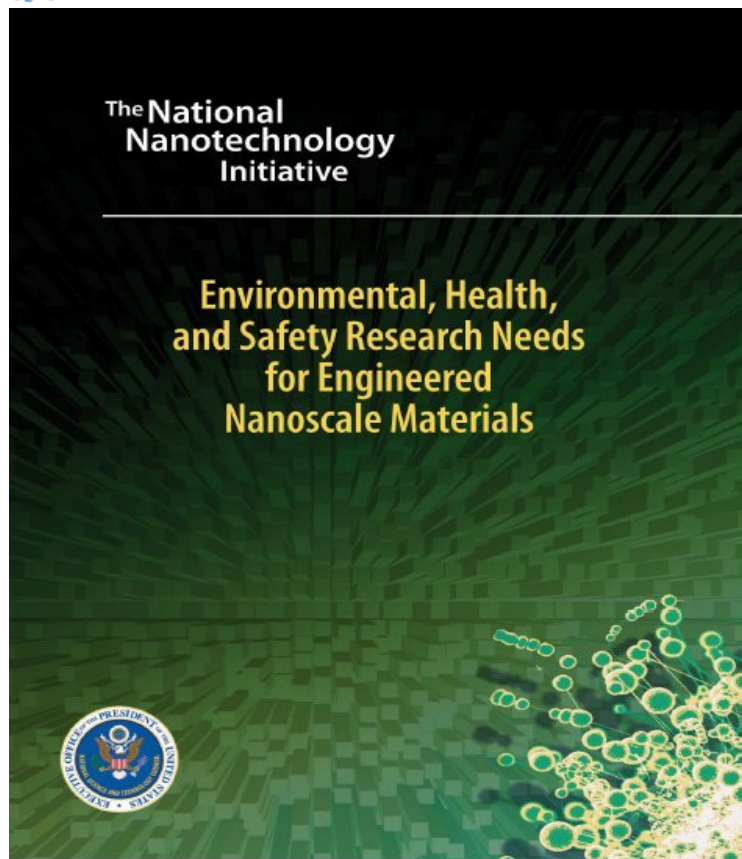
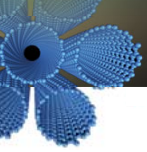




# Priority Research Needs: Nanomaterials and Human Health



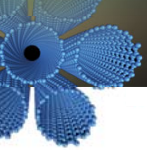
**Sally S.Tinkle, Ph.D.**  
**National Institute of  
Environmental Health Sciences  
National Institutes of Health**  
**[tinkle@niehs.nih.gov](mailto:tinkle@niehs.nih.gov)**



# Scope of Research

## 3. Nanomaterials and Human Health

**This area addresses research on the biological response to engineered nanoscale materials and their byproducts, the results of which may contribute to identifying potential adverse health effects in humans. This includes research on subcellular components, cells, tissues, organs, organ systems, and whole organisms to determine biocompatibility and toxicity of various engineered nanoscale materials; and research to evaluate current toxicity screening tests and develop new tests as needed.**



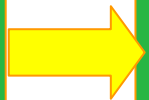
# Goals of the Human Health Research Strategy

- **To understand the relationship of the novel physico-chemical properties of engineered nanomaterials to biological response and human health.**
- **To use this information to develop physiology-based pharmaco-kinetic models that predict the biological response to new engineered nanomaterials.**
- **To support development of biocompatible nanomaterials for medical, industrial, and consumer applications.**

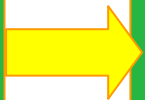
# General Background

**Research Goal: Link exposure to body burden to biological response**

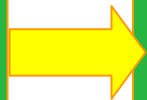
**Environmental Exposure**



**External Contact**



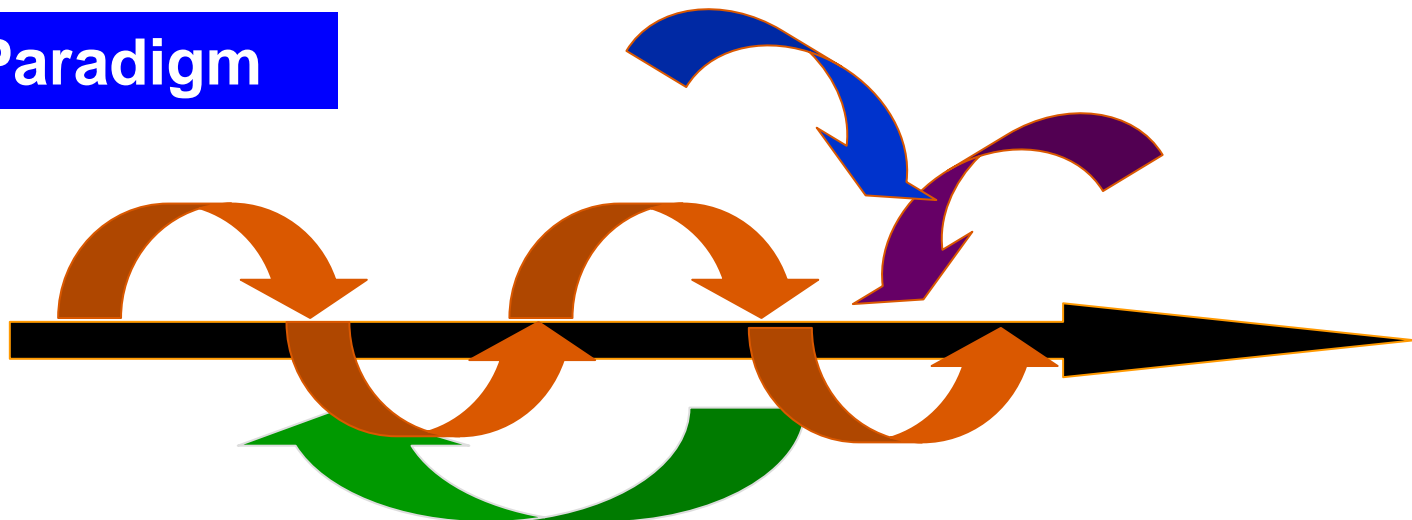
**Internal Dose**

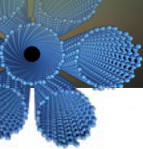


**Biological Response**

Adapted from National Research Council, 1987

**Research Paradigm**

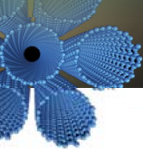




# Generalizable Characteristics of Toxicity

- **Absorption and transport through the body.**
- **Relationship between exposure, uptake, and body burden.**
- **Mechanisms of interaction at the cellular, molecular, and tissue levels.**
- **Methods to quantify and characterize exposure**
  - **environment**
  - **biological matrices.**
- ***In vitro* and *in vivo* assays and models.**





# Generalizable Characteristics of Toxicity

**Environmental  
Exposure**

**External  
Contact**

**Internal  
Dose**

**Biological  
Response**

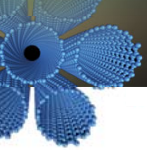
quantify and characterize  
environmental exposure

quantify and characterize nsm  
in biological matrix

absorption and  
transport  
through the  
body

mechanisms of  
interaction at the  
cellular, molecular,  
and tissue levels

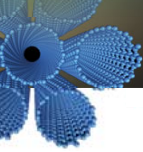
relationship between exposure, uptake, and body burden



# Research Requiring Generalizable Toxicity Data

- **Relationship between matrix in which nsm and its byproducts are embedded/used on delivered and absorbed dose.**
- **Chronic exposure and implantable nanomaterials, devices, systems.**
- **Predictive physiology-based, pharmacokinetic (PBPK) models of biocompatibility and toxicity.**
- **Occupational and environmental particle health effects databases as predictors of health effects.**





# Research Requiring Generalizable Toxicity Data

**Environmental Exposure**

**External Contact**

**Internal Dose**

**Biological Response**

quantify and characterize environmental exposure

quantify and characterize nms in biological matrix

absorption and transport through the body

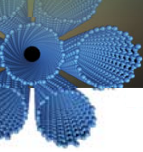
mechanisms of interaction at the cellular, molecular, and tissue levels

relationship between exposure, uptake, and body burden

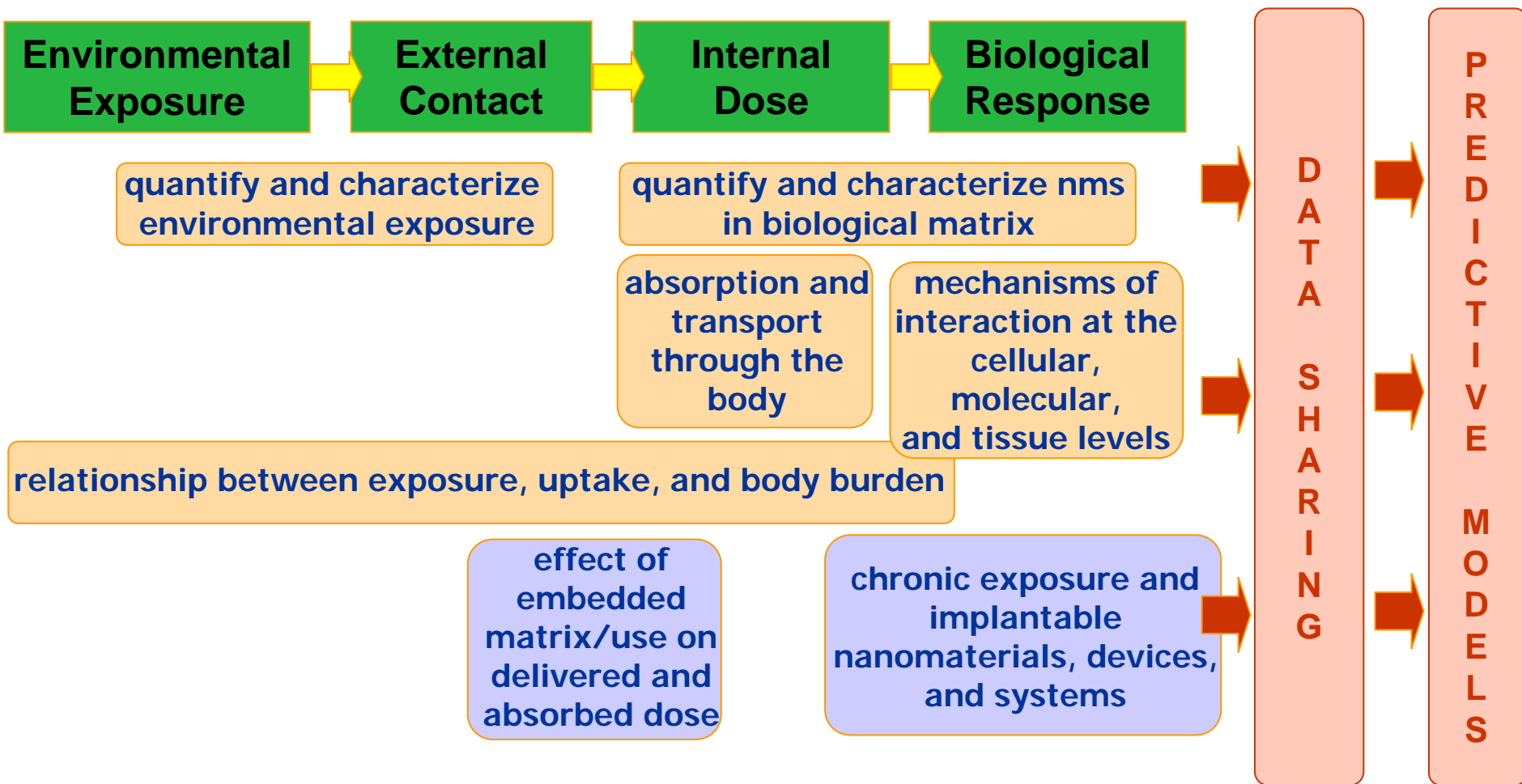
effect of embedded matrix/use on delivered and absorbed dose

chronic exposure and implantable nanomaterials, devices, and systems





# Research Goal: Predictive Modeling





# Conclusions

- **Is the breadth of this research category captured by the research needs identified?**
- **What criteria should be considered in setting research priorities?**
- **Which research need(s) should be prioritized within this category?**
- **Additional comments?**