

FROM THE DIRECTORS

Welcome to the 2015 newsletter from the Nanoscience and Nanotechnology Institute (NNI). We are already busy planning for our annual symposium which will take place in April and for the seventh year of the NSF-funded Research Experiences for Undergraduates (REU) program next summer. We look forward to another exciting year of nanoscience and nanotechnology research, education and outreach at the University of Iowa!

We are pleased to announce that **Jenny Nelson** joined the Institute as administrative services coordinator this past September. Jenny assists with grant submissions and administration, coordinates seminars and symposia for the institute as well as our education and outreach programs. We thank Heather Roth for her excellent work over the past 2 years.

In other news, co-director **Vicki Grassian** chaired an NSF workshop on NanoEHS: Fundamental Science Needs. Associate director **Amanda Haes'** co-chaired the workshop which was held in Boston in conjunction with the Sustainable Nanotechnology Organization annual conference. As discussed on page 3, the goal of the workshop was to discuss the fundamental science challenges, opportunities, and needs of the broad area of NanoEHS.

As already noted, the NNI REU program has been renewed for funding. Congratulations to both **Sarah Larsen** and **Allan Guymon** who run the program. This means we will be able to offer exciting research experiences for undergraduate students in nanoscience and nanotechnology. Besides doing research in faculty laboratories, students who participate in the program gain a wealth of experiences including learning how to communicate science to a broad range of audiences including the public. Applications are now being accepted for Summer 2015 - more

information is given on page 4.

Many core faculty received awards in 2014. The UI Office of the Vice President for Research and Economic Development recently recognized three NNI faculty for research and innovation excellence. NNI Co-Director **Vicki Grassian** was honored with the Scholar of the Year Award for her nationally recognized achievements in research. NNI Executive Committee Member **David Cwiertny** was honored with the Early Career Scholar of the Year Award for research or scholarly activity that shows significant promise. NNI Core Faculty Member **Tori Forbes** was honored with a Distinguished Mentor Award for mentoring undergraduates as they complete research and creative projects. Co-director **Vicki Grassian** also received 2014 John Jeyes Award from the Royal Society of Chemistry and the 2014 Midwest Award from the American Chemical Society. **Alexei Tivanski**, Department of Chemistry, was promoted to Associate Professor with tenure. Prof. Tivanski uses advanced Atomic Force Microscopy (AFM) techniques to study conductive, mechanical, optical, and nanoscale electrochemical properties of an array of molecular systems. He also studies the chemical speciation and environmental processing of individual submicron atmospheric aerosols and their impact on climate and environment. Several core faculty assumed editorial positions in 2014. **David**



Vicki H. Grassian
Co-Director of NNI



Sarah C. Larsen
Co-Director of NNI

Cwiertny, Department of Civil and Environmental Engineering, was named the Editor-in-Chief of the new RSC journal, Environmental Science: Water Research & Technology. **Aliasger Salem**, Pharmacy, was named an Associate Editor for the American Association of Pharmaceutical Scientists (AAPS) Journal.

Seminars focusing on various research topics in nanoscience and nanotechnology take place across campus each semester. During the spring 2015 semester, our annual symposium will be held. More details about the symposium are provided on page 4. During 2014, there were many seminars on cutting-edge topics in nanoscience and nanotechnology some of these include:

April 2014: **Prof. Sara Skrabalek**, Indiana University, "Shaping the Synthesis and Catalytic Performance of Bimetallic Nanostructures"

August, 2014, **Prof. Zachary D. Schultz**, University of Notre Dame "Nanostructure Plasmonic Enhancements for Chemical Analysis"

For 2015, keep up to date on these seminars through the NANO@IOWA biweekly email newsletter. If you don't receive the electronic newsletter and would like to, please send an email to nni@uiowa.edu and you will be added to the list.

FACULTY PROFILE

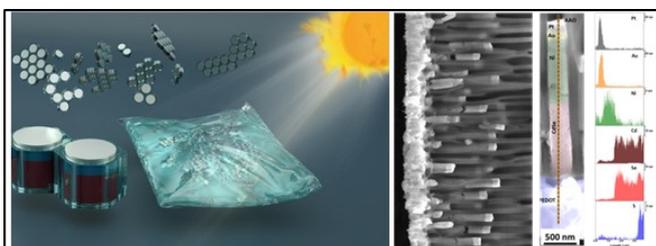


SYED MUBEEN
CHEMICAL AND BIOCHEMICAL ENGINEERING
COLLEGE OF ENGINEERING
UNIVERSITY OF IOWA

Syed Mubeen, Assistant Professor of Chemical and Biochemical Engineering, hopes advances in the science and engineering of nanomaterial systems will provide options for developing cost-effective, sustainable clean water and energy technologies. "Being trained in chemical and electrochemical engineering, I feel particularly driven to work on materials and systems that can have a technological, practical and maybe even a major societal impact" says Mubeen. Mubeen's current research interests range broadly over much of electrochemistry and fabrication of functional materials with well-defined molecular and nanoscale architectures, including plasmonic materials and devices, chemical sensors, and more recently advancing research towards material synthesis, device architecture, and systems engineering for development of low-cost, high performance electrochemical energy conversion and water treatment systems.

Mubeen, who received his PhD at UC, Riverside in 2009, joined University of Iowa last August after his post-doctoral work at UC, Santa Barbara. In addition to his research work, Mubeen is also Lead Scientist at HyperSolar, Inc. (stock symbol HYSR), a public company (trading on the Over-the-Counter market (the OTC)) developing solar technologies for water purification. Recent projects, undertaken at both UC, Santa Barbara and University of Iowa, include:

- *Low Cost Solar-to-Chemical Energy Conversion System* - Unlike



Synthesis of free floating multi-component photocatalyst nanoparticles system for H₂ production. (Right) Cross sectional SEM image of photocatalytic units. *Nano Letters*, 13, 2110-2115, 2013

photovoltaics (solar-to-electricity) which are in the advanced level of commercial development, fundamental science and engineering underlying solar-to-chemical energy conversion, is fairly very much less developed. This is because the costs of all existing efficient solar-to-chemical conversion systems are far too high and most do not sustain the harsh electrochemical environment of the cell under which they operate. In a research effort at UCSB, Mubeen and his colleagues have successfully shown how sunlight can be converted into chemical products sustainably employing a novel semiconducting device architecture (see Figure and the related articles mentioned within). Currently, Mubeen's lab is undertaking the scientific challenge to discover high efficiency light absorbing materials made from inexpensive elements and the engineering challenge to create new cost effective system architectures where these materials might be deployed such that the total cost of the solar-to-chemical conversion process is economical. Particularly the research group is focusing on developing photoelectrochemical technologies for treating waste and saline waters.

- *A New Concept for Developing Grid-scale Electrical Energy Storage Systems* - Environmental considerations will push us, ever more urgently, to focus on issues such as the economics and practicalities of large-scale solar and wind energy penetration. In light of these requirements, Mubeen's lab is currently working on developing a new concept of solid flowable batteries for grid-scale energy storage using environmentally safe and sustainable materials.
- Mubeen's lab is also exploring a wholly different class of materials namely *Plasmonic materials (esp. nanostructured Pd and Al) for photo (electro)catalysis*.

More information on the above research projects can be found on Mubeen's website <http://www.engineering.uiowa.edu/cbe/faculty-staff/syed-mubeen>

Mubeen is currently teaching Green Chemical and Energy Technology course and hopes to draw inspiration for some of the lectures based on his work on sustainable energy technologies. He also teaches Chemical Engineering Process Design I, a core undergraduate CBE course offered during fall semester. He also has a young family, his wife Joun Lee works across the river on the west side of the campus as Assistant Research Scientist in the CMRF facility.

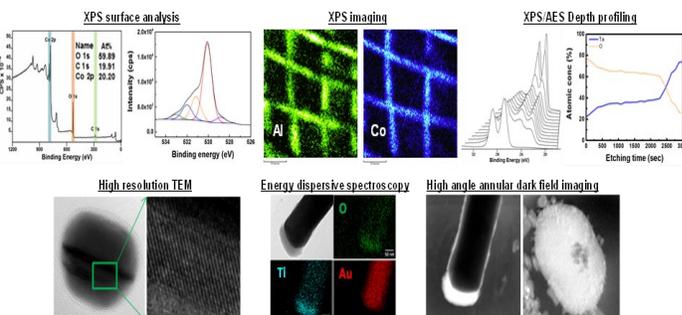
STAFF PROFILE



JOUN (SYLVA) LEE
CENTRAL MICROSCOPY RESEARCH FACILITY
COLLEGE OF LIBERAL ARTS AND SCIENCES
UNIVERSITY OF IOWA

Joun (Sylvia) Lee joined the University of Iowa in 2014 as an Assistant Research Scientist in the Central Microscopy Research Facility (CMRF). She is a chemical engineer with research background covering wide ranges of topics including nanomaterials synthesis and assembly, solar energy conversion and storage, SERS-based bioassay, and assessment of cytotoxicity of nanomaterials. Dr. Lee oversees the materials characterization needs at CMRF with emphasis on X-ray photoelectron spectroscopy, transmission electron microscopy, scanning electron microscopy and Raman spectroscopy. The listed instruments can provide large volume of chemical information as well as their structural information and play an integral part for carrying out cutting-edge research at the University of Iowa. Her current focus is on coordinating with multidisciplinary teams across the campus to improve the microscopic and spectroscopic capabilities of CMRF for characterizing electronic and optoelectronic properties of materials: techniques include ultra-violet photoelectron spectroscopy for valence band edge determination of semiconductor materials, electron energy loss spectroscopy to investigate the generation of localized surface plasmons in metallic nanostructures, and development of novel sample environments for performing operando microscopy on nanomaterials and electrocatalysts, etc.

Dr. Lee received her Ph.D. from the department of chemical and environmental engineering at the University of California, Riverside, and a ME in chemical engineering from Yonsei University in Seoul, South Korea. Prior to joining central microscopy research facility, Dr. Lee worked with Prof. Martin Moskovits and Prof. Galen Stucky in the University of California, Santa Barbara as a postdoctoral researcher in the field of plasmonics, energy and environmental sciences.



NanoEHS: Fundamental Science Needs Workshop, Boston, November 1, 2014

Professors Vicki Grassian and Amanda Haes co-chaired a National Science Foundation sponsored workshop entitled NanoEHS: Fundamental Science Needs. This event was held in association with the 2014 Sustainable Nanotechnology Organization annual meeting in Boston on November 1, 2014. While monitoring is a key aspect to biological and environmental studies, the development of NanoEHS and the field of sustainable nanotechnology must be backed by solid scientific underpinnings. Approximately 20 participants met to identify and discuss fundamental knowledge gaps that lead to uncertainties in predicting the behavior of nanomaterials and nanomaterial interactions with environmental and biological systems. Some of the grand challenges discussed included a greater understanding of the unique properties of nanomaterials that depend on size and shape from a fundamental chemistry and physics perspective and applying this understanding to environmental health and safety issues associated with nanomaterials.



Amanda Haes, Workshop Co-Chair

STEM Outreach



Members of the Nanoscience and Nanotechnology Institute continue to be very active in many Science, Technology, Engineering and Mathematics (STEM) outreach activities. As shown in the photos here, a group of faculty, staff and students from NNI@UI visited the Science Center of Iowa in Des Moines for the 4th annual NanoDays event. The NNI group brought hands-on activities designed for the institute as part of our Nano-to-go kit. Over 400 visitors to the museum learned about nanoscience and nanotechnology.





**NANOSCIENCE &
NANOTECHNOLOGY
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SAVE THE DATE!

Friday April 10, 2015

**Nanoscience and Nanotechnology
Spring 2015 Symposium**



Keynote Speaker: Professor Phil Demokritou, Associate Professor, Director, Laboratory for Environmental Health NanoScience (LEHNS), and Director, Center for Nanotechnology and

Nanotoxicology Harvard School of Public Health: *"In-vitro Dosimetry of Nanomaterials: Too complicated to consider, too important to ignore"*

Look here for future updates: <http://nanotech.uiowa.edu/events/nanoscience-and-nanotechnology-symposium>

REU SUMMER 2015

National Science Foundation Research Experience for Undergraduates (NSF-REU) in Nanoscience and Nanotechnology at The University of Iowa

PROGRAM DATES:

JUNE 1—JULY 31, 2015

The program will provide approximately eight undergraduate students with research experience in cutting edge topics related to environmental and health aspects of nanoscience and nanotechnology. REU participants will have the opportunity to work with faculty mentors from the departments of Chemical and Biochemical Engineering, Civil and Environmental Engineering, Chemistry, and Pharmacy.

Application deadline is March 2, 2015. For additional information, please visit the website: <http://nanotech.uiowa.edu/education/nano-reu-program>