

## NanoHealth at the NIEHS

### Big Advances in Small Technologies

At the National Institute of Environmental Health Sciences (NIEHS), a unique combination of knowledge, expertise, and a commitment to understanding the role of environmental exposures in human disease enables novel approaches to the study of nanomaterials and their potential impact on human health, or nanohealth. The critical research

***Nanotechnology—the understanding and control of matter at dimensions of roughly 1 to 100 nanometers, where unique phenomena enable novel applications***

— National Nanotechnology Initiative

challenges for nanoscale materials—determining dose, assessing biological response, and quantifying exposure and risk—are the same challenges on which the NIEHS has built its reputation. Recognizing that engineered nanomaterials are quickly surrounding us in the products of our daily life such as drugs, cosmetics, electronics, and more, the NIEHS began to delve into this area of research several years ago, and is continuing to expand the inquiry into this emerging and important field. The next steps will be efforts to build on the NIEHS's core research competencies and investment in this area by partnering with other science entities in integrated research programs. The outcome of these efforts will be the design of nanomaterials that are both innovative and safe for commercialization in medical, industrial, and consumer products.

[www.niehs.nih.gov/nanohealth](http://www.niehs.nih.gov/nanohealth)



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### The NanoHealth Enterprise Initiative

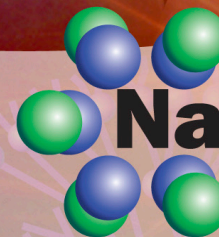
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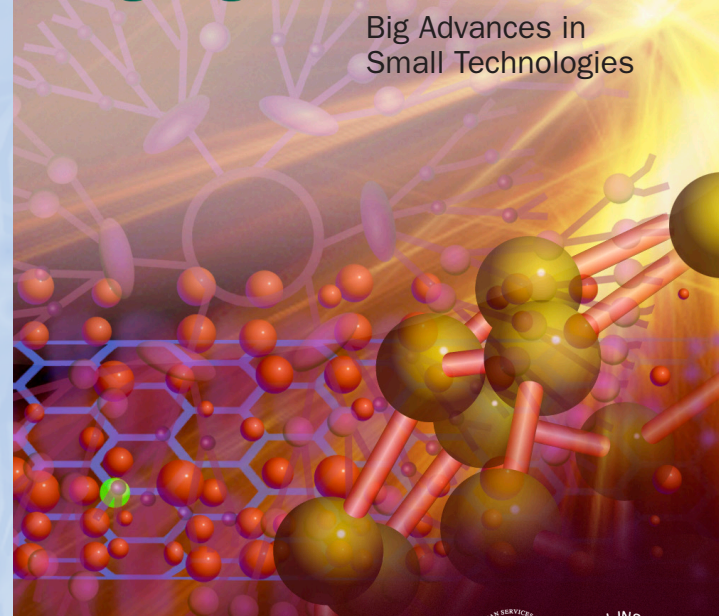
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**NanoHealth**  
at the **NIEHS**

Big Advances in  
Small Technologies



An NIEHS program to protect  
and improve human health



## The NanoHealth Enterprise Initiative

The NIH proposes a broad-based initiative that will employ state-of-the-art technologies in research to examine the fundamental physicochemical interactions of engineered nanomaterials (ENM) with biological systems at the molecular, cellular, and organ level. The NanoHealth Enterprise proposes a partnership of NIH institutes, federal agencies, and public and private partners to pursue the very best science, leverage investment for research efficiencies, and minimize the time from discovery to application of engineered nanomaterials.



The NanoHealth Enterprise framework has five components:

**Materials Science Research**—characterization of the physical and chemical properties of ENM in relevant biological systems

**Basic Biology Research**—determination of the relationship of nanoscale size and physicochemical properties to biological response at the cellular, molecular, and systemic levels

**Pathobiology Research**—investigation of the relationship of nanoscale size and physicochemical properties to ENM-induced pathophysiological endpoints

**Informatics**—a data-sharing framework to store and structure information on the potential environmental, health and safety risks of ENMs with data-mining, query, and search capabilities

**Training**—education of scientists to work on cross-disciplinary and interdisciplinary nanotechnology research teams, and to develop research programs that integrate materials science, biology, and pathobiology research



## NIEHS Nanotechnology Research Grants

The NIEHS has been working to encourage and support research into the underlying properties of engineered nanomaterials (ENM) to determine their potential biocompatibility or toxicity to human health. Recent grants, funded in partnership with other NIH institutes and federal agencies, are helping to build the foundation of our understanding of how the unique chemical and physical properties that emerge at the nanoscale may affect the interactions between environmental exposures and the body.

### Research Projects:

- Cardiac effects of exposure to nanoparticles in air pollution
- Pulmonary effects of fullerenes
- Nanoparticles effects on cell membranes and function
- Chemical, structural, and superstructural determinants of nanocarbon toxicity
- Toxicity of quantum dots in mice
- Neurotoxicity of nanomaterials
- Physical and chemical surface properties of nanoparticles
- Cardiovascular effects of carbon nanotubes
- Detection of exposures through wearable sensors
- Nano-enabled *in vitro* diagnostics
- Remediation strategies

## NTP Nanotechnology Safety Initiative



National  
Toxicology  
Program

The National Toxicology Program (NTP) is engaged in a broad-based research program to address potential human health hazards associated with the manufacture and use of nanoscale materials. The goal of this research program is to evaluate the toxicological properties including size, shape, surface chemistry, and composition

of the major classes of nanoscale materials, and to use these as model systems to investigate how nanoscale materials may interact with biological systems.

Research in the NTP Nanotechnology Safety Initiative is focused on three specific types of nanoscale materials:

- Non-medical, commercially relevant and available nanoscale materials to which humans are intentionally being exposed, such as cosmetics and sunscreens
- Nanoscale materials representing specific classes such as fullerenes (buckyballs) and metal oxides
- Subsets of nanomaterials to test specific hypotheses about key parameters such as size, composition, shape, or surface chemistry

### Research Projects:

- Potential dermal penetration of quantum dots and toxicity of the nanoscale ceramics titanium dioxide and zinc oxide, which are widely used in cosmetics and sunscreens
- Inhalation studies of single-walled carbon nanotubes to investigate potential lungs toxicity
- Systemic studies of carbon fullerenes because of the current mass production of these compounds and their increasing use in consumer products and drug delivery

<http://ntp.niehs.nih.gov>