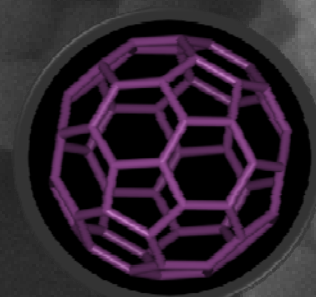
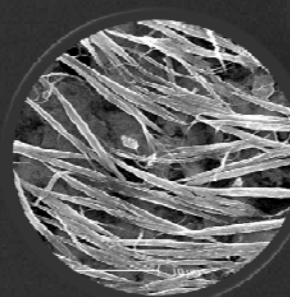
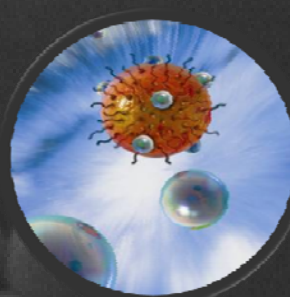
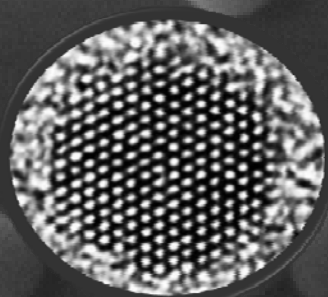


Nanotechnology and the Environment: Benefits and Risks

Kristen M. Kulinowski, PhD

kk@rice.edu

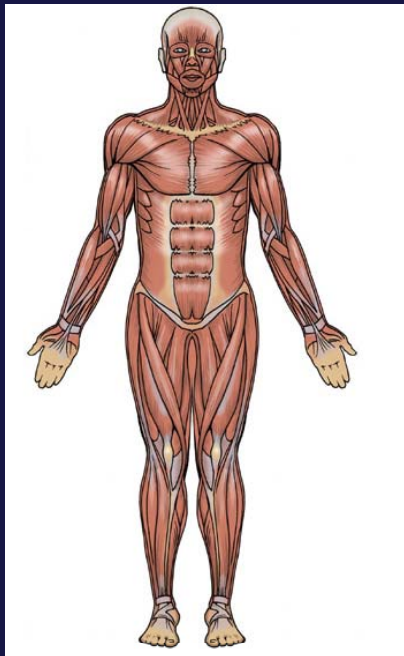


Center for Biological & Environmental Nanotechnology

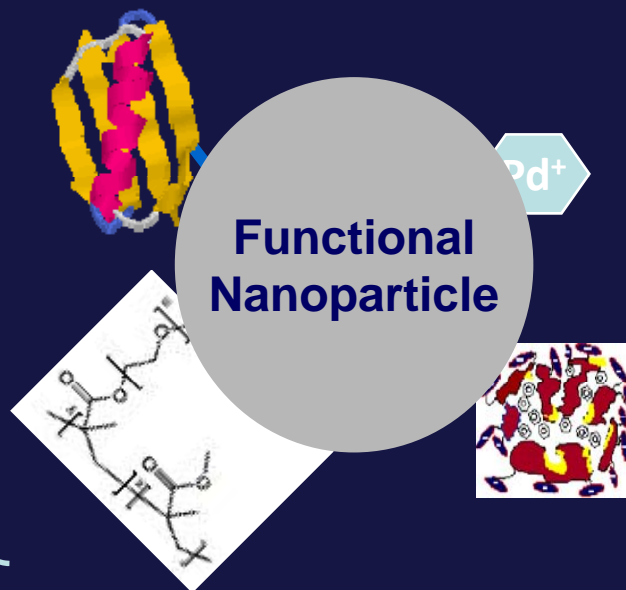
Research

Education

Outreach



Theme 2: Nanoparticles for Bioengineering



Theme 1: Nanoscience at the Wet/Dry Interface



Theme 3: Nanoparticles & Environmental Engineering



Prof Vicki Colvin, Director



Established in 2001



International Council on Nanotechnology

INCLUSIVE

Multistakeholder cooperation

GLOBAL

International perspective



TECHNICAL

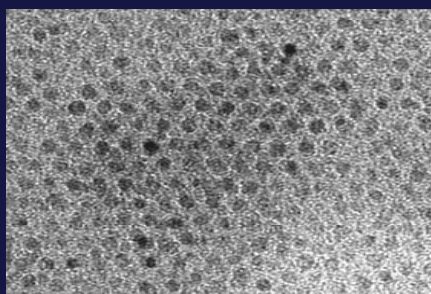
Grounded in science

PROACTIVE

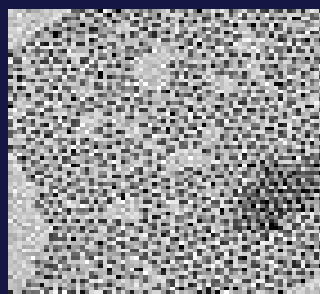
Stewards for sustainability

Size-Dependent Properties

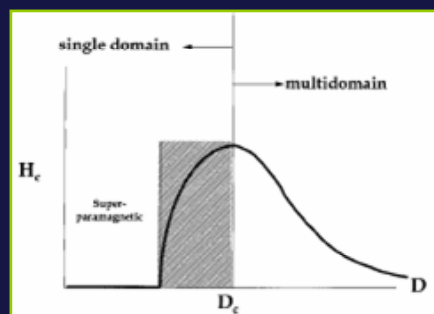
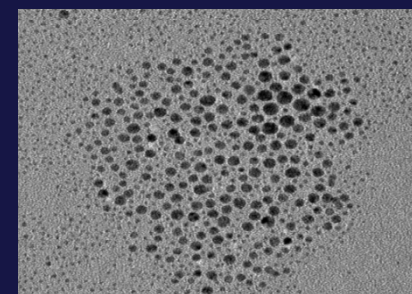
Fe_3O_4 , Magnetite (4 nm)



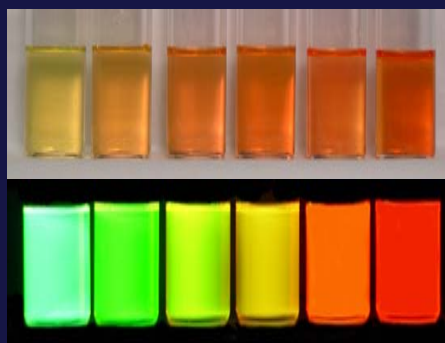
CdSe (8 nm)



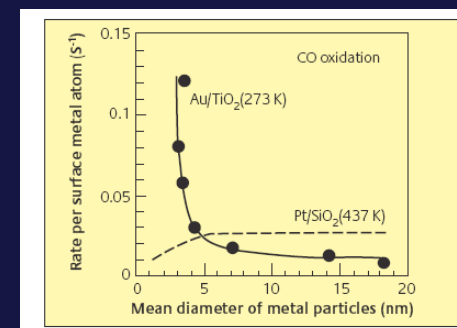
Gold (~ 10 nm)



Magnetism



Emission



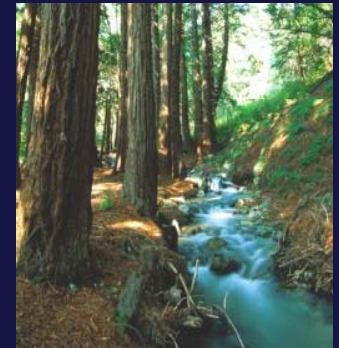
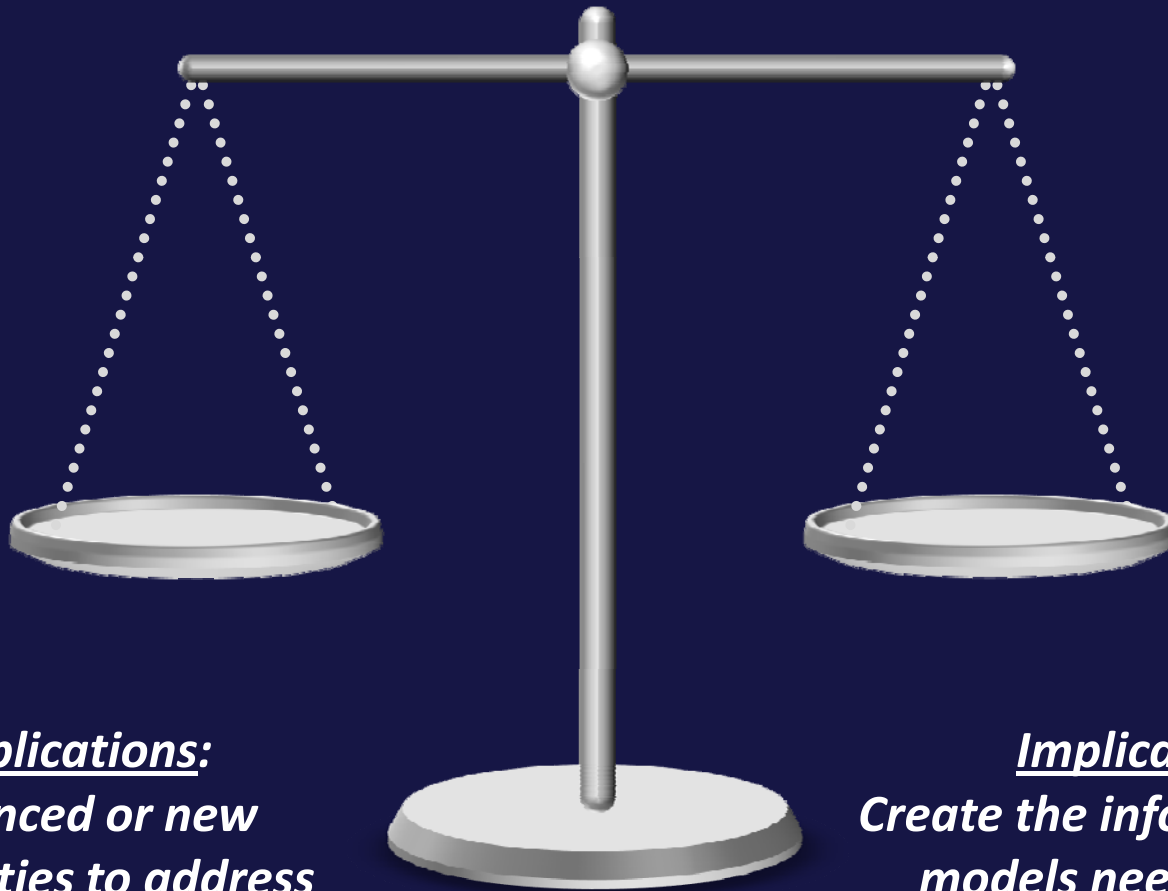
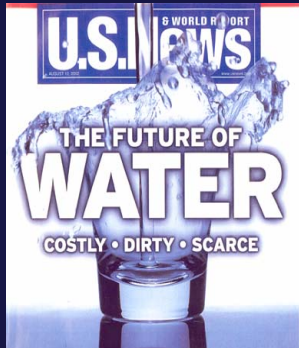
Reactivity

**Special [*chemical, physical, electrical,
mechanical, thermal*] properties**



**Special BIOLOGICAL, ENVIRONMENTAL
properties**

Balancing the Benefits and Risks



Applications:
Enhanced or new capabilities to address existing and future environmental problems.

Implications:
Create the information and models needed to use nanomaterials in a sustainable manner

Potential Targets of Risk

Workers



Consumers




Environment



What is known about the impacts of engineered nanomaterials?

Cataloguing and Discussing the Research



The Virtual Journal of Nanotechnology Environment, Health and Safety

HOT PAPER: "Nucleation of protein fibrillation by nanoparticles," Linse, S., C. Cabaleiro-Lago, Xue, W.-F., Lynch, I., Lindman, S., Thullin, E., Radford, S. E., Dawson, K. A. (2007). [Proceedings of the National Academy of Sciences of the United States of America](#) XXXX000: XXX.

This work explores the role that nanoparticles play in accelerating the rate of a process called protein fibrillation, which has been linked to amyloid diseases. Amyloid diseases are a broad class of ailments that result when amyloid proteins misfold and form insoluble fibrous plaques (fibrils) that deposit in the tissues of the body. Linse et al. noted an increased rate of protein fibrillation when beta 2-microglobulin, an amyloid protein associated with complications from kidney dialysis, was put into solution with nanoparticles. Four different types of nanoparticles (copolymer particles of N-iso-propylacrylamide (NIPAAm) and N-tert-butylacrylamide (BAAm), cerium oxide particles, CdSe or CdSe/ZnS quantum dots and multi-walled carbon nanotubes) each accelerated the production of small seeds upon which fibrils form most effectively. However this study did not determine that nanoparticles can cause human disease.

For a general overview on nanoparticles and amyloid diseases, see [here](#).

For questions and answers about nanoparticles and amyloid diseases, see [here](#).

[More information.](#)

Recent Additions [See the full issue](#) **Report Virtual Journal Issues:** April 2007

Bello D, Hsieh SF, Schmidt D, Rogers E
Nanomaterials properties vs. biological oxidative damage: Implications for toxicity screening and exposure assessment
Nanotoxicology

★★★★★ submitted by [Kampers](#) [\[about me\]](#) [\[report this\]](#)
"This is a good example of the kind of work that needs to be done all over the world to assess the hazards of nanoparticles."

- Monthly updates
- Over 3900 records
- Backgrounders on key literature

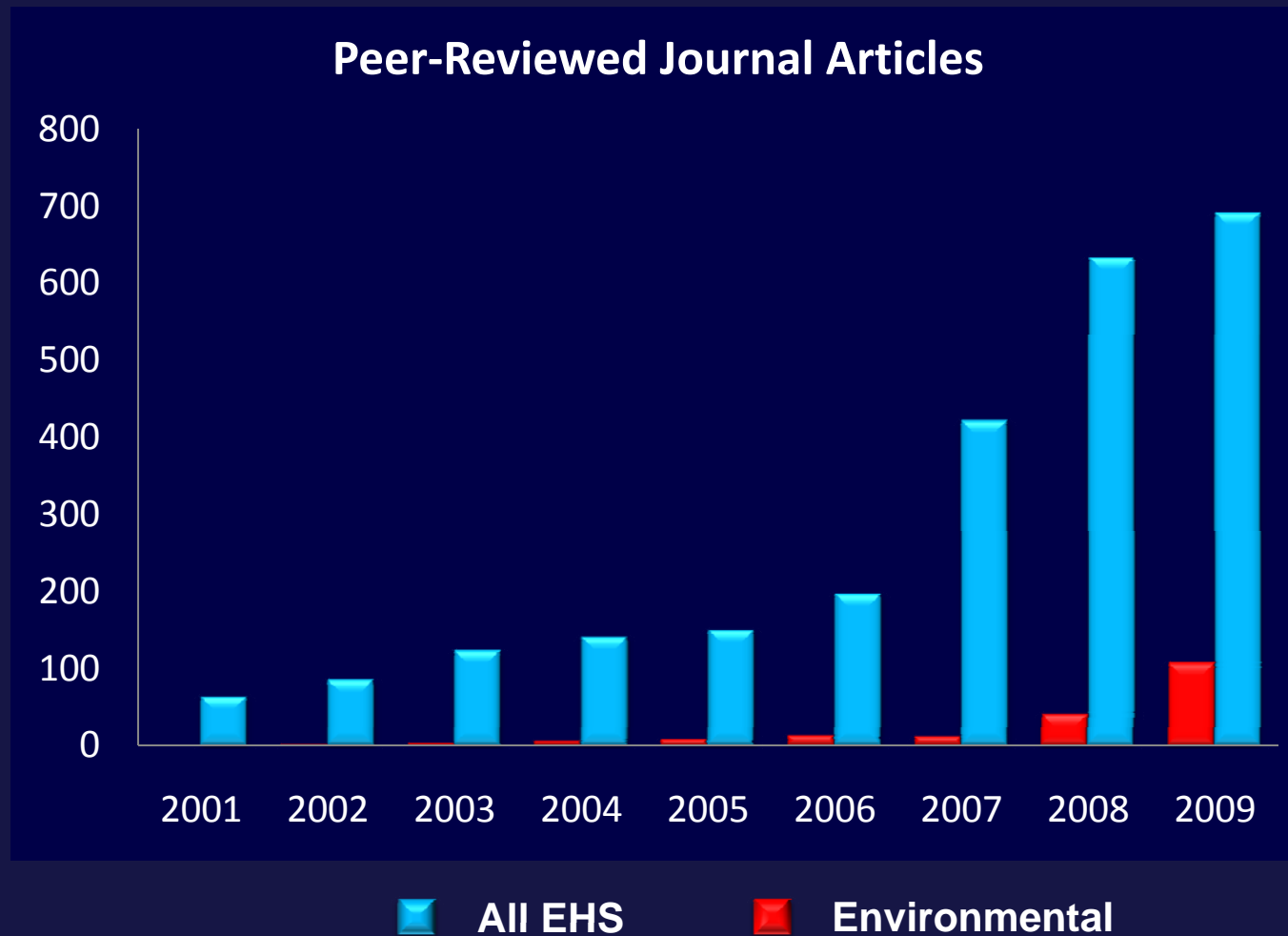


★★★★★ [out of five]

"This paper makes a major contribution to the literature ..."

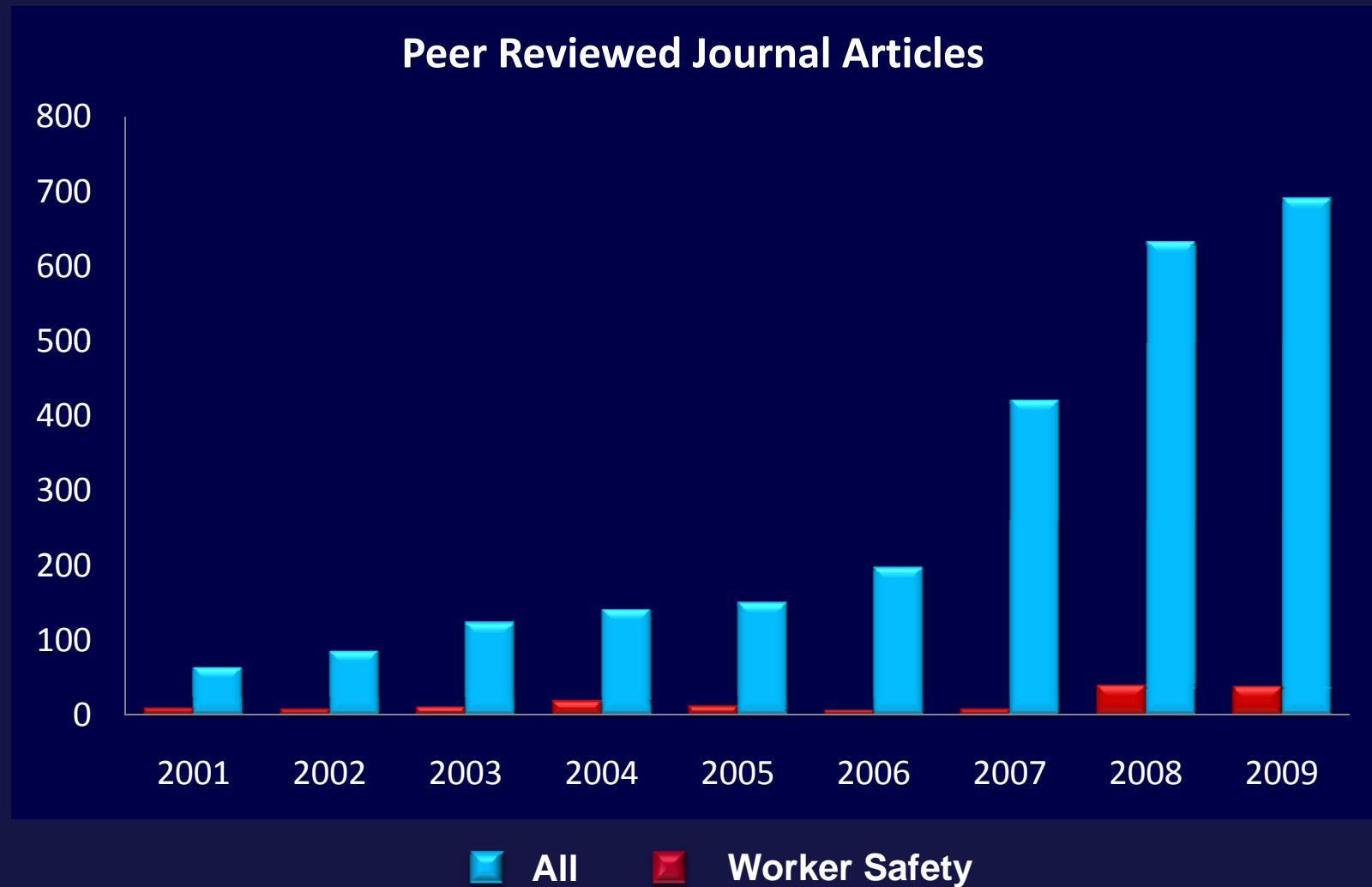
<http://icon.rice.edu/VirtualJournal.cfm>

Environmental Research Constitutes Only 7% of NanoEHS Literature



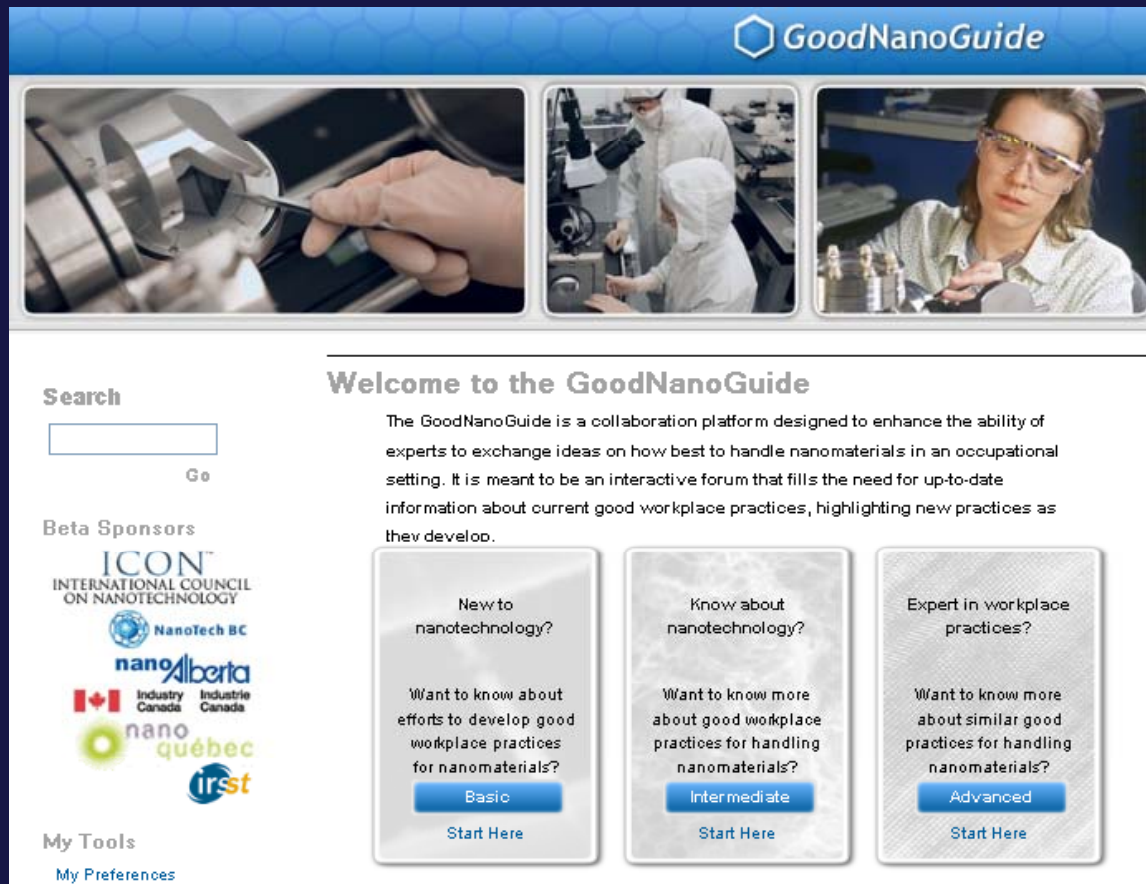
Source: <http://icon.rice.edu/report.cfm>

Limited Work of Occupational Relevance



<http://icon.rice.edu/research.cfm>

The GoodNanoGuide



The screenshot shows the GoodNanoGuide website interface. At the top, there is a blue header with the GoodNanoGuide logo. Below the header are three images: a hand using a pipette, two people in lab coats working in a lab, and a woman wearing safety goggles. The main content area features a search bar with a 'Go' button, a 'Welcome to the GoodNanoGuide' section with a paragraph of text, and three columns of information cards. Each card has a question, a description, and a 'Start Here' button. The left sidebar includes 'Beta Sponsors' with logos for ICON, NanoTech BC, nanoAlberta, and nano québec, and a 'My Tools' section with a 'My Preferences' link.

Search

Go

Beta Sponsors

ICON™
INTERNATIONAL COUNCIL
ON NANOTECHNOLOGY

NanoTech BC

nanoAlberta

Industry Canada Industrie Canada

nano québec

irst

My Tools

My Preferences

Welcome to the GoodNanoGuide

The GoodNanoGuide is a collaboration platform designed to enhance the ability of experts to exchange ideas on how best to handle nanomaterials in an occupational setting. It is meant to be an interactive forum that fills the need for up-to-date information about current good workplace practices, highlighting new practices as they develop.

<p>New to nanotechnology?</p> <p>Want to know about efforts to develop good workplace practices for nanomaterials?</p> <p>Basic</p> <p>Start Here</p>	<p>Know about nanotechnology?</p> <p>Want to know more about good workplace practices for handling nanomaterials?</p> <p>Intermediate</p> <p>Start Here</p>	<p>Expert in workplace practices?</p> <p>Want to know more about similar good practices for handling nanomaterials?</p> <p>Advanced</p> <p>Start Here</p>
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- Protected Internet site on occupational practices for the safe handling of nanomaterials
- Multiple stakeholders contribute, share and discuss information
- Modern, interactive, up-to-date
- Launched 1 June 2009

<http://GoodNanoGuide.org>

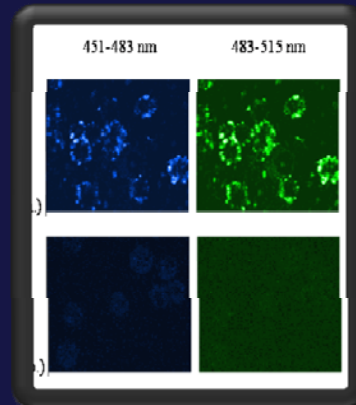
Beneficial Interactions

Cancer Therapy



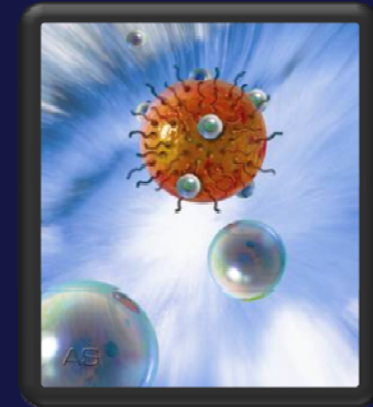
J. West et al.

Tumor Detection



R. Drezek et al.

Water Treatment



V. Colvin et al.

Pilot Project Tests Nanoparticle-Enabled Water Treatment & Reuse

“NanoRust” and novel derivatized fullerenes to remove hazardous water pollutants in municipal systems



*Guanajuato, Mexico
(UN Heritage, pop. 80,000)*



Wastewater Treatment Plant



Grad Student Jesse Farrell

- First known test of nanoparticles in municipal water and wastewater treatment
- Test bed will explore (1) using a sand-nanomagnetite in-line filter to remove arsenic in a well field, and (2) wastewater photo-disinfection with fullerenes
- Partnership with Municipal Water and Sewerage Authority of Guanajuato.
- **Project Team: Alvarez, Li, Tomson, Lou, Colvin**