



The National Nanotechnology Initiative (NNI) and National Policy

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The Definition of “Nanotechnology”

- Nanotechnology is the **understanding and control of matter** at dimensions between **approximately 1 and 100 nanometers**, where **unique phenomena** enable novel applications.
- Encompassing nanoscale science, engineering, and technology...
- ...nanotechnology involves imaging, measuring, modeling, and manipulating matter at this length scale.
- Not just miniaturization: fundamental differences in physical, chemical, and biological behavior compared to bulk materials or individual atoms/molecules (quantum behavior; surface dominance; self-assembly; collective phenomena)
- Note that the US has maintained a consistent definition of nanotechnology (above), which is the basis for identification and federal coordination of activities (NNI Strategic Plans 2004, 2007, 2011, and other documents)
- Some agencies may need further clarification to meet their missions, but use of the term “nanotechnology” should be consistent with the existing definition.



NNI Vision:

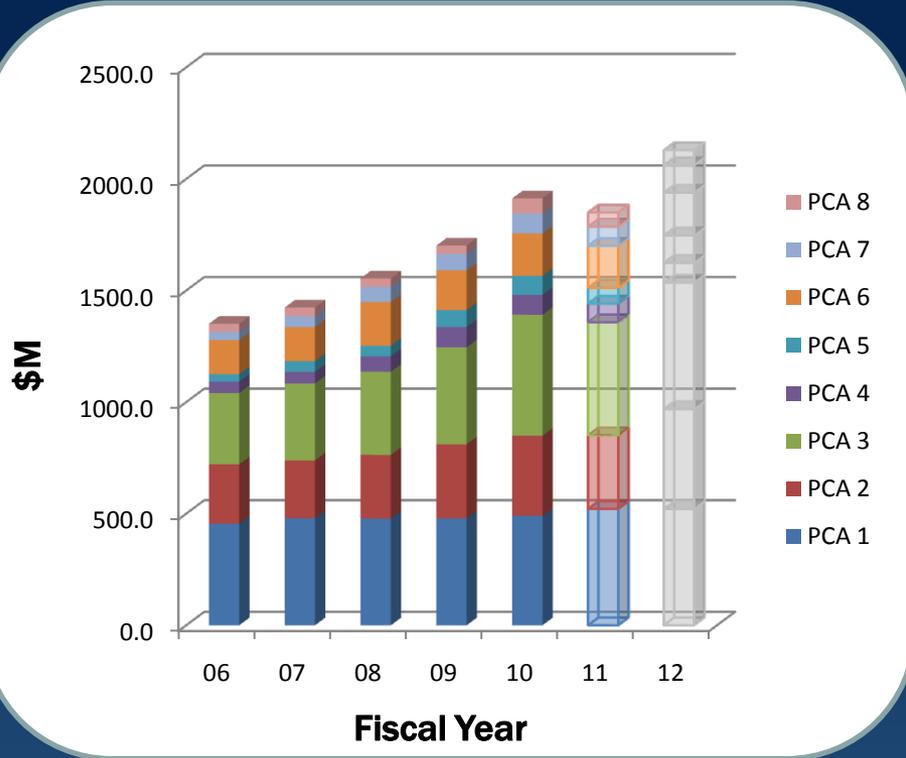
A future in which the ability to understand and control matter at the nanoscale leads to a revolution in technology and industry that benefits society

Four goals aimed at achieving that overall vision:

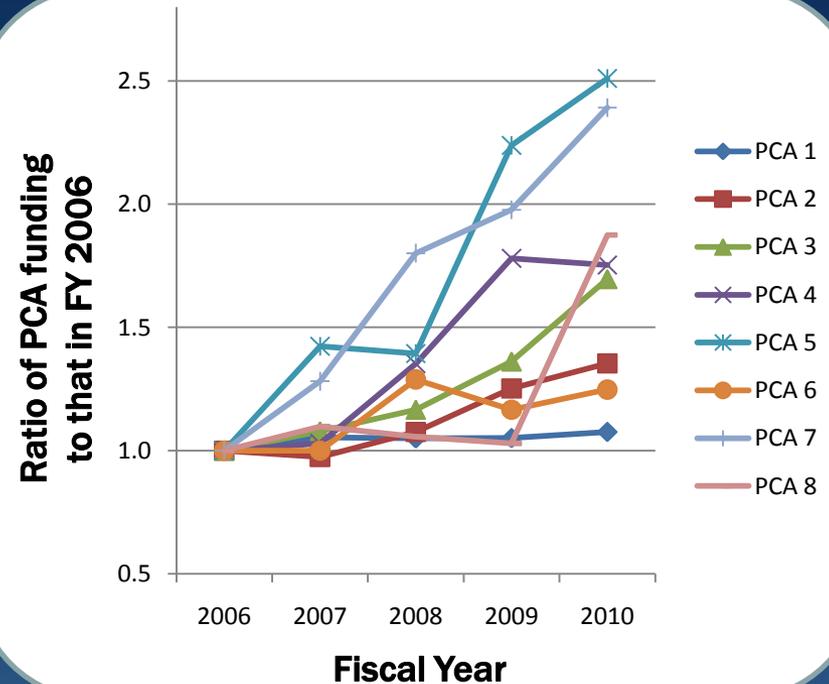
1. Advance a world-class nanotechnology research and development program
2. Foster the transfer of new technologies into products for commercial and public benefit
3. Develop and sustain educational resources, a skilled workforce, and the supporting infrastructure and tools to advance nanotechnology
4. Support responsible development of nanotechnology



Evolution of NNI budgets and Program Component Areas



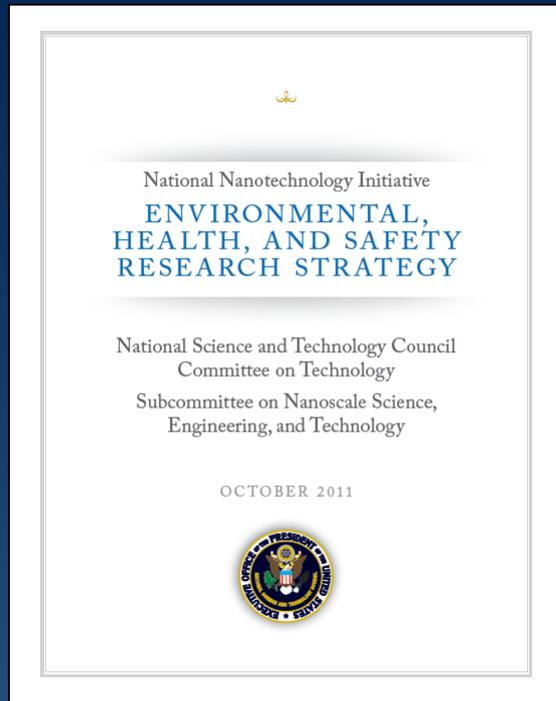
PCA 1: Fundamental Nanoscale Phenomena and Processes
 PCA 2: Nanomaterials
 PCA 3: Nanoscale Devices and Systems
 PCA 4: Instrument Research, Metrology, and Standards
 PCA 5: Nanomanufacturing
 PCA 6: Major Research Facilities & Instrumentation Acquisition
 PCA 7: Environment, Health, and Safety
 PCA 8: Education and Societal Dimensions



- Considerable increases in annual NNI investment: \$464M in FY 2001, ~\$2B now
- Funding for basic work maintained; big (relative) increases for EHS (PCA 7) and nanomanufacturing (PCA 5)



NNI EHS Research Strategy released Oct. 20, 2011 (accompanied by webinar, NNCO news release, OSTP blog)

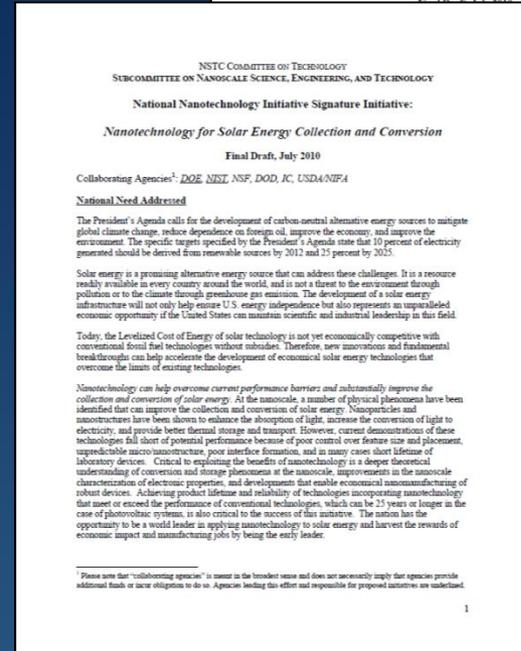
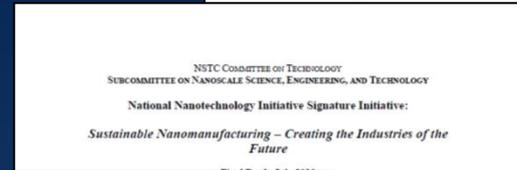
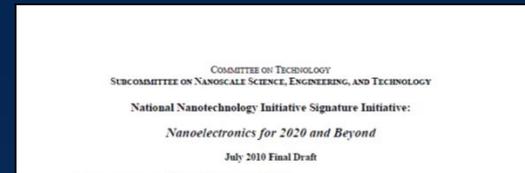


- A comprehensive and more sophisticated follow-up to initial strategy (2008) and identification of research needs (2006)
- Serves as guidance to Federal agencies regarding research activities, priorities, and program planning
- Identifies six core nanoEHS research categories, assesses status in each
 - Nanomaterial Measurement Infrastructure
 - Human Exposure Assessment
 - Human Health
 - Environment
 - Risk Assessment and Risk Management Methods
 - Informatics and Modeling for NanoEHS Research



Several “NNI Signature Initiatives” have been identified

- Represent areas of particular promise, existing effort, and significant opportunity – bridging across multiple federal agencies
- Current NSIs are in:
 - Nanotechnology for Solar Energy Collection and Conversion
 - Sustainable Nanomanufacturing
 - Nanoelectronics for 2020 and Beyond
- Intended to be dynamic; topical areas will likely be added and rotate/evolve over time.



and has accounted for a large economy since the 1990s. One of the second largest exporters of silicon in the performance of computing (increasing miniaturization of chips or transistors). However, as device dimensions, it is widely understood fundamental physics of devices

increase processing speed, reduce manufacturing cost per bit. But as the silicon manufacturing and other quantum Researchers are therefore pursuing alternative materials. Candidate approaches include silicon and superconductors, 3-D from charge such as photonics. Approaches based on quantum computing for reducing power consumption of how electronics are manufactured could establish a U.S. competitive advantage.

level nanoscale fabrication processes, systems, and architectures to

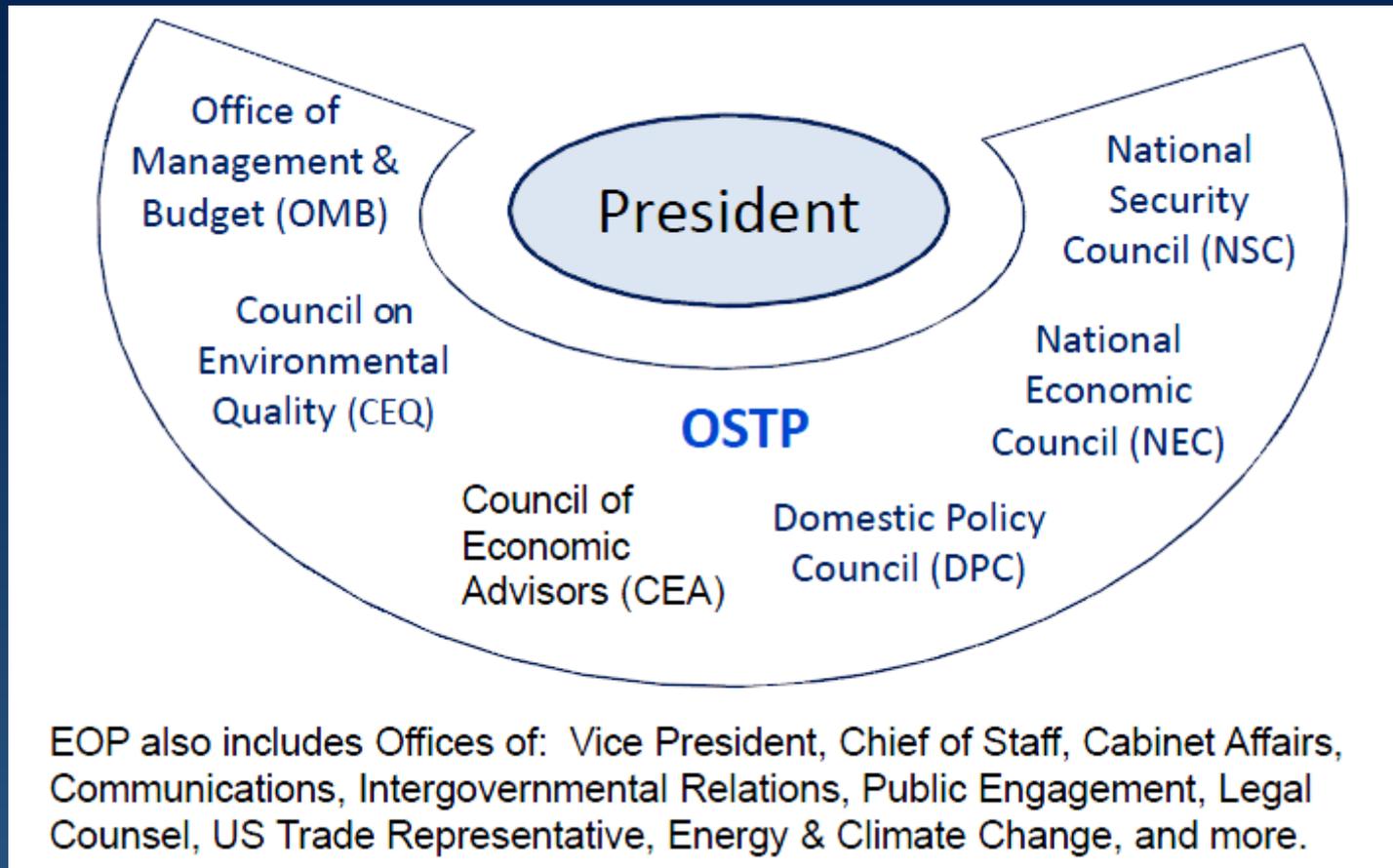
nanotechnology science

necessarily imply that agencies provide additional funds or incur obligations to do so. Agencies leading this effort and responsible for proposed initiatives are understood.

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Federal support infrastructure for science & technology: The Executive Office of the President



Responsibilities of OSTP and the S&T Advisor:

- Policy for science and technology
 - Analysis, recommendations, and coordination with other White House offices on R&D budgets and related policies, S&T education and workforce issues, interagency S&T initiatives, broadband, open government, scientific integrity...
- Science and technology for policy
 - Independent advice for the President about S&T germane to all policy issues with which he is concerned

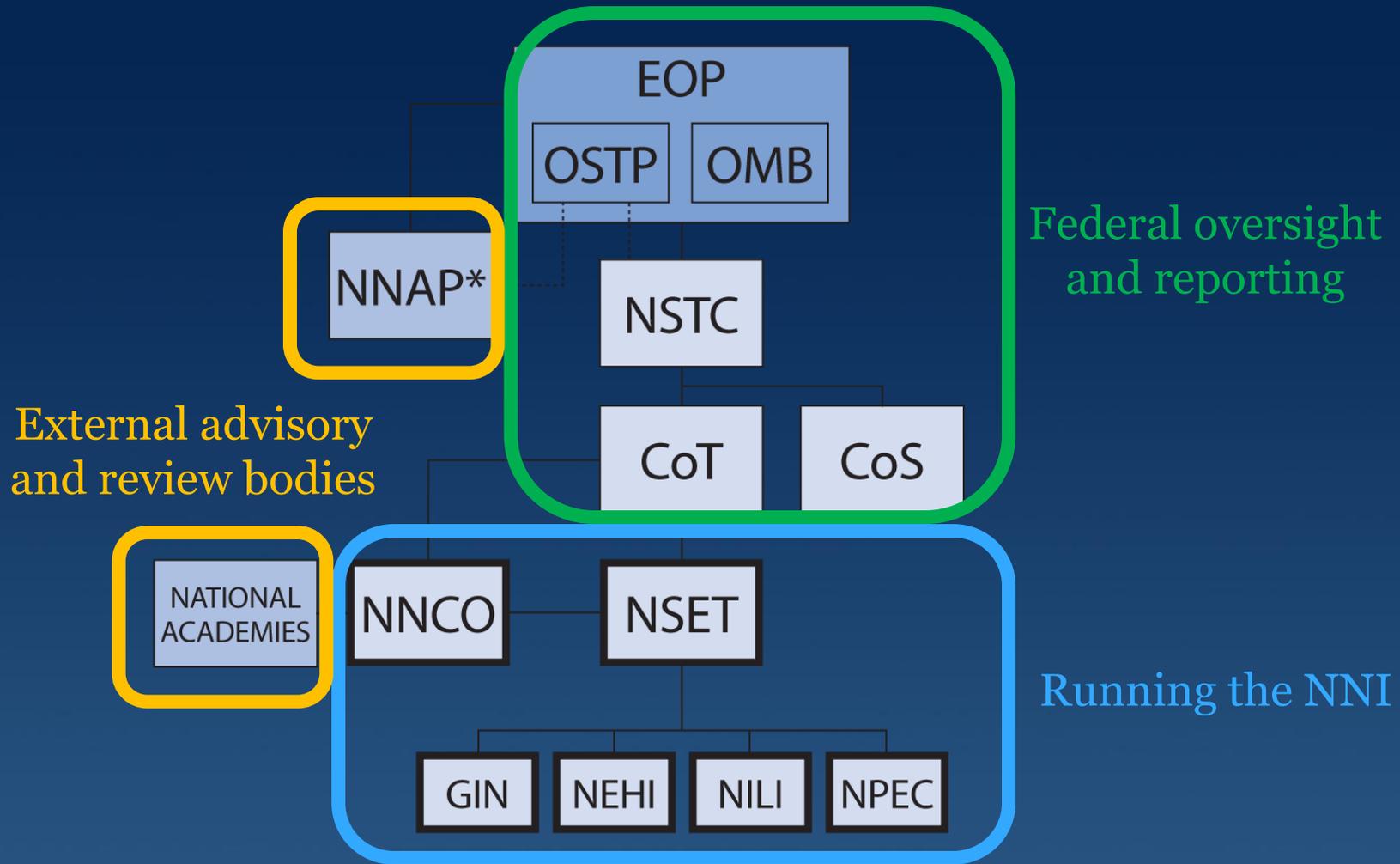


OSTP-managed entities

- **National Science and Technology Council (NSTC)**
 - Deputy secretaries & undersecretaries of cabinet departments with S&T missions, plus heads of NSF, NIH, NASA, NOAA, NIST, EPA, USGS, CDC
 - Nominally chaired by the President; chaired in practice by the OSTP Director / Science Advisor; administered by OSTP
 - Coordinates S&T activities that cross agency boundaries
 - Analysis, recommendations, and coordination with other White House offices on R&D budgets and related policies, S&T education and workforce issues, interagency S&T initiatives, broadband, open government, scientific integrity...
- **President's Council of Advisors on Science and Technology (PCAST)**
 - Co-Chairs J. Holdren & E. Lander
 - Vice-Chairs W. Press & M. Savitz
 - 16 other members from academia, industry, NGOs
 - Helps link White House to wider ST&I community



Organizational alphabet soup!



NNI Functional Structure

- **Management** —→ *EOP + Agencies*
 - Establish nanotechnology as high priority R&D area
 - Develop budget and funding allocation to agencies
 - Interact with Congress
- **Coordination** —→ *NSET Subcommittee & Working Groups*
 - Coordinate strategic planning
 - Promote interagency communication & coordination on nanotechnology R&D
- **Facilitation and Communication** —→ *NNCO*
 - Serve as central public point of contact for NNI
 - Support administratively NSET activities
 - Develop workshops and reports on behalf of the NSET and the NNI for use by Congress, academia, industry, and the public

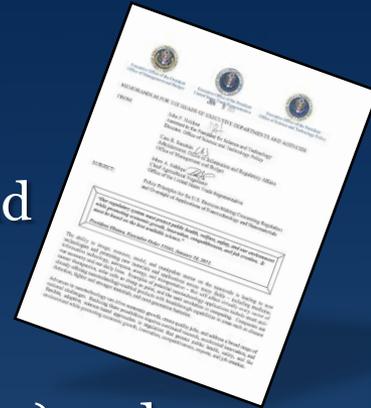
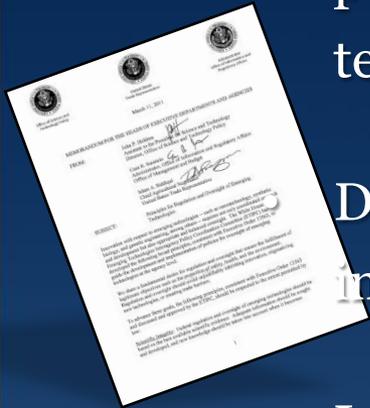


Emerging Technologies Interagency Policy Coordination Committee (ETIPC)

- Involves White House offices and agencies involved with policy and regulatory issues regarding emerging technologies; led jointly by OSTP, OMB, and USTR

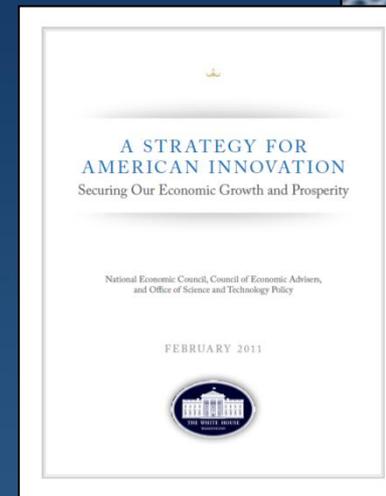
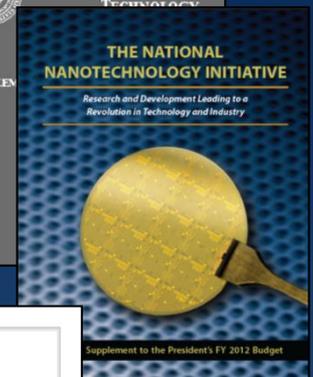
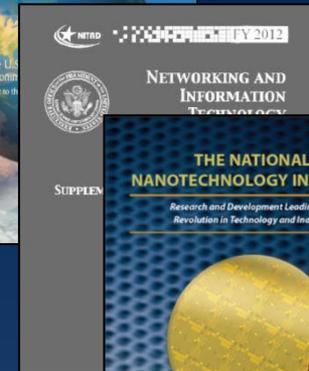
Develops broad principles to guide development and implementation of policies for oversight

- Issued overarching principles memo (March 11, 2011) and principles specific to nanotechnology (June 9, 2011): Rulemaking should be evidence-based, and commensurate with risk; nanomaterials should not as a class be presumed either benign or harmful



The NNI remains a major administration priority

- Three major, ongoing interagency programs under NSTC have standing National Coordination Offices
 - **Global Change Research Program (GCRP)**
 - since 1989, 13 agencies, ~\$2.1B
 - **Networking and Information Technology Research and Development (NITRD)**
 - since 1991, 16 agencies, ~\$3.8B
 - **National Nanotechnology Initiative (NNI)**
 - since 2001, 25 agencies, ~\$1.9B
- Other new initiatives also connect to activities under the NNI, including:
 - **Materials Genome Initiative (MGI)**
 - **Advanced Manufacturing Partnerships (AMP)**
- Nanotechnology and the NNI are highlighted in President Obama's Strategy for American Innovation





Nano.gov

National Nanotechnology Initiative

*Leading to a revolution in technology
and industry that benefits society*

Nanotechnology
101

Nanotechnology
and You

About the
NNI

Collaborations
and Funding

Publications
and Resources

[Education](#) [Newsroom](#) [Events](#)

First-ever human trials for synthetic nanoparticle vaccine

Phase 1 clinical trials will test this nanotechnology-enabled vaccine that is intended to help people stop smoking and help prevent relapse.

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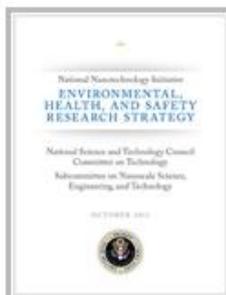
[What is
Nanotech?](#)

[What are the
Benefits?](#)

[How is the
NNI Helping?](#)

-  Nanotechnology is the understanding and control of matter at the nanoscale, at dimensions between approximately 1 and 100 nanometers, where unique phenomena enable novel applications.
-  Encompassing nanoscale science, engineering, and technology, nanotechnology involves imaging, measuring, modeling, and manipulating matter at this length scale.
-  So how small is "nano"? A nanometer is one billionth of a meter. A sheet of paper is about 100,000 nanometers thick. And there are 25,400,000 nanometers in one inch.

[See more in Nano 101](#)



2011 NNI Environmental, Health, & Safety Research Strategy

Nanotechnology safety benefits everyone, from lab researchers and factory workers to the consumers of products enabled by this emerging technology.

News & Media Releases

Oct 28, 2011

The National Cancer Institute (NCI) Announces the Initiation of a Public Private Industry Partnership on Translation of Nanotechnology in Cancer (TONIC)

Oct 20, 2011

Federal Government Releases Environmental, Health, &



Nanotechnology

Nanotechnology:
Statistics of