and Computer Engineering, and Bioengineering

11:40 Opportunities for Nanotechnology in Animal Health
Tiffany Houchin, Elanco Animal Health (an Eli Lilly company)

11:50-12:45 Concluding Session: Session Chair: Irfan Ahmad, CNST/ABE

11:50 Student Awards

Concluding Remarks:
Lizanne DeStefano, Prof. Educational Psychology, and I-STEM Director

12:45 Adjourn

12:50 **Box Lunch**

1:45-4:30 **Laboratory Tours and One-on-One Meetings with Faculty and
Campus Administration**

**includes presentations by faculty and students affiliated with the following multidisciplinary centers and projects:*

- *NSF IGERT-Cellular and Molecular Mechanics and BioNanotechnology-*
- *M-CNTC: Midwest Cancer Nanotechnology Training Center (NIH/NCI)*
- *EBICS: Emerging Behaviors of Integrated Cellular Structures Center (NSF STC)*
- *US Army TATRC: Micro and Nano-mediated 3D Stereo Lithography*

(Tour duration: 20mins; tours start at 20 mins interval)

Workshop Registration, Poster Signup, and Hotel Information

Registration Required. Seating is limited, so register early online:

<http://nano.illinois.edu>

Workshop Location

**National Center for Supercomputing Applications (NCSA), and
Micro and Nanotechnology Laboratory**

For parking directions to the NCSA or the Micro and Nanotechnology Laboratory at the University of Illinois at Urbana-Champaign visit: www.cnst.illinois.edu

CNST Workshop Organizing Committee

- Irfan Ahmad, Co-Chair, and Agricultural and Biological Engineering, CNST, MNTL, Office of Research, COE
- Rashid Bashir, Co-Chair, and Electrical and Computer Engineering, Bioengineering, MNTL, CNST
- Joseph Lyding, Co-Chair, Electrical and Computer Engineering, Beckman
- Brian Cunningham, Electrical and Computer Engineering, Bioengineering, MNTL, CABPN
- Lizanne Destefano, Educational Psychology, College of Education
- Placid Ferreira, Mechanical Science and Engineering
- Lois Hoyer, Associate Dean for Research, College of Veterinary Medicine
- Jimmy Hsia, Mechanical Science and Engineering, and GEM⁴
- Phoebe Lenear, Educational Programs Manager, Center for Emergent Behaviors of Integrated Cellular Systems
- Paul Kenis, Chemical and Biomolecular Engineering, and Nano-CEMMS
- Jozef Kokini, FSHN, and Office of Research, College of Agricultural Consumer and Environmental Sciences
- Jennifer Lewis, Materials Science and Engineering, and FS Materials Research Laboratory
- Yi Lu, Chemistry
- Sophi Martin, Office of Research, College of Engineering
- Emily Morehouse, CNST
- Gregory Pluta, Managing Director, Center for Agricultural Biological and Pharmaceutical Nanotechnology
- Umberto Ravaioli, NanoHub, and Engineering Administration
- John Rogers, Materials Science and Engineering, and Nano-CEMMS

Workshop Sponsored by:

**The Center for Nanoscale Science and Technology
at the University of Illinois at Urbana-Champaign**

Co-sponsors:

- Micro and Nanotechnology Laboratory
- National Center for Supercomputing Applications
- Beckman Institute for Advanced Science and Technology
- Coordinated Science Laboratory
- Frederick Seitz Materials Research Laboratory
- Institute for Genomic Biology
- NSF IGERT- CMMB
- NIH/NCI M-CNTC
- NSF STC Center on Emergent Behaviors of Integrated Cellular Systems (EBICS, co-location)
- NSF Nano-CEMMS
- Network for Computational Nanotechnology/NanoHub at Illinois
- Nanotechnology Community of Scholars at ACES

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Workshop Premise

The broad objective of the University of Illinois Center for Nanoscale Science and Technology (CNST) workshop is to showcase University of Illinois research in bionanotechnology/ nanomedicine, nanoelectronics/nanophotonics, nanomaterials/nanomanufacturing, and computational nanotechnology/nanomechanics.

The general framework of the nanotechnology workshop is similar to those held on campus since 2003; which were all well attended by industry and academia. Some of those interactions have since then led to industry and cross-campus collaborations. The CNST-led forums and workshops have contributed tremendously toward the formation of multidisciplinary teams leading to the establishment of multi-million dollar new nanotechnology centers on-campus.

The workshop will provide a forum for industry interactions and collaborations. The workshop brings together campus community (faculty, graduate and undergraduates, administration) from UIUC and other academic institutions, and industry engaged in cutting-edge research. A workshop panel will discuss the roadmap to future direction of research and development in nanotechnology and regional partnerships.

FORMAT: The two-day workshop will be held on May 2 and 3, 2012 workshop at the renowned National Center for Supercomputing Applications and the Micro and Nanotechnology Laboratory at the University of Illinois at Urbana-Champaign. The workshop program includes plenary session speeches, technical sessions, panels, and poster sessions, in addition to lunch and dinner receptions.

nano@Illinois

Established in 2001-02, the University of Illinois Center for Nanoscale Science and Technology (CNST) is the premier center for nanotechnology research, education and training, and entrepreneurial and outreach activities. CNST draws its strength from working as a collaboratory involving the Beckman Institute for Advanced Science and Technology, Roy J. Carver Biotechnology Center, Coordinated Science Laboratory, Frederick Seitz

Materials Research Laboratory, Institute for Genomic Biology, Micro and Nanotechnology Laboratory, Center for Nanoscale Chemical, Electrical, Mechanical, Manufacturing Systems, National Center for Supercomputing Applications, the Schools of Chemical Sciences and of Molecular and Cellular Biology, and other multidisciplinary centers. It brings together nanoscale research from

across the campus, drawing faculty from engineering, chemistry, physics, biology, neuroscience, agriculture, medicine, and other areas. The center envisions seamless integration of research from materials to devices to systems and applications.

CNST is uniquely located to harness the entrepreneurial and technical spirit in downstate Illinois, with ongoing linkages with the University Research Park, the Illinois Department of Commerce and Economic Opportunity, and the State legislature. Industrial and international linkages have also been initiated through multidisciplinary centers. In addition, CNST has embarked on developing a curriculum for nanotechnology education, which will transcend a number of campus departments and units. Exceptional students with interest in nanotechnology projects have been awarded fellowships, as the center prepares the next generation workforce. CNST-led efforts have led to leveraging of existing nanotechnology research labs into also hands-on training sites for molecular and cellular biology, mechanobiology, micro and nanofabrication, and enabling technologies, and tissue engineering. The CNST thrives on its cutting-edge core research in bionanotechnology, computational nanotechnology, nanocharacterization, nanoelectromechanical systems, nanoelectronics, nanofabrication, nanomaterials, and nanophotonics. Translational areas include: nanoagriculture and food, nanoenvironment, nanomanufacturing, nanomedicine, nanosecurity, and societal implications of nanotechnology.

For more information visit: www.cnst.illinois.edu or email: <mailto:nanotechnology@illinois.edu> or call 217-244-1353.



Keynote Speakers:



Piotr Grodzinski, Ph.D.

Director of NCI Alliance for Nanotechnology in Cancer at the National Cancer Institute/NIH

Dr. Piotr Grodzinski is a Director of NCI Alliance for Nanotechnology in Cancer at the National Cancer Institute in Bethesda, Maryland. He coordinates program and research activities of the Alliance which dedicates around \$150M over funding period of 5 years to form interdisciplinary centers as well as fund individual research and training programs targeting nanotechnology solutions for improved prevention, detection, and therapy of cancer.

Dr. Grodzinski is a materials scientist by training, but like many others found bio- and nanotechnology fascinating. In the mid-nineties, he left the world of semiconductor research and built a large microfluidics program at Motorola Corporate R&D in Arizona. The group made important contributions to the development of integrated microfluidics for genetic sample preparation with its work being featured in Highlights of Chemical Engineering News and Nature reviews. After his tenure at Motorola, Dr. Grodzinski was with Bioscience Division of Los Alamos National Laboratory where he served as a Group Leader and an interim Chief Scientist for DOE Center for Integrated Nanotechnologies (CINT). At the National Institutes of Health (NIH), in addition to his programmatic responsibilities, he co-chaired Trans-NIH Nanotechnology Task Force, which is coordinating the nanotechnology efforts across 27 institutes of the agency with the budget over \$300M/year.

Dr. Grodzinski received Ph.D. in Materials Science from the University of Southern California, Los Angeles in 1992. He is an inventor on 15 patents and published 52 peer-reviewed papers, 7 book chapters, and delivered over 100 invited conference presentations. Dr. Grodzinski has been an invited speaker and served on the committees of numerous bio- and nano-MEMS conferences in the past years.



Tayo Akinwande, *Ph.D.*

Program Manager for the Microsystems Technology Office, Defense Advanced Research Projects Agency (DARPA), and Professor of Electrical Engineering and Computer Science at the Massachusetts Institute of Technology

Dr. Tayo Akinwande joined the Defense Advanced Research Projects Agency in September 2009. His interests include emerging micro/nano-electromechanical systems, large area microsystems, and electronic and actuation devices based on charged particle beams.

Dr. Akinwande came to DARPA from the Massachusetts Institute of Technology, where he is a professor in the Electrical Engineering and Computer Science Department. Joining MIT's Microsystems Technology Laboratory in 1995, his research focused on microstructures and nanostructures for sensors and actuators, vacuum nano-electronics and large area electronics with particular emphasis on smart sensors and actuators, intelligent displays and devices based on charged particle beams. Prior to MIT, Dr. Akinwande worked for Honeywell where he conducted research on GaAs complementary FET technology for very high speed and low power signal processing. He was later a member of Honeywell's Si Microstructures group, where he conducted research on pressure sensors, accelerometers, thin-film field emission and display devices.

Dr. Akinwande is the recipient of numerous awards including the 1996 National Science Foundation Career Award and the Sweatt Award, Honeywell's highest technical award. He served several technical conference committees including the Device Research Conference, International Electron Device Conference, International Display Research Conference and International Vacuum Microelectronics Conference. In addition, he is the chair of the IEEE Electron Device Society Nanotechnology Committee and a Fellow of the IEEE.

Dr. Akinwande received his B.S. (1978) in Electrical Engineering from the University of Ife, Nigeria, and his M.S. (1981) and Ph.D. (1986) in Electrical Engineering from Stanford University.



Lloyd Whitman, Ph.D.

Deputy Director, NIST Center for Nanoscale Science and Technology

Lloyd Whitman received a B.S. in Physics from Brown University (with honors, *magna cum laude*), and M.S. and Ph.D. degrees in Physics from Cornell University. After a National Research Council Postdoctoral Research Fellowship at NIST, he joined the research staff at the Naval Research Laboratory (NRL). At NRL, Lloyd was the Head of the Surface Nanoscience and Sensor Technology Section, a multidisciplinary research group working at the nexus of nanoscience, biotechnology, and microsystems. He led a diverse portfolio of research studying semiconductor, organic, and biomolecular nanostructures, their use in novel functional surfaces, and their integration into advanced sensor systems for national security applications.

In addition to leading research at NRL, Lloyd served as a Science Advisor to the Special Assistant to the Secretary of Defense for Chemical and Biological Defense and Chemical Demilitarization Programs. Lloyd joined the NIST Center for Nanoscale Science and Technology (CNST) as its first Deputy Director in April 2008, overseeing the operations of the Center and working closely with the Director in leading the Center's strategies and programs. He also serves as the liaison to NIST's overall nanotechnology program, representing NIST on the National Science and Technology Council, Committee on Technology Subcommittee on Nanoscale Science, Engineering and Technology, where he co-chairs the Nanomanufacturing, Industry Liaison, and Innovation Working Group. Lloyd has over 160 publications and multiple patents in the areas of nanoscience and sensor technology, and numerous media citations and awards, including the Navy Meritorious Civilian Service Award.

Center for Nanoscale Science and Technology

nano@illinois—Multidisciplinary Research: Collaboratory

Center for Nanoscale Science and Technology (CNST)

1102-04 Micro and Nanotechnology Laboratory
208 North Wright Street, Urbana, IL 61801
Rashid Bashir and Ilesanmi Adesida, Co-Directors
Irfan Ahmad, Executive Director
(217) 333-2015 • www.cnst.illinois.edu

Beckman Institute for Advanced Science and Technology (BI)

405 North Mathews Avenue, Urbana, IL 61801-2300
Arthur Kramer, Director; Van Anderson, Associate Director
(217) 244-1176 • www.beckman.illinois.edu

Center for Agricultural, Biomedical, and Pharmaceutical Nanotechnology (CABPN) (NSF-IUCRC)

1102-04 Micro and Nanotechnology Laboratory
208 North Wright Street, Urbana, IL 61801
Brian Cunningham, Director
Irfan Ahmad, Associate Director/Industry Liaison
www.cnst.illinois.edu/cabpn

Center for Cellular Mechanics (CCM)

2101D Mechanical Engineering Laboratory
1206 West Green Street, Urbana, IL 61801
Taher Saif, Director
(217) 333-8552 • www.ccm.illinois.edu

Center for Directed Assembly of Nanostructures (CDAN)* (co-location)

2015 Frederick Seitz Materials
Research Laboratory
104 South Goodwin Avenue, Urbana, IL 61801
Kenneth Schweizer, Site Lead
(217) 333-6440 • www.mrl.illinois.edu

Center for Nanoscale Chemical-Electrical-Mechanical Manufacturing Systems (Nano-CEMMS)*

4410 Mechanical Engineering Laboratory
105 South Mathews Avenue, Urbana, IL 61801
John Rogers, Director; Polly Kroha, Managing Director
(217) 265-0093 • www.nano-cemms.illinois.edu

Center of Advanced Materials for Purification of Water with Systems (WaterCAMPWS)*

2127 Mechanical Engineering Laboratory
1206 West Green Street, Urbana, IL 61801
Benito Marinas, Acting Director; Brian Pianfetti, Associate Director
(217) 333-2633 • www.watercampws.illinois.edu

Center on Emergent Behaviors of Integrated Cellular Systems (EBICS)*

1102A Micro and Nanotechnology Laboratory
208 North Wright Street, Urbana, IL 61801
Jimmy Hsia, Education Director
Phoebe Lenear, Education Program Manager
(217) 333-2321 • [*www.ebics.net](http://www.ebics.net)

Coordinated Science Laboratory (CSL)

202 Coordinated Science Laboratory
1308 W. Main Street, Urbana, IL 61801
William Sanders, Director; Elizabeth Dennison, Associate Director
(217) 333-2511 • www.csl.illinois.edu

Frederick Seitz Materials Research Laboratory (FSMRL)+

2015 Frederick Seitz Materials
Research Laboratory
104 South Goodwin Avenue, Urbana, IL 61801
Jennifer Lewis, Director
Kris Williams, Director Operations
(217) 333-1370 • www.mrl.illinois.edu
Kris Williams, Director Operations
(217) 333-1370 • www.mrl.illinois.edu

Global Enterprise for Micro Mechanics and Molecular Medicine (GEM4)

1250 Micro and Nanotechnology Laboratory
208 North Wright Street, Urbana, IL 61801
Jimmy Hsia, Director
(217) 244-4102 • www.gem4.org

Institute for Genomic Biology (IGB)

Institute for Genomic Biology
1206 W. Gregory Drive, Urbana, IL 61801
Gene Robinson, Director
Jennifer Quirk, Associate Director
(217) 244-2999 • www.igb.illinois.edu

Materials Computation Center (MCC)*

2015 Frederick Seitz Materials
Research Laboratory
104 South Goodwin Avenue, Urbana, IL 61801
Jennifer Lewis, Director
(217) 265-0319 • www.mcc.uiuc.edu

Micro and Nanotechnology Laboratory (MNTL)*

2000 Micro and Nanotechnology Laboratory
208 North Wright Street, Urbana, IL 61801
Rashid Bashir, Director
John Hughes, Associate Director Operations
(217) 333-3097 • www.mntl.illinois.edu

Multidisciplinary University Research Initiative (MURI-ARO)

3264 Micro and Nanotechnology Laboratory
208 North Wright Street, Urbana, IL 61801
Shun Lien Chuang, Director
(217) 333-3359 • muri-t2sl.ece.illinois.edu

**National Center for Supercomputing Applications (NCSA)*
and Institute for Advanced Computing Applications and Technologies**

NCSA Building
1205 West Clark Street, Urbana, IL 61801
Thom Dunning, Jr., Director
Danny Powell, Executive Director
(217) 244-0072 • www.ncsa.illinois.edu

NIH/NCI Midwest-Cancer Nanotechnology Training Center (M-CNTC)

1256 Micro and Nanotechnology Laboratory
208 North Wright Street, Urbana, IL 61801
Rashid Bashir and Ann Nardulli, Co-Directors
Program Manager: Laura Miller
Phone: (217)-244-7092 • www.m-cntc.illinois.edu

**NIH Resource Center for Macromolecular Modeling and Bioinformatics
(RCMMB)**

3147 Beckman Institute
405 North Matthews, Urbana, IL 61801
Klaus Schulten, Director
(217) 244-1604 • www.ks.uiuc.edu

NSF-IGERT Cellular and Molecular Mechanics and BioNanotechnology (CMMB)

1256 Micro and Nanotechnology Laboratory
208 North Wright Street, Urbana, IL 61801
Rashid Bashir, Director
Program Manager: Laura Miller
(217)-244-7092 • www.cmmb-igert.illinois.edu

Network for Computational Nanotechnology/NanoHub at Illinois*

2104 Micro and Nanotechnology Laboratory
208 North Wright Street
Urbana, IL 61801
Nahil Sobh, Site Lead
Umberto Ravaioli, Faculty Lead
(217) 244-9481 • www.nanohub.org

Innovation-based Entrepreneurship at Illinois

www.illinois.edu/academics/entrepreneur
**Currently/formerly a National Science Foundation Center*
*** National Cancer Institute Center*

+ *Currently/formerly a Department of Energy Laboratory/Center*

Network for Computational Nanotechnology/NanoHub at Illinois*

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208 North Wright Street
Urbana, IL 61801
Nahil Sobh, Site Lead
Umberto Ravaioli, Faculty Lead
(217) 244-9481
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Siteman Center of Cancer Nanotechnology Excellence (SCCNE) (Illinois co-location)**

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208 North Wright Street
Urbana, IL 61801
Rashid Bashir, PI
Irfan Ahmad, Project Coordinator/co-PI
(217) 333-2015
www.cnst.illinois.edu/sccne-uiuc.htm

**Currently/formerly a National Science Foundation Center*

*** National Cancer Institute Center*

+ *Currently/formerly a Department of Energy Laboratory/Center*

For more information email: nanotechnology@illinois.edu or visit www.cnst.illinois.edu

For Technical Collaboration Contact:

Center for Nanoscale Science and Technology

University of Illinois

217-333-2015

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