

Federal Agencies and Nanotechnology

Examining the Federal Nanotechnology
Research Strategy

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Introduction

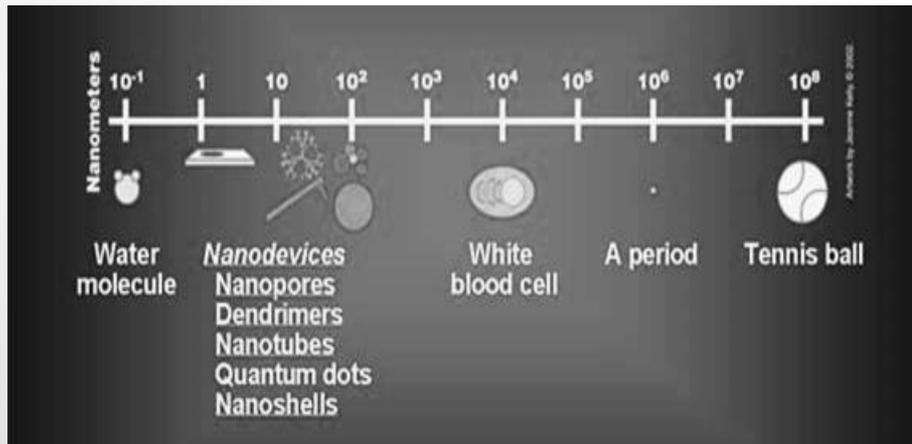
- Nanotechnology improves products
- Nanotechnology is available to consumers
 - 500% increase in nano-enabled products since 2005
- Cumulative Federal investment of ~\$18 billion since 2001
- Nanotechnology is still emerging
 - Some nanomaterials are difficult to measure
 - Some nanomaterials are toxic

Need to consider the implications for regulatory bodies and the Federal nanotechnology infrastructure

Background

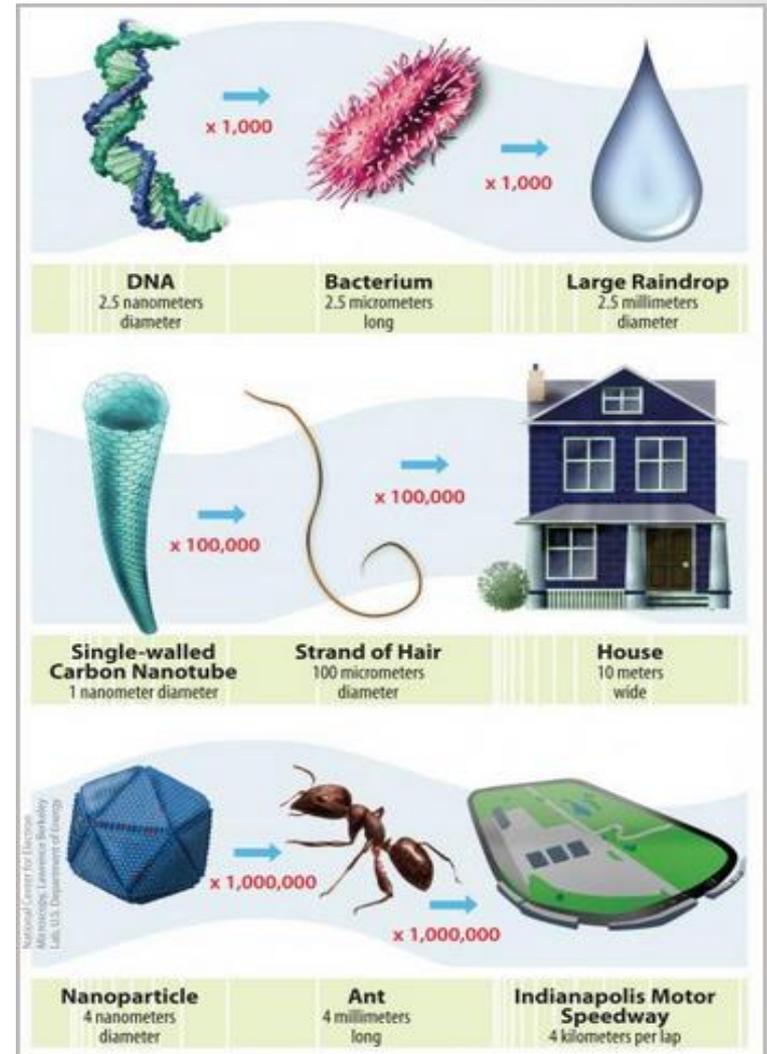
Definitions for nanotechnology

- **Nanometer** (nm): One billionth of a meter
- **Nanomaterial**: One or more dimensions 1-100nm
- More specifically, unique properties based on size



Graphic courtesy of the National Cancer Institute at http://www.cancer.gov/cancertopics/understanding_cancer/nanodevices/AllPages

1 nanometer \approx 0.00000004 inches



Graphic courtesy of the National Nanotechnology Coordination Office (NNCO) at www.nano.gov

Applications in...

- Electronics
- Clothing
- Medical devices
- Cosmetics
- Fuel cells
- Biosensors
- Environmental remediation

Federal interest

- Useful for technological advances, but...
- Some nanomaterials are toxic
- Regulatory agencies exist to inform and protect consumers



Lightweight, flexible solar cells with incorporated nanoparticles

Photo courtesy of the NNCO and Nanosys at

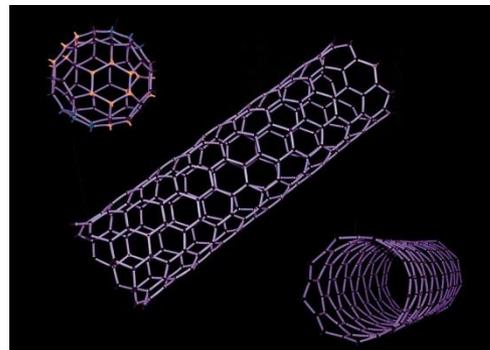
<http://nano.gov/you/nanotechnology-benefits>



Iron oxide nanoparticles for cleaning arsenic from water

Photo courtesy of the NNCO and Rice University at

<http://nano.gov/you/nanotechnology-benefits>



Model of carbon nanotubes and a buckminster fullerene ("bucky ball")

Photo courtesy of the Swiss Nanoscience Institute at

http://www.nanoscience.ch/nccr/nanoscience/pictures/gallery_01/gallery_01_03

The significance of current nanotechnology

- Nanoparticles are not new to the environment
- Commercialization is increasing; projected to provide 6 million jobs by 2020
- No fundamentally transformative products, but research continues

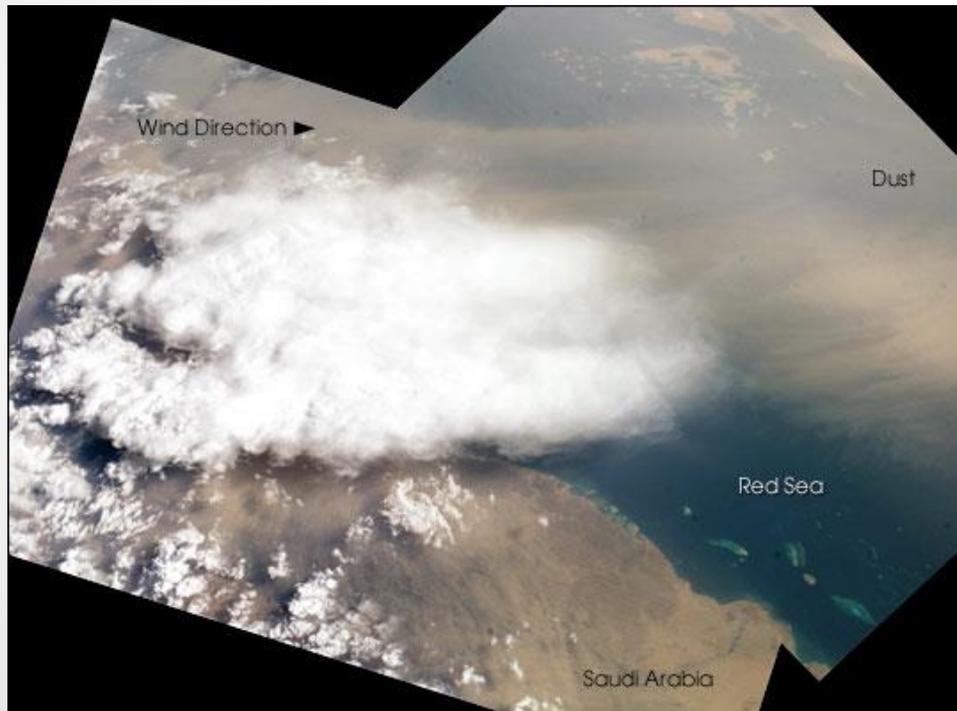


Photo courtesy of the NASA Earth
Observatory at
[http://earthobservatory.nasa.gov/IOTD/
view.php?id=3584](http://earthobservatory.nasa.gov/IOTD/view.php?id=3584)



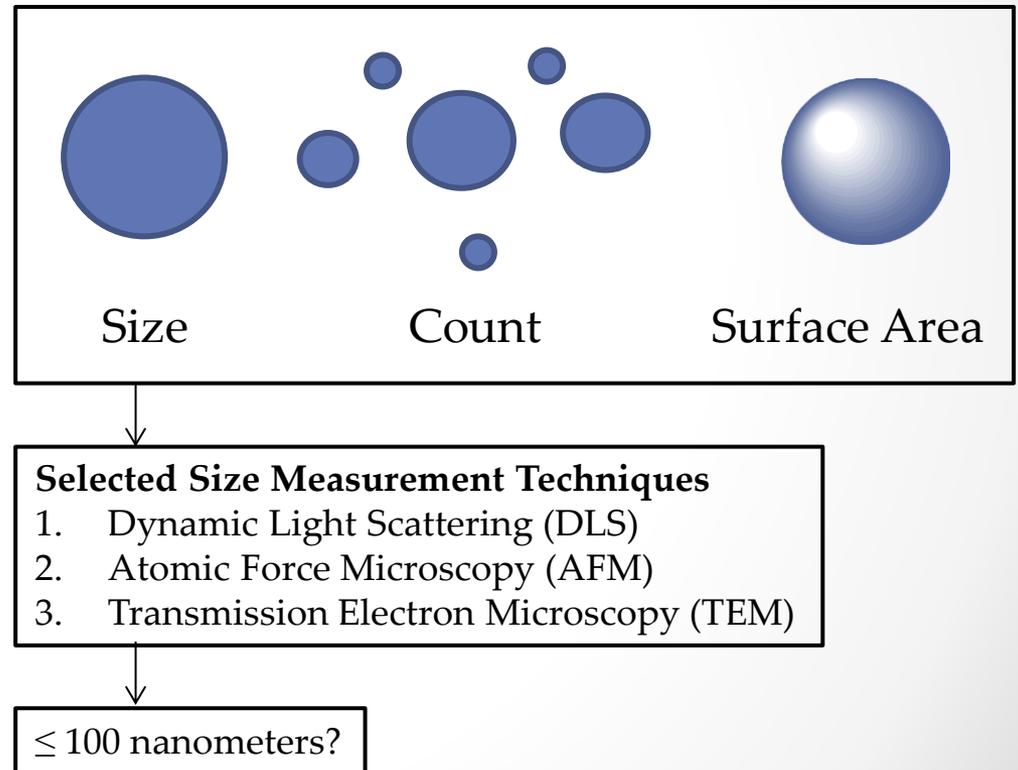
Photo courtesy of the Wired at
<http://www.wired.com/wiredscience/2009/03/volcanopics/>

Regulatory challenges

- Interactions between properties are unpredictable (size, shape, charge, etc.)
- Different measurement techniques produce different results
- How to define a nano-enabled product?

What is a nano-enabled product?

- What should be measured?
- How should it be measured?
- What is the threshold for a product to be nano-enabled?



Issue Definition

Need accurate risk assessment of this emerging technology

Insufficient standardization

- Results might be irreproducible
- Standardization is essential for comparison of results

Insufficient knowledge-sharing

- Data are distributed across journals
- Observation of many experiments is essential to discovering trends; unnecessarily difficult with current research infrastructure

Policy Proposals

Increase implementation of standards

- Continue partnerships with ASTM International and ISO
- Request use of standard methods in research funded by Federal grants
- Request use of standards in data reporting to regulatory bodies

Nanotechnology research database

- Expand the existing NNI database
- Create a system of federated databases

Questions