

FROM THE DIRECTORS

Welcome to the 2014 newsletter from the Nanoscience and Nanotechnology Institute. It has been a busy year highlighted by our symposium in Fall 2013 focused on environmental and health aspects of nanoscience and nanotechnology. In 2014, we look forward to another exciting year of nanoscience and nanotechnology advances!

We are pleased to announce that **Amanda Haes**, an associate professor in the Department of Chemistry, has been appointed as the Associate Director of NNI. You can read more about Dr. Haes' research in the feature article on page 2. We look forward to working with Dr. Haes in her new leadership role in advancing interdisciplinary nanoscience research on the UI campus.

In other news, NNI Co-Director **Vicki Grassian** was appointed editor-in-chief of *Environmental Science: Nano*, a new peer-reviewed journal published by the Royal Society of Chemistry. The journal will focus on high-quality research on the interactions of natural and engineered nanomaterials with biological and environmental systems. Additionally, a recent *Iowa Alumni Magazine* article, "The Science of Small," by Shelbi Thomas, highlighted current NNI research. **Vicki Grassian** was also named to the NanoVox Board of Directors. NanoVox is a regional nanotechnology initiative aimed at enabling collaboration among academic institutions, industry and government in the Midwest. We are excited to note that NNI

Executive Committee member **Aliasger Salem**, head of the Division of Pharmaceutics and Translational Therapeutics, was awarded the Lyle and Sharon Bighley Professorship in Pharmaceutical Sciences. Dr. Salem's research group focuses on applying nanotechnology in drug delivery and cancer vaccines, training the body's immune system to attack tumors.

Several core faculty obtained new grants in the area of Nanoscience and Nanotechnology. **Sara Mason**, assistant professor in the Department of Chemistry, received an NSF Career Award to develop quantum nanogeochemistry as a platform to provide fundamental understanding of environmental nanoparticle structure-reactivity. **Tori Forbes**, also an assistant professor in the Department of Chemistry, was named an NSF Career Award recipient for her project to investigate how tubular nanomaterials transport and store water, research that may one day advance drug delivery and promote cleaner water. **Thomas Peters**, along with co-PIs **Vicki**



Vicki H. Grassian
Co-Director of NNI



Sarah C. Larsen
Co-Director of NNI

Grassian and Renee Anthony, received a \$1.2 million NIOSH Grant to develop a nanoparticle respiratory dose (NRD) sampler for metal-based nanoparticles. Dr. Peters is using this grant to continue work on a recently developed novel personal sampler and an analytical method that is easy to utilize, inexpensive, and integrates into current personal exposure sampling strategies. **Jose Assouline**, adjunct associate professor of biomedical engineering, is the founder of NanoMedTrix, which was awarded funding by the State of Iowa (as recipients of the inaugural Demonstration Fund Award and the first SBIR/STTR Outreach Program Award), as well as the University of Iowa. The company has recently acquired new facilities at the BioVentures Center in the University of Iowa Research Park, located in Coralville, for commercial production/manufacturing of its nanomaterial based contrast agents.

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Seminars focusing on various research in nanoscience and nanotechnology take place across campus each semester. During the fall semester, we held our annual symposium with the theme of Nanoscience and Nanotechnology: Environmental and Health Aspects. More details about the symposium are provided on page 3. During 2013, there were many seminars on cutting-edge topics in nanoscience and nanotechnology including:

February 2013: **Dr. Robert Hamers**, Professor, Department of Chemistry, University of Wisconsin, *Nanoparticles in the Environment: Understanding Environmental Fate and Toxicity*

March 2013: **Dr. Hamid Ghandehari**, USTAR Professor, Departments of Pharmaceutics & Pharmaceutical Chemistry, and Bioengineering; Co-Director, Nano Institute of Utah; Director, Utah Center for Nanomedicine, *Advanced Drug Delivery for Targeted Tumor Therapy*

May 2013: **Dr. Prabir Dutta**, Distinguished University Professor, Department of Chemistry & Biochemistry, The Ohio State University, *Correlations of Physicochemical Properties of Nanoparticles with Their Biological Behavior*

September 2013: **Dr. Stan Wong**, Professor, Department of Chemistry, SUNY, Stony Brook, *Chemical Strategies in Nanoscience*

October 2013: **Dr. Gonghu Li**, Assistant Professor, Department of Chemistry, University of New Hampshire, *Combining Molecular Catalysts and Nanostructured Surfaces for Solar CO₂ Reduction*

For 2014, 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

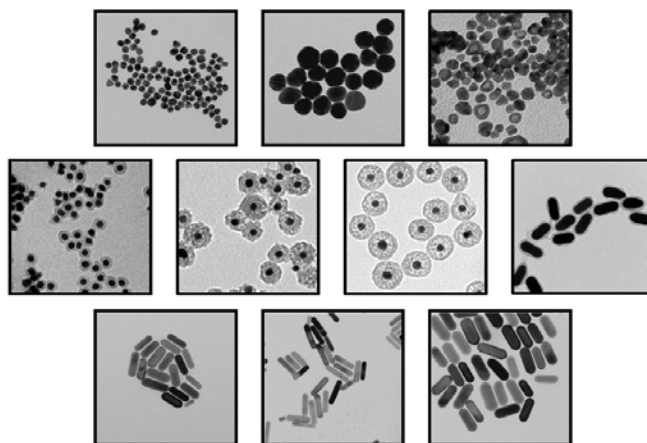


Amanda J. Haes
Chemistry
College of Liberal Arts and Sciences
University of Iowa

Amanda J. Haes is an associate professor in the Department of Chemistry at the University of Iowa and Associate Director of NNI. The Haes Research Group is recognized as a leader in the synthesis and characterization of noble metal (i.e., gold and silver) nanoparticles with novel and well-characterized surface chemistry. Professor Haes focuses on a number of key issues related to nanoscience and nanotechnology including quality control of nanomaterials using both experimental and theoretical approaches as well as applied research problems focused on using nanomaterials in biological and environmental assays. The Haes Research Group focuses their research efforts on determining "quality control" practices for improving the functionality of these materials so that nanoparticle-enhanced quantitative analysis can be exploited. Next, they study the plasmonic properties of the materials for understanding the mechanism and importance of the nanoparticle composition (both core and surface properties) in a number of applications including capillary electrophoresis. Furthermore, the surfaces of these nanostructures are modified using organic monolayers, polymer matrices, or porous silica membranes. These surface-modified nanostructures are then used for surface enhanced Raman scattering (SERS) measurements for enhancing the detectability of target small molecules.

The ultimate goal of the Haes Research Group is to use their nanomaterials for developing new biological and chemical diagnostic tools. All of these applications begin with the synthesis of silver and/or gold nanoparticles. Spheres and rods are two common shapes that the group synthesizes. These nanomaterials are excellent substrates for enhancing spectroscopic signatures of molecules. To improve the stability of the materials in solution, nanomaterial surfaces are modified with perm-selective layers composed of small molecules, polymers, or silica. These layers serve a dual purpose—reduce nanoparticle aggregation as well as promote selective diffusion small molecules toward the metal surface for detection using surface enhanced Raman scattering. This nanomaterial detection platform yields low detection limits of small molecules in complex sample matrices. Examples of these materials are in the figure below. Current applications include detection of anti-cancer drug metabolites, hormones, pain medication, Parkinson's disease biomarkers, Vitamin D and metabolites, as well as small molecule, drug, and explosives detection.

More information on research in the Haes Group may be found at their website: www.chem.uiowa.edu/haes-research-group



Silver and gold nanoparticles synthesized by the Haes Research Group. All images are 275 nm x 275 nm.

NNI Fall 2013 Symposium - Nanoscience and Nanotechnology: Environmental and Health Aspects

The NNI Fall 2013 Symposium on Nanoscience and Nanotechnology: Environmental and Health Aspects took place on September 27, 2013. From nanomedicine to nanosensors to nano-enabled remediation, the use of very small particles and very small objects with at least one dimension below 100 nm continues to be an exciting area of research that has the potential to transform our world. The NNI Fall 2013 Symposium focused on the environmental and health aspects of nanoscience and nanotechnology and was NNI's most successful symposium to date. More than 100 people

attended the symposium throughout the day, and several collaborations were formed as a result of interactions at the symposium.

Speakers provided their perspectives on a broad range of topics on environmental and health aspects of nanoscience and nanotechnology. Assistant Professor David Cwiertny presented "Nanotube- and Nanofiber-Enabled Chemical Treatment Strategies: Next-Generation Technologies for Water Sustainability?" and Adjunct Associate Professor Jose Assouline spoke about "NanoMedTrix (NMTx), a Novel Biotech Startup Company with Dynamic Ambitions in Medicine and Biomedical Sciences."

We were pleased to welcome Christy Haynes, University of Minnesota professor and Kavli Foundation Emerging Leader in Chemistry, as our keynote speaker (pictured at left). Dr. Haynes' research group focuses on applications of analytical chemistry in the fields of immunology and toxicology, with much expertise in the area of single cell analysis. One major area of interest is nanotoxicology, an emerging field investigating the biological and ecological impacts of engineered nanomaterials. Another major focus in the group is on studying fundamental properties of cells involved in inflammation. In fact, the Haynes group

has performed the first ever real-time single blood platelet measurements, examining the chemical messenger molecules that platelets secrete upon stimulation. Dr. Haynes presented her riveting and well-received lecture on "Biological and Ecological Toxicity in Engineered Nanomaterials." These talks were followed by a panel discussion. After the morning talks and panel discussion, the symposium continued with a luncheon focused on collaborative discussions, an exciting poster session featuring 24 posters, and hands-on demonstration of a Nano-to-Go Kit for outreach and education (pictured at right).



STEM Outreach

The Nanoscience and Nanotechnology Institute at the University of Iowa (NNI) is leading efforts in Science, Technology, Engineering and Mathematics (STEM) outreach to K-12 students and the general public. In October, **Deandrea Leigh Watkins** joined the Department of Chemistry and NNI as STEM program coordinator. She has been working to coordinate STEM outreach efforts and to develop new ties with the local community, particularly with respect to strengthening our diversity efforts. She is passionate about increasing the presence, acceptance and full inclusion of populations

underrepresented in the fields of science, technology, engineering and mathematics.

Recent outreach activities of NNI members include the STEM Institute, sponsored by the Workplace Learning Connection, which was held at MERF in May and November 2013; Project Hope (Healthcare Occupations, Preparation, and Exploration) for underrepresented middle school students and sponsored by the College of Education, March 2013 and January 2014; NanoDays at the Science Center of Iowa; and STEM Family Free Night at the Children's Museum in Coralville in October 2013.



**NANOSCIENCE &
NANOTECHNOLOGY
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REU in Nanoscience & Nanotechnology

Summer 2014

The University of Iowa

SUMMER 2014:

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

PROGRAM DATES:

MAY 26, 2014 – AUGUST 1, 2014

The program will provide eight rising junior or senior 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, Pharmacy, and Occupational and Environmental Health.

The deadline for applicants is March 1, 2014. For additional information, please visit the website: <http://nanotech.uiowa.edu/education/nano-reu-program>