Mid-year workshop: Thursday, January 15
"Nanoparticles-- Chemical and materials questions: health and environmental concerns"
Chair: Lee Penn, Chemistry, UMN

Abstract: Everyday, people encounter nanomaterials in products (e.g., in socks and cosmetics), technology (e.g., computer and phone components), medicine, and the environment (both natural and anthropogenic nanomaterials). Nanotechnology has advanced tremendously in the past two decades, and nanomaterials, with at least one dimension in the nanoscale regime, have been used in a wide range of applications. There is a pressing need to improve our understanding of the chemical and physical properties of nanoparticles as well as how those properties change as a function of time and environment. This workshop will be devoted to discussions about the fundamental properties of nanomaterials, how nanomaterials interact with their environment, how nanomaterials change as a function of time and their environment, the potential impacts of nanoparticle releases into the environment, as well as the legal, societal, and ethical implications of an emerging field like nanotechnology.
Current Speaker List (with tentative talk times)

Proposed Schedule
8:20 a – Welcome (Lee Penn)
8:30 a – Zeev Rosenzweig from Chemistry at UMBC
9:00 a – Don Baer from PNNL
9:30 a – Ian Gunsolos from UMN
10:00a – break
10:15a – Gayla Orr from PNNL
10:45a – Leili Fatehi from UMN
11:15a – Vicki Grassian from U-Iowa
11:45a – CABOT – confirmed, but speaker to be determined

12:15p – lunch
1:15p – Industrial Vignettes (5min each, ca. ten, with discussion after 5th and 10th.)
2:30 – Panel discussion
Dr. Rosenzweig’s research program aims to develop new techniques for the synthesis of luminescent and magnetic nanomaterials and utilize them in a wide range of applications including biomedical imaging, biosensors, and photovoltaics. Current research projects in the laboratory involve the synthesis of luminescent semiconductor nanomaterials and their toxicity testing in zebra fish models, and the synthesis of complex composite nanomaterials with unique luminescent properties that could be used in optical coding applications. Another important area of research is the replacement of currently used toxic and rare nanomaterials with benign and earth abundant nanomaterials to minimize adverse effects on human health and the environment while reducing the cost of nanotechnology applications.
Characteristics of nanoparticles that limit our ability to control and measure their properties

The fundamental nature of nanoparticles gives rise to several characteristics that complicate both their application and characterization. These complications directly link to the growing recognition that nanoparticles and other nanostructured materials are sometimes inadequately characterized and that this may limit or even invalidate some of the conclusions regarding particle properties and behavior. Our research on the interaction of iron metal-core oxide-shell nanoparticles with environmental contaminants, studies of the behaviors of ceria nanoparticles, with a variety of medical, catalysis and energy applications, and measurements of properties silver particles that can be produced in many different shapes and sizes highlight a number of common nanoparticle challenges that are not always recognized by researchers and vendors working with nanoparticles. These challenges include: 1) the importance of surfaces and surface characterization, 2) supposedly equivalent nanoparticles often don’t have identical properties (nanoparticles are often not created equal – subtle differences in synthesis and processing can have large impacts); 3) nanoparticles are dynamic and frequently change with time having lifetime implications for products and complicating understanding of health and safety impacts; 4) the high sensitivity of nanoparticles to their environment complicates characterization and applications in many ways; 5) the time and environmental sensitivity of means that they are easily altered (damaged) during analysis.

Portions of this work were performed using EMSL, a national scientific user facility sponsored by DOE-BER and located at PNNL. Aspects of the work have been supported by the DOE’s offices of Basic Energy Science (BES) and BER and the NIEHS under Center grant U19 ES019544
Minimizing the unintended consequences of nanomaterial entry into natural environments is of growing interest as the production and commercial use of these novel materials grow. Environmental risk is often evaluated on a case-by-case basis using model biological systems and simple toxicological endpoints. While valid and useful, this approach has limited capability to predict risk. In contrast, our approach is to study more generally the nanomaterial-biological interface, with a focus on the cell membrane. Here we use the single celled bacterium Shewanella oneidensis as a model biological system, chosen to minimize biological complexity while maximizing environmental relevance. Specific hypotheses generated through observation of the bacterium-nanoparticle interface are further evaluated in mirrored experiments on supported lipid bilayers. This dual approach results in complimentary data sets that describe the response of a living or model organism to nanomaterial exposure under identical conditions, providing both realistic and fundamental insight into the nanomaterial-biological interface. This approach is used to identify basic rules that can predict risk and inform the design of more environmentally-friendly nanomaterials.”
Current research interests include:
Investigate the cellular interactions and fate of nanoparticles to better understand mechanisms of particle toxicity and biocompatibility.
Study the spatial and temporal patterns of the EGF receptor interactions with its ligands and dimerization partners to better understand their function in the transformation of information across the cell membrane.
Identify the role of membrane microdomains in receptor function.
Investigate the molecular interactions of the ErbB receptors, and the NMDA receptor that govern the formation and specificity of the glutamatergic synapse.
Leili Fatehi is a Visiting Scholar in the Science, Technology, and Environmental Policy program area at the Hubert H. Humphrey School of Public Affairs. She is also an Adjunct Associate Professor of Law at the University of Minnesota Law School. Her research focuses on the legal, societal, and ethical implications of emerging science and technologies such as nanotechnology. Her current research interests include the legal, ethical, and policy dimensions of synthetic biology, genetics, and human enhancement technologies. Ms. Fatehi has served on several grants related to issues of law and ethics in emerging sciences and technologies, including grants from the National Science Foundation and National Institutes of Health.

Related: From 2005-2007, Ms. Fatehi was a Research Associate at Meridian Institute in Washington, DC, where she researched and published on the implications of nanotechnology for the world's poor, and Editor of "Nanotechnology and Development News".
TITLE: Adsorption of Environmentally and Biologically Relevant Molecules on Nanoparticle Surfaces and Its Impact on Nanoparticle Behavior

Staying for PANEL!

Website: Applications and Implications of Nanoscience and Nanotechnology in Environmental Processes: Nanoscience and nanotechnology have potential use in environmental applications. In collaboration with Gary Aurand, we are investigating how nanomaterials can be used in biomass conversion. Another important aspect of our work is in the implications of nanoscience and nanotechnology and the environmental consequences of nanomaterials. Our studies are focused on the behavior of nanomaterials in environmentally and biologically relevant media. We take an integrated comprehensive approach to understanding the molecular level details of the chemistry to better understand environmental and health impacts.
11:45a – CABOT speaker

Nanoparticle Safety Using Our Work on Graphenes as a Case Study
Panel Discussion
Moderator(s)
Joe Delaney from Boston Scientific
Prof. Wayne Gladfelter from UMN (as “back-up” second moderator)

Industrial vignettes

FINISH formally by 4:00p
OPTIONAL CharFac tour