Project on Emerging Nanotechnologies:

A partnership of the

Woodrow Wilson International Center for Scholars and the Pew Charitable Trusts

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THE PEW CHARITABLE TRUSTS

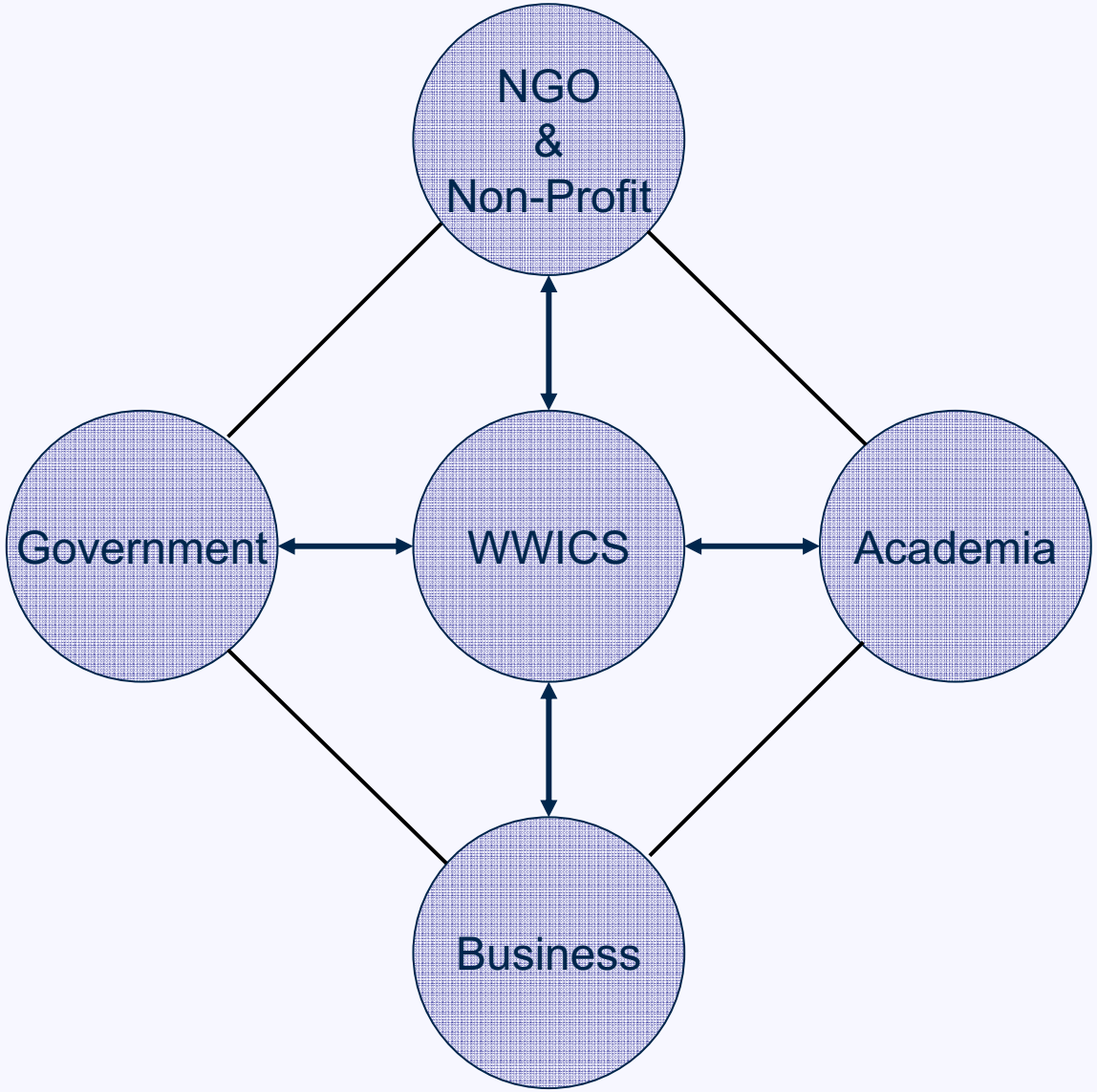
Woodrow Wilson International Center for Scholars

Foresight and Governance Project

About the Wilson Center

- Living memorial to Former President Wilson established by Congress in 1968
- Non-partisan institution, supported by public and private funds
- A lively, neutral, domestic and international forum for free and informed dialogue
- Integrated into the Smithsonian Institute
- 200 staff, fellows, and scholars
- Annual budget of $30m
- Directed by Former US Congressman Lee Hamilton

Wilson Center Role



Project on Emerging Nanotechnologies

- Goal: Ensure government and private sector address the EHS risks as well as the benefits of nanotechnology
- Partners: Woodrow Wilson International Center for Scholars & the Pew Charitable Trusts
- Budget: $3 million over 2 years
- Programs: Meetings, Research, Polling, Outreach

National Nanotechnology Initiative

- 1991: NSF program on Nanoparticle Synthesis and Processing
- 1996: NSF establishes informal nanoscale interagency group
- 1998: NSTC establishes Interagency Working Group of Nanoscience and Engineering
- 2000: US National Nanotechnology Initiative (NNI) announced

National Nanotechnology Initiative Budget by Agency
($ in millions)

Agency	2001 Actual	2005 Estimate	2006 Request
NSF	150	338	344
DOD	110	407	230
DOE	93	210	207
HHS (NIH)	39	143	145
DOC(NIST)	10	75	75
NASA	20	45	32
USDA		3	8
EPA		5	5
HHS (NIOSH)		3	3
DOJ		2	2
DHS (TSA)		1	1
TOTAL	422	1,230	1,052

2006 NNI Education and ELSI Investment

Table 5
Estimates of 2006 NNI Investments within Societal Dimensions PCA
(dollars in millions)

	Environmental, Health, and Safety R&D	Education and Ethical, Legal, and other Societal Issues
NSF	24.0	35.5
DOD	1.0	1.0
DOE	0.5	0.6
HHS(NIH)	3.0	5.0
DOC(NIST)	0.9	
NASA		
USDA	0.5	0.5
EPA	4.0	
HHS (NIOSH)	3.1	
DOJ	1.5	
DHS		
TOTAL*	38.5	42.6

NSF Educational & Societal Investments

Education Spending: $28m ELSI Spending: $7.5

- **Center for Learning and Teaching in Nanoscale Science and Engineering (Northwestern U)**
- **Center for Nanotechnology in Science (TBA)**
- **Center on Nanotechnology Informal Science Education (TBA)**
- **NIRT: From Laboratory to Society: Developing an Informed Approach to Nanoscale Science and Technology (University of South Carolina)**
- **NIRT: Science and Commercialization NanoBank, Database Analysis (UCLA)**

2006 NNI Investment

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Interagency Coordination of Activities

Nanotechnology, Environment and Health Working Group (NEHI)

- Working group of the Nanoscale Science, Engineering and Technology subcommittee (NSET)

- Membership from all relevant regulatory and research agencies, Office of Science and Technology Policy, and Office of Management and Budget

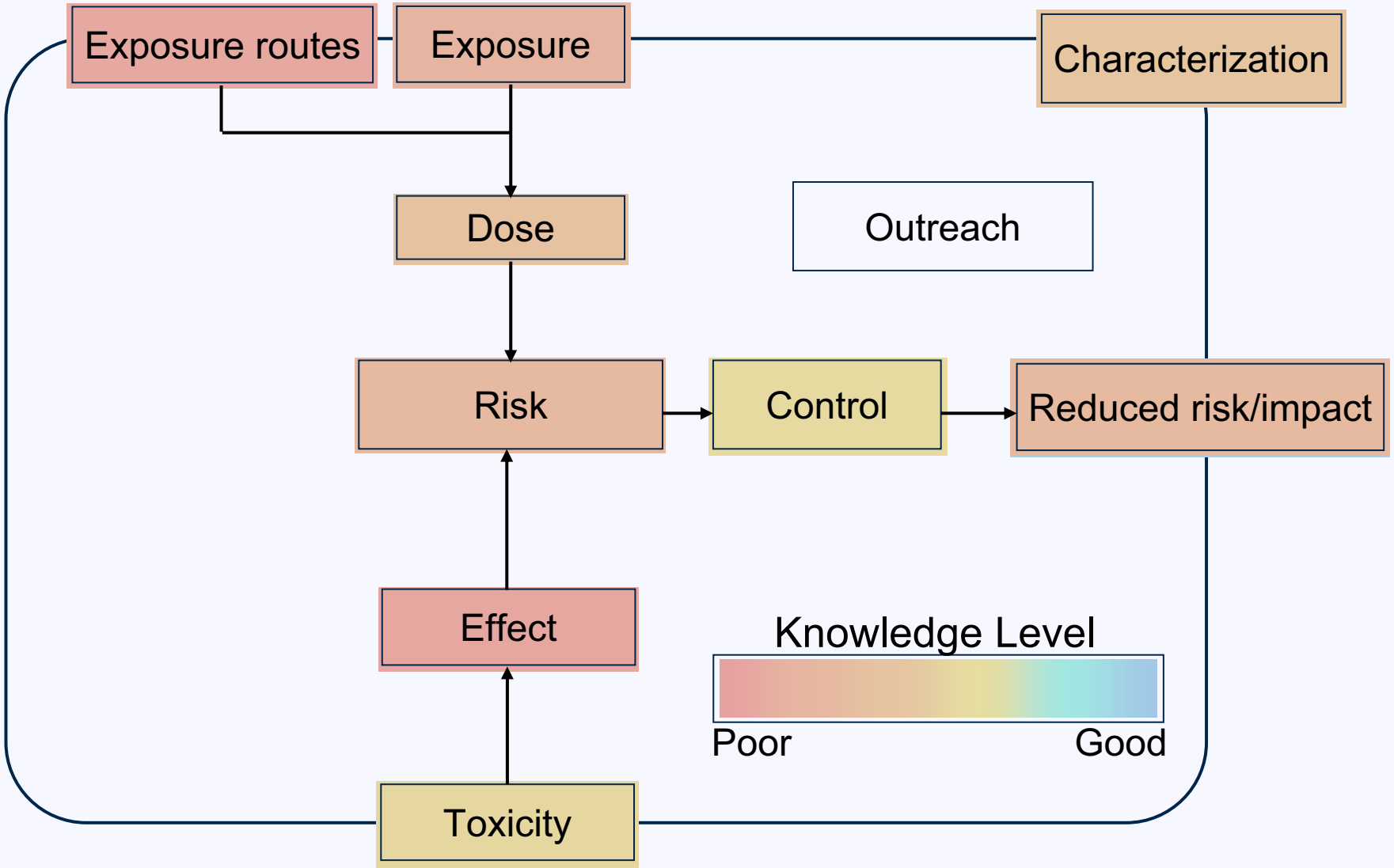
- Goals of Working Group:
  - **Provide for exchange of information among agencies**
  - **Facilitate the identification/prioritization of research and other activities required for responsible nanotechnology**
  - **Promote communication of information related to the environmental and health implications of nanotechnology**

US Regulatory Approach

U.S. laws and statues applicable to the assessment and regulation of workplace, environmental, and health risks of new technologies.

Agency	Law
Environmental Protection Agency	**Toxic Substances Control Act (TSCA)** **Clean Air & Clear Water Acts** **Resource Conservation & Recovery Act (RCRA)** **National Environmental Policy Act (NEPA)**
Food & Drug Administration	**Food, Drug & Cosmetic Act (FDCA)**
Consumer Product Safety Commission (CPSC)	**Federal Hazardous Substance Act**
Department of Agriculture	**Various Acts & Authorizing Statutes**
Occupational Health & Safety Administration (OSHA)	**Occupational Safety & Health Act**

Addressing the potential impact of nanotechnology



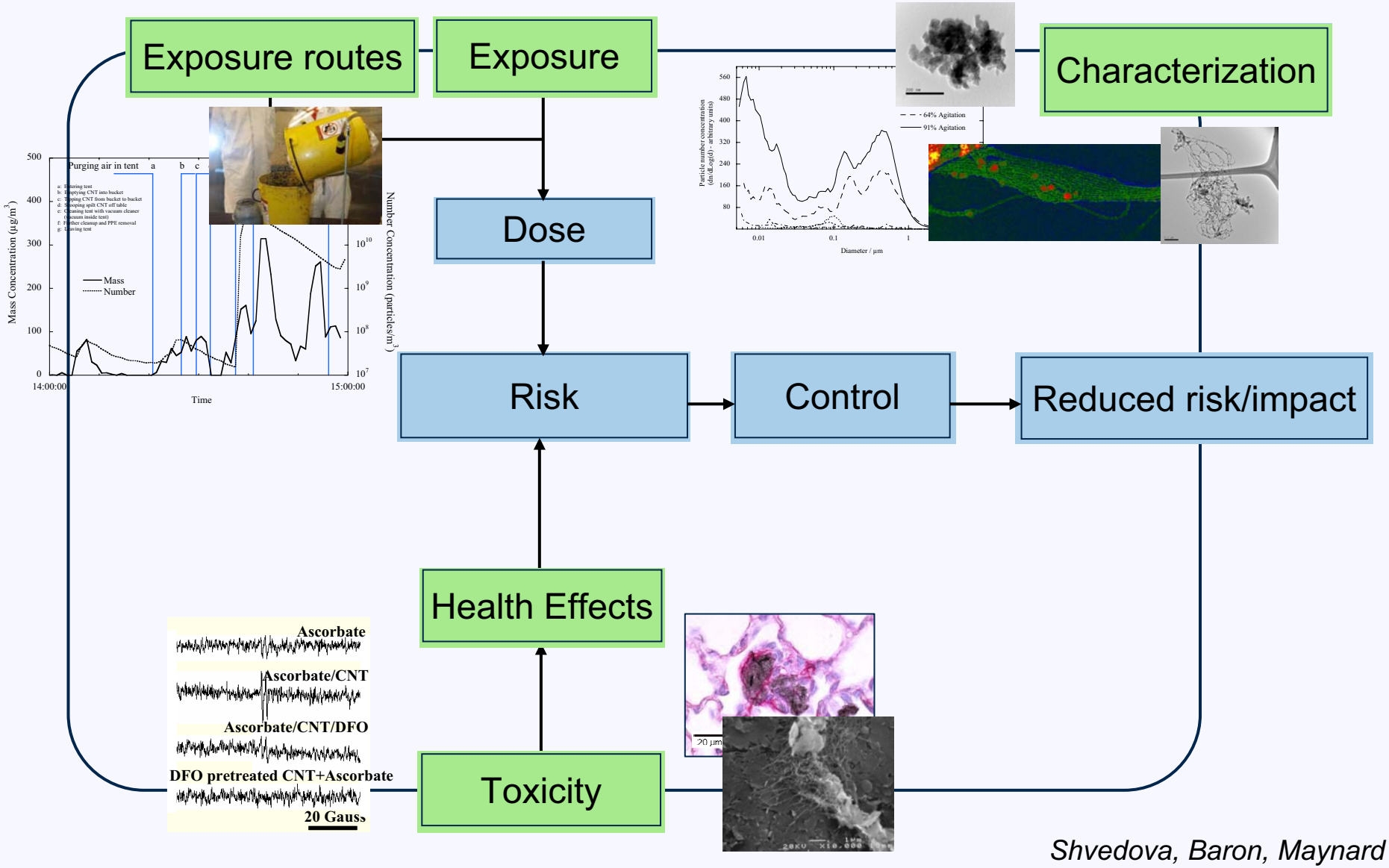
Environmental, Safety and Health Implications

Major US Federal Research and Development Initiatives

	NIOSH	EPA	FDA	NIH	NSF	NIST	DOE	DOD	OSHA
Hazard	■	■	■	■	■		■	■	
Exposure	■	■							
Characterization	■			■	■	■	■		
Control	■	■							
Risk assessment and management	■		■						
Outreach	■	■	■		■				■

National Institute for Occupational Safety and Health

Integrated research into the health impact of carbon nanotubes



Shvedova, Baron, Maynard

Environmental Protection Agency

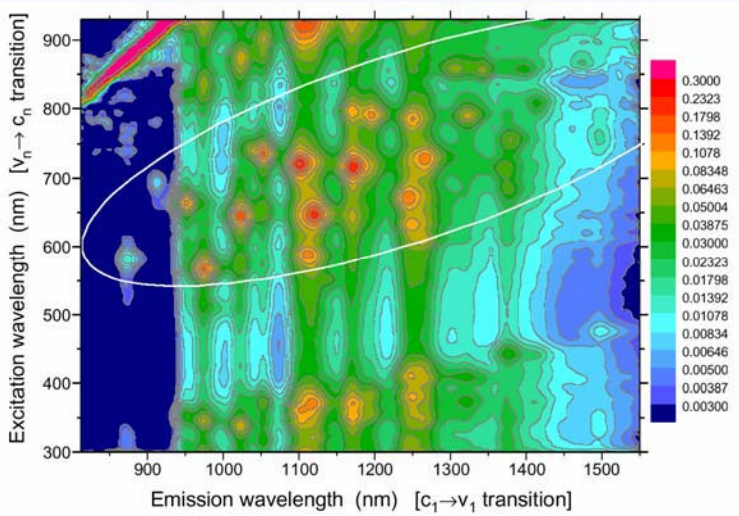
- **Focus on Nanotechnology:**
  - Potential for environmental improvement
  - Possibility for harmful effects on human health/environment
  - EPA's regulatory responsibilities
    - Toxic Substances Control Act, Clean Air Act, Clean Water Act, Comprehensive Environmental Response, Compensation and Liability Act/Superfund

- **Science to Achieve Results program (STAR)**
  - 2004 Program: Environmental and Human Health Effects of nanomaterials
    - $7 million, joint with NSF and NIOSH
    - 18 Grants Awarded – 14 EPA, 2 – NSF, 2 – NIOSH, To be announced
  - 2005 Program: Environmental and Human Health Effects of nanomaterials
    - Announcement anticipated Fall 2005

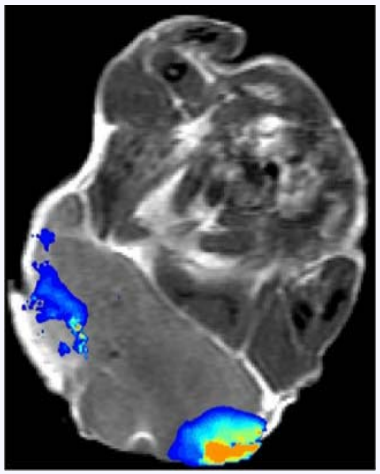
National Science Foundation

Center for Biological and Environmental Nanotechnology - Rice University

- **Highlights:**
  - $12.4 million from NSF, $5.3 million from Rice, over 5 years
  - > 200 invited “center” presentations; > 200 accepted publications
  - Research, education, knowledge transfer, commercialization
  - First observation of carbon nanotube emission and its first application to biological imaging
  - Near-infrared nanoparticles demonstrated to shrink tumors using photothermal therapy
  - First publications in the area of nanotechnology and environmental impact



Nanotube fluorescence

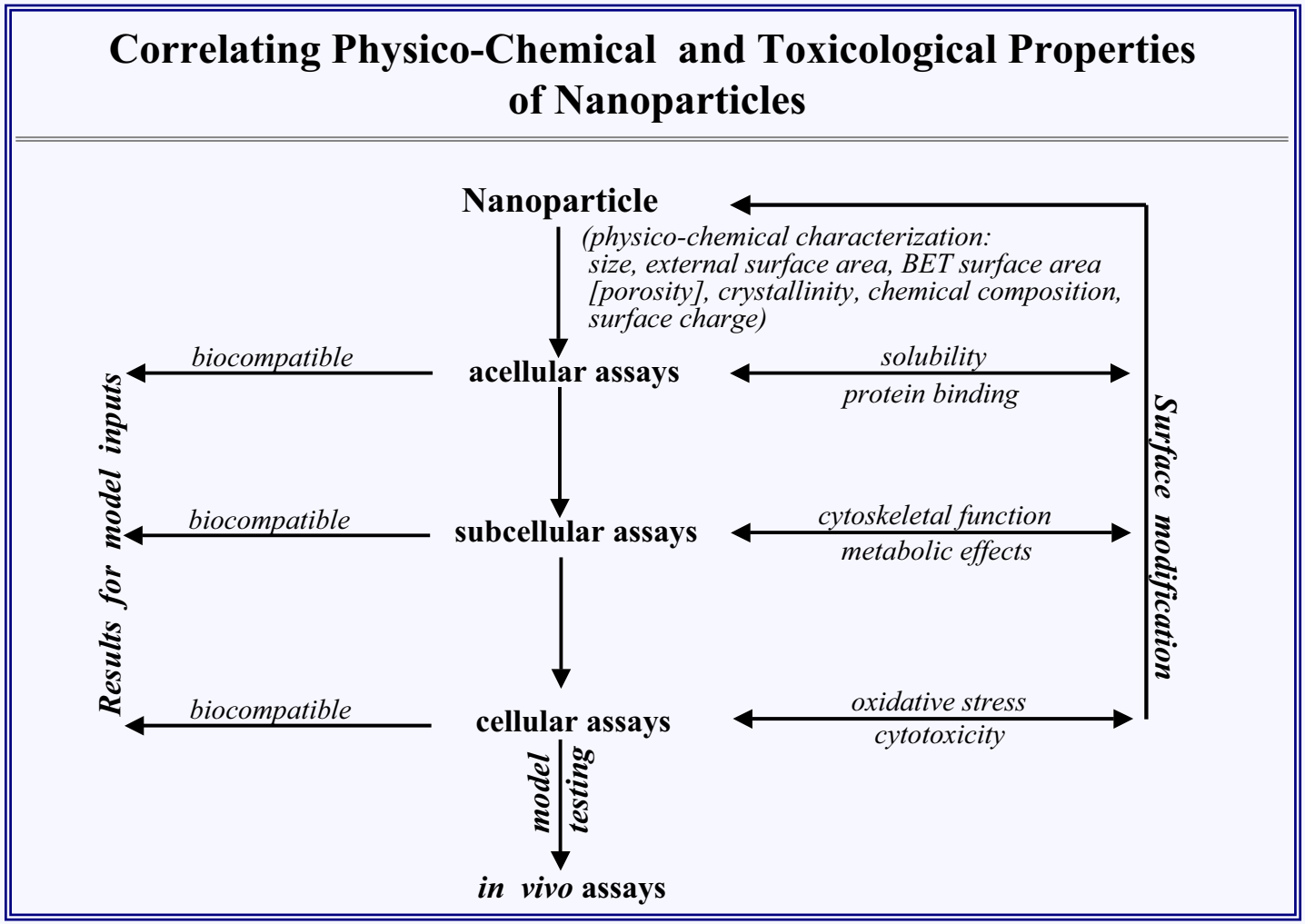


Nanoshell-heated cancer tissue

Ecotoxicology and nanocarbons

Department of Defense (MURI program)

Physicochemical characteristics and toxicological properties of nanoparticles



Oberdörster, Pui and Biswas

University of Rochester, University of Minnesota, Washington University St. Louis

Responsible and sustainable nanotechnology

Progress through partnership

US Government

Industry

Non Government Organizations

Academia

State and International Government

National and Global partnerships

- **WWICS Project on Emerging Nanotechnologies**
- **Consultative boards on Advancing Nanotechnology (CBANs)**
- **Nanotechnology standards**
- **Research partnerships (National and Global)**
- **Strategic research planning**
- **International Council On nanotechnology (ICON)**
- **International Life Sciences Institute**
- **International Dialogue on responsible research and development of nanotechnology**
- **Voluntary Standards**

Summary

- Major gaps exist in our understanding of the health, safety, environmental and societal impacts of nanotechnology.

- The potential impact of nanotechnology is a global issue: International partnerships and coordination are essential to ensure sustainable emerging nanotechnologies.

- " With nano, we need to get it right. Or, the tremendous benefits/potential of the technology will not be realized."

  Chad Holliday, CEO, DuPont. Fred Krupp, President, Environmental Defense.

  Wall Street Journal June 14th 2005.

Project on Emerging Nanotechnologies

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