

FROM THE DIRECTOR

Welcome to the 2011 newsletter from the Nanoscience and Nanotechnology Institute at UI (NNI@UI). It has been an exciting year for UI students, staff and faculty engaged in nanoscience and nanotechnology research and education.

For example, earlier this year, **Thomas Peters**, Associate Professor of Occupational and Environmental Health, was invited to Moscow in February, 2011 for the Science and Technology Working Group Meeting (STWG) of the US-Russia Bilateral Presidential Commission. Through an interagency selection process under the National Nanotechnology Initiative, Dr. Peters was chosen to lead a topical area of the Environmental Health and Safety (EHS) session: *Protocol and methods development, including dosimetry and measurement tools, methods for identification of nanomaterials in the biological medium and in the environment and methods for assessment of their hazard levels.*

In June, I had the opportunity to co-chair with Robert Hamers, Distinguished University Professor from University of Wisconsin-Madison, a National Science Foundation-funded workshop in Arlington, VA. The workshop was titled "Nanomaterials and the Environment: The Chemistry and Materials Perspective". The 35 participants of the workshop, including UI professors **Tori Forbes** and **Sarah Mason**, met to discuss challenges, opportuni-



Vicki H. Grassian
 Director of NNI@UI

ties and research needs for nanomaterial interactions with environmental and biological systems from a chemical, molecular perspective.

The workshop identified a number of grand challenges, knowledge gaps, methodology gaps, and research needs where molecular-based approaches could provide significant insights into the effect of nanomaterials on environmental health and safety. The workshop report can be found at <http://nsfenv-nano.chem.wisc.edu>.

Besides outside engagement, a number of interesting seminars in nanoscience and nanotechnology were given on the UI campus in the last year, including:

September, 2010: **Balaji Narasimhan**, Professor of Chemical and Biological Engineering, Iowa State University, *Nanovaccine Platforms for Biodefense Pathogens*

October, 2010: **Maureen Donovan**, Professor of Pharmaceutics and Translational Therapeutics, UI College of Pharmacy, *Size and Surface Characteristics Influencing Nanoparticle Uptake and Transport through the Olfactory Mucosa*

March, 2011: **R. William Field**, Professor of Occupational and Environmental Health, and Epide-

miology, *Radioactive Nanoparticle (Radon) Exposure and Lung Cancer*

January, 2011: **Amanda Haes**, Assistant Professor of Chemistry, *Designing Nanomaterials for Biomedical Applications*, Immunology & Molecular Cellular Biology Graduate Programs, UI Department of Internal Medicine

January, 2011: **Thomas Peters**, *Airborne Monitoring to Distinguish Engineered Nanomaterials from Incidental Particles*

Nanoscience and Nanotechnology researchers continue to be very successful in acquiring funding for collaborative efforts in cutting edge research. **Jerald Schnoor**, Allen S. Henry Chair in Engineering, Department of Civil and Environmental Engineering & Co-Director of the Center for Global and Regional Environmental Research, was awarded a \$200,000 subcontract with Rice University's EPA/NSF STAR-funded grant: "Engineered Nanomaterials and Plant Interactions: Uptake, Transformations, and Effects". Dr. Schnoor and **Anne Schwarzkopf Alexander**, Civil and Environmental Engineering, are examining the uptake, toxicity and metabolism by plants to a variety of nanoparticles including cerium oxides, iron oxides, silver oxides, quantum dots and nC60.

(Continued next page)

Sarah Larsen, Professor of Chemistry, and co-Director of NNI@UI, along with **Allan Guymon**, Professor of Chemical & Biochemical Engineering, received a \$360,000 NSF Research Experiences for Undergraduates (REU) grant, funding an REU program for the summers of 2011, 2012, and 2013. This follows a very successful 3-year REU program Dr. Larsen directed in 2008-2010. See page 3 for more information and highlights of the 2011 REU program.

In November, 2010, the Roy J. Carver Charitable Trust awarded a \$175,000 grant to the UI for the acquisition of a dispersive Raman spectrophotometer with confocal microscope. **Maureen Donovan**, Professor of Pharmaceutical Sciences and Experimental Therapeutics, is the PI on the grant. The Co-PI's are **Jennifer Fiegel**, Assistant Professor of Pharmaceutical Sciences and Experimental Therapeutics, and Chemical & Biochemical Engineering; **Julie**

Jessop, Associate Professor, Department of Chemical & Biochemical Engineering; **Vicki Grassian**, Professor of Chemistry, Chemical & Biochemical Engineering, and Occupational & Environmental Health; and **Randy Nessler**, Central Microscopy Research Facility.

In January 2011, the Department of Chemistry in the College of Liberal Arts and Sciences received a \$198,500 grant from the Roy J. Carver Charitable Trust and \$40,000 in matching funds from the UI Office of the Vice President for Research for the purchase of a state-of-the-art Bruker D8 Advance X-ray diffractometer. This instrument will provide critical information on the atomic structure of a wide-range of cutting-edge solid-state materials being investigated in research laboratories across campus. These new diffraction capabilities will greatly aid in the study of powders and films such as pharmaceutical drug compositions, poorly crystalline nanoscale particles, and polymeric

structures that are being developed for biomedical, environmental, and energy applications.

Five NNI@UI Core Faculty members have received one-year pilot grant awards ranging up to \$50,000 each through the Institute for Clinical and Translational Science (ICTS). ICTS pilot grants are awarded annually to junior investigators and established scientists to enable preliminary and proof-of-concept studies and encourage the expansion of clinical and translational research into new areas. Pilot grant award winners include the following: **Aliasger Salem**, Associate Professor of Pharmaceutics; **Amanda Haes**, Assistant Professor of Chemistry; **Amnon Kohen**, Ph.D., Professor of Chemistry; **Kevin Rice**, Professor of Medicinal & Natural Products Chemistry and Pharmaceutics; and **Leonard MacGillivray**, Professor of Chemistry.

Nanotoxicology Research Cluster at the University of Iowa

The toxicology of manufactured nanomaterials is a burgeoning science. Since 2008, a Nanotoxicology Initiative under the co-directorship of Drs. **Peter S. Thorne** and **Vicki H. Grassian** has developed with members from the Colleges of Public Health, Medicine, Pharmacy, Engineering, and Liberal Arts and Sciences. This initiative has been successful and combines the expertise of investigators from NNI@UI with those from the Environmental Health Sciences Research Center (EHSRC).

Manufactured nanomaterials are found in cosmetics, coatings, consumer electronics, household products, and building materials, and are used in environmental remediation. Because of this they present a potential risk for human exposure, and thus provide an impetus for studying their health implications. The primary goal of nanotoxicology research is to better understand the health effects of these very small particles from several different perspectives, including toxicity and novel methods for drug delivery.

Nanotoxicology investigators study manufactured nanomaterials, nanomaterials for drug delivery and incidental nanoparticles. The latter are nanoparticles or ultrafine particles that arise from high temperature processes including combustion and welding as well as from gas to particle conversion processes that are prevalent in both urban and rural environments. Thus, there is great interest in understanding the health effects of these nanoparticles as they impact air quality in both indoor and outdoor environments and human health.

FACULTY PROFILE



C. Allan Guymon
Chemical & Biochemical Engineering
College of Engineering, University of Iowa

With the increased opportunities that nanotechnology has provided in polymeric materials, understanding the role of order in polymer systems and the consequent effect of this order on ultimate properties is critical in development of organic nanostructured systems. Additionally, photopolymerization, i.e. polymerization processes initiated by light, is one of the most rapidly expanding and transformative technologies for materials production.

Dr. Allan Guymon, Professor, has been with the Department of Chemical and Biochemical Engineering at the University of Iowa since 2002 and a member of NNI@UI since its inception. Research in his group has focused

on combining the promising fields of nanotechnology and photopolymerization in understanding the role of order on polymerization kinetics in and of self-assembled systems, and conversely the impact of the polymerization on ultimate nanostructure and properties. Further work has focused on developing new chemistries and methodologies to expand the scope of photopolymerization by alleviating current limitations through molecular design. Critical in this work is investigating and characterizing the system before, during, and after polymerization to allow optimization and development of unique properties. This knowledge has been applied in application areas including tissue engineering, drug delivery, contact lens materials, coatings development, and display materials.

Professor Guymon has been a research mentor with the NNI@UI REU program since the first group of undergraduate researchers arrived on campus in May, 2008. He joined Professor Sarah Larsen as co-director this past summer. Participants benefit not only from his technical expertise, but also his love of soccer (developed by coaching 3 children in the sport) through a series of friendly soccer matches at Hubbard Park. The final event this past summer was a visit to the Amana Colonies in which the students were able to compare the intricacies of hand crafted technology with the nanotechnology they learned over the summer.

More information on research in the Guymon Research Group may be found at their website: http://www.engineering.uiowa.edu/~a_guymon/index.html

Summer 2011 REU in Nanoscience and Nanotechnology

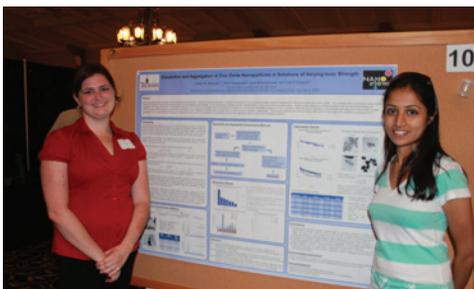
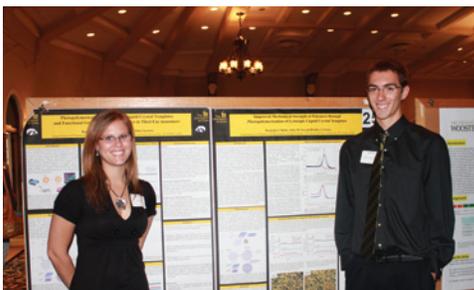
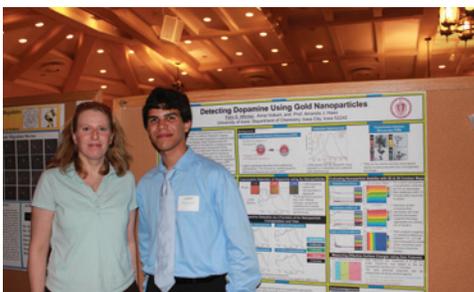
The 2011 NSF Research Experience for Undergraduates (REU) in Nanoscience and Nanotechnology at the UI was a huge success and continued its tradition of excellence in its fourth consecutive year.

The program, which pairs undergraduate students with NNI@UI faculty mentors throughout campus, was held for 10 weeks on the UI campus.

Fifteen undergraduate students came from all across the United States to spend their summer on the UI campus working with their faculty mentors, graduate students, and postdoctoral associates, to gain research experience in cutting edge topics related to environmental and health aspects of nanoscience and nanotechnology and to learn about future opportunities for graduate study.

The REU program is run through NNI@UI. NNI@UI gratefully acknowledges the partnership with the Iowa Center for Research by Undergraduates (ICRU) and the SROP/McNair program administered through the Graduate College.

REU participants present their research at the Undergraduate Research Poster Session, sponsored by the UI Graduate College



Hassan Raza, Assistant Professor of Electrical and Computer Engineering, has developed a new multidisciplinary course to teach the fundamentals of nanoscale devices and systems from theory, computation, and experimental aspects. The course, available for the Fall 2011 semester, is titled *Nanoscale Devices and Systems (55:195)*.

Sarah Larsen represented NNI@UI at City High School and Southeast Junior High in Iowa City to discuss STEM career information in March and May, 2011, respectively. The seminar introduced students to exciting new careers in the sciences and engineering.

Russell Larsen, Sarah Larsen, and **Nicholas Ndiege** represented NNI@UI at the April, 2011 “NanoDays” event in Des Moines, Iowa. NanoDays, organized by the Nanoscale Informal Science Education Network (NISE Net), is a nationwide group of educational programs about nanoscale science and engineering and its potential impact on the future.

Over 80 eighth grade students at Mid-Prairie Middle School in Kalona, Iowa, actively participated in a presentation last October by **Anna Volkert**, graduate student in the **Amanda Haes** group. Anna guided the students through hands-on activities and a discussion on nanoparticles.

STEMulating Conference Held on UI Campus

The UI Chapter of National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCChE) hosted a very successful NOBCChE Midwest Regional Conference, “STEMulating our Future” in November, 2010. **Nicholas Ndiege**, Postdoctoral Associate in Chemistry, was a key organizer of the event and gave an oral presentation “*Nanocrystalline Zeolite Modification for Biomedical Imaging*”. Workshops were facilitated by several other UI researchers affiliated with NNI@UI, as well as researchers from other universities and industry, including:

- **Tonya Peeples** (UI Professor of Chemical and Biochemical Engineering), “What’s Hot in Biotechnology”
- **Mani Subramanian** (UI Professor of Chemical and Biochemical Engineering), “What’s Hot in Biotechnology”
- **Vicki Grassian** (UI Professor of Chemistry), “Nanotechnology in the Environment”
- **Ning Fang** (Iowa State Professor of Chemistry), “Nanotechnology in Human Health”
- **Allan Guymon** (UI Professor of Chemical and Biochemical Engineering), “Funding Your Education: Graduate Training Programs”
- **Norbert Pienta** (UI Professor of Chemistry), “Important Points in Training the Educator/Teach the Teacher”



NOBCChE



**NANOSCIENCE &
NANOTECHNOLOGY
INSTITUTE @ UI**

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REU in Nanoscience & Nanotechnology

Summer 2011

The University of Iowa

SUMMER 2012:

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

PROGRAM DATES:

MAY 22, 2012 - JULY 27, 2012

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, 2012. For additional information, please visit the website: <http://research.uiowa.edu/nniui/reu>