NANO@IOWA
Nanoscience and Nanotechnology Institute at The University of Iowa
THE UNIVERSITY OF IOWA
SPRING 2013

FROM THE DIRECTORS

Welcome to the 2013 newsletter from the Nanoscience and Nanotechnology Institute. During the past year, the institute transitioned to the College of Liberal Arts and Sciences, and we are looking forward to an exciting new year for UI students, staff and faculty engaged in nanoscience and nanotechnology research and education.

Vicki H. Grassian
Co-Director of NNI

Sarah C. Larsen
Co-Director of NNI

For the Nanoscience and Nanotechnology Institute, 2012 was a year of transition as the administration of the institute was moved to the College of Liberal Arts and Sciences. This move has been helpful in utilizing the academic and administrative structure supported by CLAS and the Department of Chemistry. We would like to thank Jackie Jensen for her service as the administrative services coordinator to the institute during our time under the Vice President for Research Office, and we would like to welcome Heather Roth as the new administrative services coordinator for the Nanoscience and Nanotechnology Institute. Heather joined the institute in October 2012. Prior to working with the institute, Heather worked in the Department of Civil and Environmental Engineering, where she provided editorial support to *Environmental Science & Technology* for CEE Department Chair and NNI investigator Michelle Scherer. Another important announcement is that Sarah Larsen was named co-director of the institute, joining Vicki Grassian, co-director, who was the founding director of the institute. Sarah has led a number of important initiatives including being PI of the NSF-supported REU program which is currently in its sixth year of operation, and along with Russell Larsen, she has spearheaded the expanding outreach efforts for the institute.

Even during this time of transition, the activity was high. Several core faculty obtained new grants in the area of Nanoscience and Nanotechnology. **Professor Jennifer Fiegel**, from the departments of Pharmaceutical Sciences and Experimental Therapeutics and Chemical and Biochemical Engineering, was awarded an NIH grant titled "Development of LOS-modified Nanoparticles for Improved Airway Epitheliel Uptake." The goal of this two-year grant is to optimize the physicochemical properties of nanoparticle carriers to achieve low mucosal binding, while retaining epithelial uptake in respiratory environments. **Professor Julie Jessop**, also from Chemical and Biochemical Engineering, was a co-investigator on this grant. **Professor Amanda Haes**, Department of Chemistry, was awarded an NSF grant on "Surface Enhanced Raman Scattering (SERS)-Active Chromatographic Gold Nanorods." This project will exploit the plasmonic properties of gold nanorods encapsulated in chromatographic-like silica membranes for selective transport and subsequent SERS of small molecules and anti-cancer drugs. **Professor Eric Nuxoll**, Department of Chemical and Biochemical Engineering, received an NSF grant titled "Remote Sterilizing Coatings Using Magnetic Nanoparticles." In this project, heat will be used to sterilize bacterial biofilms remotely through magnetic induction. **Professor Edward Gillan**, Department of Chemistry, spearheaded efforts to obtain a state-of-the-art Bruker D8 Advance X-ray diffractometer

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from the Roy J. Carver Charitable Trust. **Professor Hassan Raza**, Department of Electrical and Computer Engineering, recently published a textbook titled *Graphene Nanoelectronics*. This book covers the theory, spectroscopy and applications of graphene nanostructures.

Seminars focusing on various research in nanoscience and nanotechnology take place across campus each semester. During 2012, there were many seminars on cutting-edge topics in nanoscience and nanotechnology, including:

February 2012: **Professor Alexei Tivanski**, Department of Chemistry, University of Iowa, *Chemical Microscopy of Micro- and Nano-dimensional Organic Materials*

April 2012: **Dr. Christie Sayer**, RTI International, Research Triangle Park, North Carolina, *Contemporary Issues in Nanotoxicology: Continuing to Relate Material Properties to Biological Response*

August 2012: **Professor Amanda Haes**, Department of Chemistry, University of Iowa, *Nanomaterials for Surface Enhanced Spectroscopy: Is Quantitative Detection Really Possible?*

October 2012: **Professor James Hutchison**, Department of Chemistry, University of Oregon, *Metal Nanoparticle Synthesis, Functionalization and Transformations: Toward Greener Nanoscience*

November 2012: **Professor George Schatz**, Department of Chemistry, Northwestern University, *New Plasmonic Nanomaterials and Optical Applications*

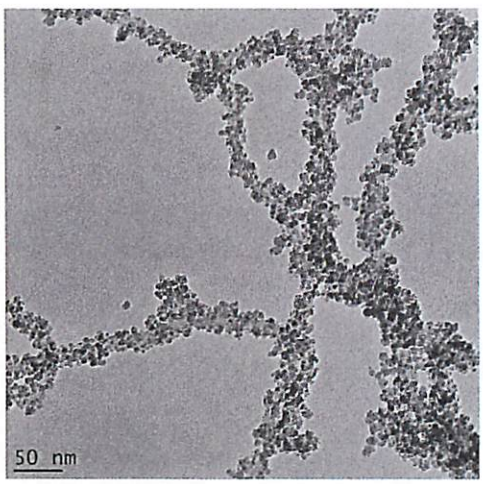
For 2013, keep up to date on these seminars through the NANO@IOWA biweekly newsletter. Subscribe to the newsletter by emailing us at nni@uiowa.edu.

FACULTY PROFILE

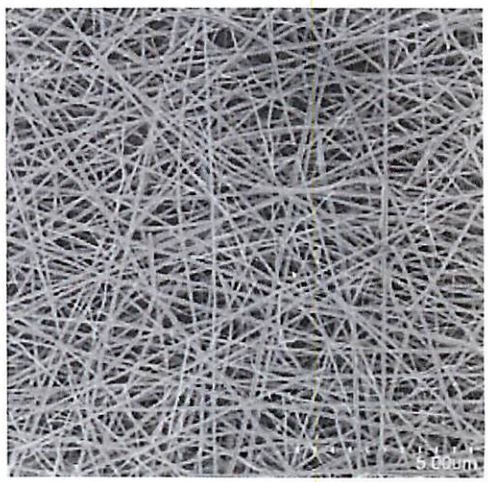
David M. Cwiertny
Civil and Environmental Engineering
College of Engineering, University of Iowa

David M. Cwiertny is currently an Assistant Professor of Civil and Environmental Engineering at the University of Iowa. The rapid growth in nanotechnology has raised numerous questions as to the potential impact of nanoparticles on the natural environment, especially the quality of our air and water resources. On one hand, the unique reactive properties of engineered nanomaterials make them attractive options in various applications to improve environmental quality including water and wastewater treatment. However, others have scrutinized the growing number of industrial applications and commercial products reliant on engineered nanomaterials, which will undoubtedly result in their inadvertent release into the environment, where they may adversely impact the quality of air, water and soil. The Cwiertny laboratory explores both sides of nanotechnology's double-edged sword. A primary focus of the group is the development of nanomaterial-based treatment strategies for water and wastewater treatment. For example, David's group has shown that carbon nanotubes (CNTs) are an ideal substrate for use in ozone-based advanced oxidation processes, generating powerfully oxidizing hydroxyl radicals that can be used to degrade a wide variety of chemical and biological contaminants. They have also explored the use of novel hybrid nanostructures, in which nanoscale metal oxides are grown on CNT surfaces, as sorbents for heavy metals in contaminated water supplies. More recently, the group has been utilizing the innovative synthesis process of electrospinning to fabricate nanofiber mats of different reactive substrates (e.g., photocatalysts and sorbents) for use as point-of-use filtration devices. A motivating theme for these research projects is the belief that the unique reactivity displayed by materials within the nanodomain can be exploited to overcome challenges that have long stymied water quality engineers. Because such applications must be done responsibly, a complementary focus of the Cwiertny laboratory is the fate of nanomaterials in natural and engineered aquatic systems. These projects explore the colloidal stability and dissolution of nanomaterials, as well as potentially hazardous byproducts generated from their processing in the environment via (photo)chemical reactions.

David has a PhD from the Department of Geography and Environmental Engineering at Johns Hopkins University, and a BS in Environmental Engineering Science with a minor in Chemistry from the University of California at Berkeley. After receiving his PhD, David came to the University of Iowa (the first time) as a postdoctoral researcher working jointly with Professors Vicki Grassian and Michelle Scherer. Prior to starting as a faculty member in the Department of Civil and Environmental Engineering at the University of Iowa in the fall of 2011, he was an Assistant Professor of Chemical and Environmental Engineering at the University of California at Riverside. More information can be found on David's website: http://www.engineering.uiowa.edu/cee/faculty-staff/david-m-cwiertny



Carbon nanotubes decorated with iron oxide nanomaterials that represent promising, high-capacity sorbents for heavy metal pollutants.

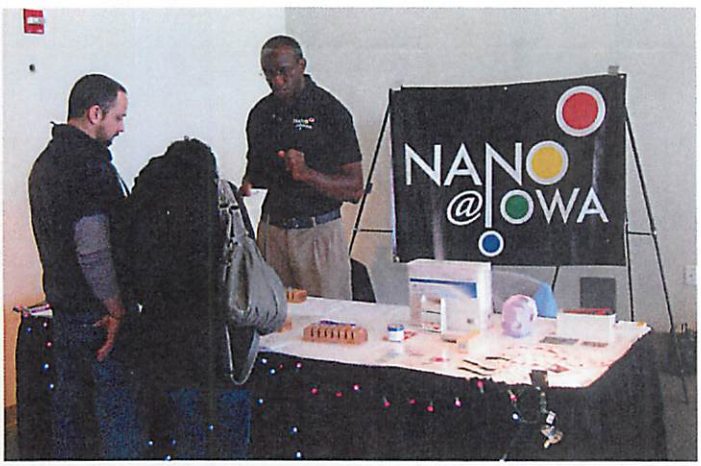


A mat of electrospun titanium dioxide nanofibers that can be used in photocatalytic filtration applications.

STEM Outreach

The Nanoscience and Nanotechnology Institute at the University of Iowa (NNI) is engaged in Science, Technology, Engineering and Mathematics (STEM) outreach to K-12 students and the general public. **Professor Vicki Grassian's** proposal, "Expanding and Enhancing STEM Initiatives Within CLAS," was funded by the Provost Office through Better Futures for Iowans funding. This project is to expand existing efforts, plan and conduct new activities, and enhance the effectiveness of STEM (Science, Technology, Engineering and Mathematics) outreach and education in departments and centers within the College of Liberal Arts and Sciences (CLAS), including the Department of Physics and Astronomy, Department of Biology, Department of Chemistry, Delta Center, Optical Science and Technology Center, and Nanoscience and Nanotechnology Institute.

For K-12 education, hands-on activities and outreach materials are included in a *Nano-to-go* outreach kit that includes activities for ~25 students, with accompanying presentation and demonstration materials for the presenter. The *Nano-to-go* kit can be borrowed by NNI-affiliated faculty for use in outreach presentations. NNI core faculty have been involved in many outreach activities that have increased the public's understanding of nanoscience and nanotechnology. Faculty have visited local high schools and middle schools (Eastern Iowa region) as STEM career day speakers. Faculty have presented workshops to middle school and high school students participating in science clubs. **Professor Michelle Scherer**, Civil and Environmental Engineering, has presented a microscope workshop titled *Scale Matters* to elementary school groups. Every spring, **Professor Allan Guymon**, Chemical and Biochemical Engineering, presents a polymer and nanomaterials unit to chemistry classes at West High School in Iowa City. **Professor Aliasger Salem**, Pharmaceutical Sciences & Experimental Therapeutics, presented on nanomedicine at several community events in Iowa City, Muscatine and Henry County. **Dr. Russell Larsen** developed and presented hands-on nano activities for NanoDays at the Science Center of Iowa in Des Moines in conjunction with the NISE (Nanoscale Informal Science Education) national network. An informal learning audience of approximately 300 and 500 children and parents visited the NanoDays exhibit in 2011 and 2012, respectively. If you are interested in participating in NanoDays this spring, please contact us at nni@uiowa.edu.



NanoVox Partnership Announced

The Nanoscience and Nanotechnology Institute (NNI) is embarking on a partnership with NanoVox (https://nanovox.net/) which is a regional nanotechnology initiative aimed at enabling collaboration among academic institutions, industry and government. The NanoVox region includes Minnesota, Wisconsin, Iowa, and North and South Dakota. The goal of NanoVox is to bring together the R&D community to enhance collaboration in the area of nanotechnology. In 2013, NNI will become an academic partner with NanoVox and we will work together to promote nanotechnology R&D in the state of Iowa. UI nanotechnology researchers are invited to participate in the 3rd Annual Regional Academic and Industry Nanotechnology Conference, which is co-sponsored by NanoVox and will take place in St. Cloud, Minnesota, on February 28, 2013 (http://www.stcloudstate.edu/cose/2013NanotechConference.asp). Attendees and speakers from Minnesota, Wisconsin, Iowa and the Dakotas will participate in a day of networking opportunities and technical sessions featuring current nanotechnology research in agriculture, environment, energy and medicine.

NanoVox
ENABLING COLLABORATION

THE UNIVERSITY OF IOWA | NANOSCIENCE & NANOTECHNOLOGY INSTITUTE @ UI

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REU in Nanoscience & Nanotechnology

Summer 2013

The University of Iowa

SUMMER 2013:

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

PROGRAM DATES:
MAY 28, 2013 – AUGUST 2, 2013

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, 2013. For additional information, please visit the website: http://www.uiowa.edu/~nanotech/reu/