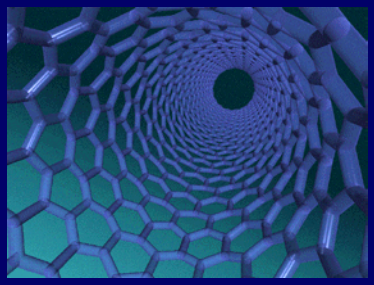

Gradient CORPORATION

EH&S Nano News

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Editor: Barbara D. Beck, Ph.D., DABT
Dr. Beck directs Gradient's nanotechnology, toxicology, and risk assessment practices.

In This Issue

Recent Government Briefs

NIOSH eNews November 2006, vol 4, no 7.

The November issue of NIOSH eNews provides a brief review of new developments in nanotechnology they are expecting as the year comes to an end and 2007 begins. For example, a new NIOSH guidance document, "Occupational Health Surveillance for Nanotechnology Workers," will be posted soon. In addition, NIOSH, NIH, and EPA are jointly accepting grant applications for research aimed at understanding toxicities associated with nanomaterials.

For more information, visit: http://www.cdc.gov/niosh/enews/enewsV4N7.html

Reports, Reviews, White Papers, and Books

Nanotechnology White Paper

The Use of Nanotechnology in Personal Care Products
Cosmetics, Toiletry, and Fragrance Association (CTFA)

http://www.ctfa.org/Template.cfm?template=/ContentManagement/ContentDisplay.cfm&ContentID=4263

This white paper from the CFTA provides an overview of the use, regulation, and safety of nanomaterials in personal care products. The authors explain that the use of nanoscale particles in consumer products (*e.g.,* titanium dioxide and zinc oxide in sunscreens) is not new and they observe that "the scientific methods currently used to ensure the safety of existing and new substances that may be used as ingredients of personal care products are equally appropriate for evaluating the safety of ingredients developed in the nano-scale range." A significant portion of the white paper addresses the regulatory mechanisms currently in place for personal care products containing nano-scale materials and the major relevant toxicity studies that have been published in recent years. The authors conclude that the scientific evidence to-date "does not support a broad assumption of increased toxicity for nanoscale materials because of their smaller size, particularly for dermal exposure;" however, it should be noted that this conclusion is based primarily on studies relevant to sunscreens.

Nanotechnology in Consumer Products

M. Gleiche, H. Hoffschulz, and S. Lenhert.

http://www.nanoforum.org/nf06~modul~showmore~folder~99999~scid~421~.html?action=longview_publication&

This Nanoforum Report focuses on consumer products in the European marketplace that claim to contain nanomaterials. The report is broken into two main sections – effects and innovations (*e.g.,* protection against corrosion, flame retardancy, and lightweight construction) and the products themselves. The authors discuss the various effects and innovations attributed to nanomaterials in consumer products briefly, though quite comprehensively. Textiles and apparel, personal care products, sports equipment, and electronics are among the product categories considered in the report. Throughout the paper, the authors note when nanomaterials are not actually present in the products as claimed (e.g., when the size of the particles are greater than the nano-scale). The authors conclude that the range of effects made possible by nanotechnology is not yet being fully exploited for use in consumer products and that the real product revolution may lie in more than one effect being used in an individual product.

Upcoming Meetings and Conferences

NanoTech Insight

Luxor, Egypt; March 10-17, 2007

http://www.nanoinsight.net/in/07/view/index/index.cfm

With reports on cutting edge developments in nanotech and an emphasis on networking, this conference in Luxor is relevant for all in the field of nano: from ethicists and investors to biologists, chemists, and those in technology transfer. The meeting's program is wide-ranging, with sessions on topics such as environmental risks/benefits, fabrication, medical applications, and renewable energy. However, the underlying focus is on international involvement and dialogue in order to develop nanotech in a sustainable way—bridging the gap between the industrial and developing worlds.

Strategic Communication and Applied Ethics in Nanobiotechnology

Oxford, England, UK; March 11-16, 2006

http://www.ctfa.org/Template.cfm?template=/ContentManagement/ContentDisplay.cfm&ContentID=4263

Researchers in academia, industry, and government are invited to attend this six-day course on public communication of nanotechnology. The goals of the course are to equip attendees with the "knowledge of the relevant ethical, legal, and social aspects of nanobiotechnology; skills to communicate effectively with the media and the public; and understanding of issues involved in the public acceptance of nanobiotechnology." The course format includes lectures, case studies, group exercises, discussions, and debates.

Hot-off-the-Presses Peer-Reviewed Research Articles of Note

K. Wittmaack, 2006. "In Search of the Most Relevant Parameter for Quantifying Lung Inflammatory Response to Nanoparticle Exposure: Particle Number, Surface Area or What?" *Environmental Health Perspectives* doi:10.1289/ehp.9254.

Abstract: http://www.http://www.ehponline.org/docs/2006/9254/abstract.html

Synopsis:

- Lung inflammation, as a response parameter for nanoparticle inhalation toxicity, is commonly studied in rats and mice. Previous studies have relied on surface area as a dose metric for determining the inflammatory effects of nanoparticles, though high doses of such material often had to be used to elicit a measurable response. As a result, nonlinear effects have often been observed and the issue of maximum tolerated doses also arises. While there are numerous inherent challenges in the quantification of lung inflammation, Wittmaack analyzed data from two previously published studies in order to identify the appropriate dose metric for lung inflammation in the context of both fine and ultra-fine particles.
- In the first study (Oberdörster *et al.,* 2000), rats were exposed via instillation to 20 and 250 nm titanium dioxide particles. After 24 hr, polymorphonuclear leukocytes were measured in the bronchoalveolar lavage. Using "BET" analysis (developed by Brunauer, Emmett, and Teller) to quantify the instilled surface area, the data suggested that "virtually identical" inflammatory responses were elicited by the different sized TiO_2 particles. In the second study (Stoeger *et al.*, 2006), mice were exposed via instillation to six different types of ultra-fine carbon particles (BET surface area ranged from 35-800 m^2/g, mean particle size ranged from 10±2 to 45±15 nm, and organic carbon level was between 1 and 20%). Stoeger *et al.,* found that inflammation was dependent on particle type and mass, was strongly related to BET surface area, and was only evident when the surface area of the instilled particles exceeded ~20 cm^2. Wittmaack used data from these two studies to perform various statistical analyses.
- Wittmaack examined particle number, joint length (the product of particle number and mean size), and surface area defined two ways (based on particle size and BET). Wittmaack found that except for surface area based on particle size, all other parameters (particle number, joint length, and BET surface area) worked well as dose metrics—though particle number was most effective.

Implications:

- The author was unable to identify the single most appropriate metric for quantifying the inflammatory effect of nanoparticles on the lung for several reasons, including substantial statistical uncertainty in the response data and the inability to explain differences in surface toxicity that were due to particle type. In this context, there is a need for improved methods to characterize nanoparticles and to evaluate surface toxicity.
- The data analysis and interpretation by Wittmaack revealed several issues he considers not previously appreciated. It is imperative to consider particles made from the same material, but by different methods – because such differences may not allow one appropriate dose metric to be identified. For example, of the carbon particles evaluated, diesel exhaust particles were at the low end of the surface toxicity spectrum, perhaps due to aggregation as seen via TEM and SEM.

Nature Commentary

Maynard *et al.,* 2006. "Safe handling of nanotechnology" *Nature* 444(16):267-269

Abstract: http://www.http://www.nature.com/nature/journal/v444/n7117/full/444267a.html

Synopsis:

- The potential risks of nanotechnology are gaining focus worldwide, and without adequate and systematic risk-based research, technological developments in the field as a whole will likely be slowed down. In light of this, Maynard and colleagues propose five 'grand challenges' in order to incite innovative – and appropriate – research in nanomaterial safety. The challenges are presented as a framework for research on nano health and environmental risks and are to be applied over the next 15 years.
- First, the authors call for the development of exposure assessment instruments, specifically for nanomaterials in air and water. For example, they explain that portable, accurate, inexpensive aerosol samplers for workers should be available commercially within the next three years. Within the next five years, tools to track the release and amounts of nanomaterials in water should be available.
- Toxicity screening of nanomaterials is the second grand challenge. Three aspects of toxicity testing are of particular import: validated screening tests, alternatives to animal testing, and the ability to evaluate the toxicity of fibre-shaped nanoparticles due to such particles' potential to behave like asbestos.

- Predictive models are needed within the next 10 years. Such models must address three areas, as outlined by the authors: validated models are needed to predict the release, transport, accumulation, *etc.* of nanomaterials in the environment; validated models are needed to predict nanomaterial behavior in the body; and models are needed to identify nanomaterials that are "safe by design."
- Systems are needed in order to evaluate the safety of nanomaterials and products throughout their life cycle. Such systems will require both scientific and policy-making groups and should be viable within the next five years.
- Finally, the authors challenge government, industry, and stakeholders to work together to develop strategic research programs—within the next year—so that these groups are involved from the start in risk-based research.

Implications:

- The sustainability and immediate market potential for nanotechnology and nanomaterials is dependent on the real and perceived risks of such products. We have all hopefully learned from past examples (e.g., genetically modified organisms) that safety and risk issues must be proactively addressed.
- International cooperation and collaboration will be required in order to attain the goals set forth by Maynard and colleagues. While scientists have the expertise to take on the challenges, industry leaders and investors must realize the importance of EH&S concerns with nanotech and commit to the challenges as well.

The press release from the Institute of Occupational Medicine regarding this publication can be found here: http://www.iom-world.org/news/nanosafety.php.

Coming Next Month

- A review of Dr. Owen Moss' recent article, "Insights Into the Health Effects of Nanoparticles: Why Numbers Matter"

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