U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON RESEARCH AND SCIENCE EDUCATION

HEARING CHARTER

Nanotechnology:
Oversight of the National Nanotechnology Initiative and Priorities for the Future

Thursday, April 14, 2011
2:00 p.m. - 4:00 p.m.
2318 Rayburn House Office Building

1. Purpose

On Thursday, April 14, 2011, the Subcommittee on Research and Science Education will hold a hearing to examine the National Nanotechnology Initiative (NNI) and address the Nation's research and development priorities for the future. Witnesses include a representative from the NNI, as well as researchers and other nanotechnology experts. The hearing will provide background on the science and applications of nanotechnology.

2. Witnesses

Dr. Clayton Teague, Director, National Nanotechnology Coordination Office (NNCO)
Dr. Jeffrey Welser, Director, Nanoelectronics Research Initiative, Semiconductor Research Corporation and Semiconductor Industry Alliance
Dr. Seth Rudnick, Chairman, Board of Directors, Liquidia Technologies
Dr. James Tour, Professor of Chemistry, Computer Science and Mechanical Engineering and Materials Science**,** Rice University
Mr. William Moffitt, President and Chief Executive Officer, Nanosphere, Inc.

3. Brief Overview

- Nanotechnology is the understanding and control of matter at dimensions between approximately 1 and 100 nanometers, where unique phenomena enable novel applications. (A nanometer is one-billionth of a meter. A sheet of paper is about 100,000 nanometers thick.) Unusual physical, chemical, and biological properties can emerge in materials at the nanoscale. These properties may differ in important ways from the properties of bulk materials and single atoms or molecules.[1]

- In December 2003, the President signed the *21st Century National Nanotechnology Research and Development Act* (P.L. 108-153). This Act provided a statutory framework for the interagency National Nanotechnology Initiative (NNI), authorized appropriations for nanotechnology research and development (R&D) activities through fiscal year 2008 (FY08), and enhanced the coordination and oversight of the program. The U.S. House of Representatives passed bills in both the 110th (H.R. 5940) and 111th (H.R. 554 and H.R.

[1] The National Nanotechnology Initiative Supplement to the President's FY 2012 Budget, p. 3

5116) Congresses to amend and reauthorize the Act; however, the Senate did not act in either Congress.

- Funding for the NNI has grown from $464 million in fiscal year 2001 (FY01) to $1.9 billion in FY10; 15 agencies currently have nanotechnology R&D programs. Through FY11, Congress has appropriated approximately $14.2 billion in nanoscale science, engineering, and technology, through the NNI.[2]

- The President's FY12 budget request proposes a total of $2.1 billion for the NNI, more than a $200 million or 11.3 percent increase over the FY10 enacted levels.[3]

- It is estimated that in the U.S. the private sector investment in the research and development of nanotechnology is twice that of the public investment.[4]

- Globally, the U.S. is the leader in this field but foreign investments in nanotechnology continue to increase. In 2009, the U.S. continued to lead global public investments in nanotechnology at over $2.5 billion (Federal, state and local contributions). While Japan, France, China, South Korea, and Taiwan grew their support, no other investment reached $1 billion.[5]

- The very structure of materials can be improved through nanotechnology, by developing nanomaterials that are stronger, lighter, more durable or better conductors, among other traits…adding nanoparticles to plastics can make them stronger, lighter and more durable. Nanoparticles are currently used in baseball bats and tennis rackets, but someday may also be used in bulletproof vests and light, fuel efficient vehicles…Nanotechnology also holds the potential to exponentially increase information storage capacity; soon [a] computer's entire memory will be able to be stored on a single tiny chip.[6]

- Varying estimates project nanotechnology product revenues will reach between $2.95 billion and $3.1 trillion by 2015.[7]

5. Background

As described by the NNI:

> 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

[2] Nanotechnology: A Policy Primer, CRS, p. 6: The Third Assessment of the NNI by PCAST denotes $12 billion spent on NNI since 2001; that report was published before the 2011 funding was in place.
[3] The National Nanotechnology Initiative Supplement to the President's FY 2012 Budget, p. 7 (Note: These amounts differ from the OSTP February 2011 Draft one-pager on the NNI used in previous budget hearings, as the Supplement had not yet been released.)
[4] Nanotechnology: A Policy Primer, CRS, p. 4
[5] Ranking the Nations on Nanotech: Hidden Havens and False Threats, LuxResearch August, 2010, p. 3-4
[6] Nano.gov, Applications and Products
[7] The National Nanotechnology Initiative: Overview, Reauthorization, and Appropriations Issues, CRS, p. 3

> length scale. A nanometer is one-billionth of a meter. A sheet of paper is about 100,000 nanometers thick; a single gold atom is about a third of a nanometer in diameter. Dimensions between approximately 1 and 100 nanometers are known as the nanoscale. Unusual physical, chemical, and biological properties can emerge in materials at the nanoscale. These properties may differ in important ways from the properties of bulk materials and single atoms or molecules.[8]

Nanotechnology is an enabling technology and, as such, its commercialization does not depend specifically on the creation of new products and new markets. Gains can come from incorporating nanotechnology into existing products, resulting in new and improved versions of these products. Examples could include faster computers, lighter materials for aircraft, less invasive ways to treat cancer, and more efficient ways to store and transport electricity. Some less-revolutionary nanotechnology-enabled products are already on the market, including stain-resistant, wrinkle-free pants, ultraviolet-light blocking sunscreens, and scratch-free coatings for eyeglasses and windows.

National Nanotechnology Initiative (NNI)

The National Nanotechnology Initiative (NNI) is a multi-agency research and development (R&D) program. The goals of the NNI, which was initiated in 2001, are to maintain a world-class research and development program; to facilitate technology transfer; to develop educational resources, a skilled workforce, and the infrastructure and tools to support the advancement of nanotechnology; and to support responsible development of nanotechnology.

Currently, 15 Federal agencies have ongoing programs in nanotechnology R&D. Additionally, 10 other agencies, such as the Food and Drug Administration, the U.S. Patent and Trademark Office, and the Department of Transportation, participate in the coordination and planning work associated with the NNI (see Table 1).

TABLE 1: NNI PARTICIPATING AGENCIES[9]

Federal agencies with budgets dedicated to nanotechnology research and development
Consumer Product Safety Commission (CPSC)
Department of Defense (DOD)
Department of Energy (DOE)
Department of Homeland Security (DHS)
Department of Justice (DOJ)
Department of Transportation (DOT, including the Federal Highway Administration, FHWA)
Environmental Protection Agency (EPA)
Food and Drug Administration (FDA, Department of Health and Human Services)
Forest Service (FS, Department of Agriculture)
National Aeronautics and Space Administration (NASA)
National Institute for Occupational Safety and Health (NIOSH, Department of Health and Human Services/Centers for Disease Control and Prevention)
National Institute of Food and Agriculture (NIFA, Department of Agriculture)
National Institute of Standards and Technology (NIST, Department of Commerce)
National Institutes of Health (NIH, Department of Health and Human Services)
National Science Foundation (NSF)

[8] Nano.gov, What is Nanotechnology
[9] The National Nanotechnology Supplement to the President's FY 2012 Budget, p. 5

Other participating agencies
Bureau of Industry and Security (BIS, Department of Commerce)
Department of Education (DOEd)
Department of Labor (DOL, including the Occupational Safety and Health Administration, OSHA)
Department of State (DOS)
Department of the Treasury (DOTreas)
Director of National Intelligence (DNI)
Nuclear Regulatory Commission (NRC)
U.S. Geological Survey (USGS, Department of the Interior)
U.S. International Trade Commission (USITC)
U.S. Patent and Trademark Office (USPTO, Department of Commerce)

The potential contributions of nanoscale science and technology to future U.S. economic growth were first raised to the level of a Federal initiative, known as NNI, in the FY01 budget request to Congress.

Legislatively, the NNI was originally authorized in 2003, through the *21st Century National Nanotechnology Research and Development Act* (P.L. 108-153). The Act adds oversight mechanisms to provide for planning, management, and coordination of the program; encourages partnerships between academia and industry; encourages expanded nanotechnology research and education and training programs; and emphasizes the importance of research into societal concerns related to nanotechnology to understand the impact of new products on health and the environment.

The Act authorized appropriations for nanotechnology research and development (R&D) activities through FY08. While the programs and funding in the Act were only authorized through 2008 they have continued to receive funding through the annual Appropriations process. As is the case with numerous Federal programs, in order to maintain program integrity the Federal government continues to provide funding while the reauthorization process takes place.

The U.S. House of Representatives attempted to reauthorize the NNI in both of the last two Congresses, passing H.R. 5940 in the 110th and H.R. 554 and H.R. 5116 in the 111th. The Senate did not act in either Congress.

The management structure for the NNI is as follows:

> The National Nanotechnology Initiative is managed within the framework of the National Science and Technology Council (NSTC), the Cabinet-level council by which the President coordinates science and technology policy across the Federal Government. The Nanoscale Science, Engineering, and Technology (NSET) Subcommittee of the NSTC's Committee on Technology coordinates planning, budgeting, program implementation, and review of the initiative. The NSET Subcommittee is composed of representatives from agencies participating in the NNI. The National Nanotechnology Coordination Office (NNCO) provides technical and administrative support to the NSET Subcommittee, serves as a central point of contact for Federal nanotechnology R&D activities, and engages in public outreach on behalf of the NNI. The NNCO also serves as a liaison to academia, industry, professional societies, foreign organizations, and others to exchange technical and programmatic information. Additionally, the NNCO coordinates

preparation and publication of NNI interagency planning, budget, and assessment documents.[10]

The NNI has also established eight program component areas (PCAs) that provide an organizational framework for categorizing NNI activities (see Table 2).

TABLE 2: PROGRAM COMPONENT AREAS[11]		
No.	**PCA Title**	**Description**
1	Fundamental Nanoscale Phenomena and Processes	Discovery and development of fundamental knowledge pertaining to new phenomena in the physical, biological, and engineering sciences that occur at the nanoscale. Elucidation of scientific and engineering principles related to nanoscale structures, processes, and mechanisms.
2	Nanomaterials	Research aimed at the discovery of novel nanoscale and nanostructured materials and at a comprehensive understanding of the properties of nanomaterials (ranging across length scales, and including interface interactions). R&D leading to the ability to design and synthesize, in a controlled manner, nanostructured materials with targeted properties.
3	Nanoscale Devices and Systems	R&D that applies the principles of nanoscale science and engineering to create novel, or to improve existing, devices and systems. Includes the incorporation of nanoscale or nanostructured materials to achieve improved performance or new functionality. To meet this definition, the enabling science and technology must be at the nanoscale, but the systems and devices themselves are not restricted to that size.
4	Instrumentation, Research, Metrology, and Standards for Nanotechnology	R&D pertaining to the tools needed to advance nanotechnology research and commercialization, including next-generation instrumentation for characterization, measurement, synthesis, and design of materials, structures, devices, and systems. Also includes R&D and other activities related to development of standards for nomenclature, materials characterizations and testing, and manufacture.
5	Nanomanufacturing	R&D aimed at enabling scaled-up, reliable, and cost-effective manufacturing of nanoscale materials, structures, devices, and systems. Includes R&D and integration of ultra-miniaturized top-down processes and increasingly complex bottom-up or self-assembly processes.
6	Major Research Facilities and Instrumentation Acquisition	Establishment of user facilities, acquisition of major instrumentation, and other activities that develop, support, or enhance the nation's scientific infrastructure for the conduct of nanoscale science, engineering, and technology R&D. Includes ongoing operation of user facilities and networks.
7	Environment, Health and Safety	Research primarily directed at understanding the environmental, health, and safety impacts of nanotechnology development and corresponding risk assessment, risk management, and methods for risk mitigation.
8	Education and Societal Dimensions	Education-related activities such as development of materials for schools, undergraduate programs, technical training, and public communication, including outreach and engagement. Research directed at identifying and quantifying the broad implications of nanotechnology for society, including social, economic, workforce, educational, ethical, and legal implications.

NNI FY12 Budget Request

In February 2011, the NNI released a supplement to the President's FY12 budget request. This supplement identifies the total amount of nanotechnology-related funding requested by each NNI participating agency.

[10] Report to the President and Congress on the Third Assessment of the National Nanotechnology Initiative, PCAST, p. vii
[11] National Nanotechnology Initiative Strategic Plan, p. 5

The FY12 budget request for NNI is $2.1 billion, an increase of $216 million or 11.3 percent over the FY10 actual levels. The Administration's budget request includes funding for three signature initiatives: Nanoelectronics for 2020 and Beyond; Sustainable Manufacturing: Creating the Industries of the Future; and Nanotechnology for Solar Energy Collection and Conversion. The DOE contribution will increase to $611 million, a $237 million or 63 percent increase. Likewise, NASA sees a 64 percent increase, EPA an 11.9 percent increase, NSF a 6.3 percent increase, HHS a five percent increase, and NIST a one percent increase. All other agency funding is reduced by a total of $88 million. (See Appendix A for more detail.)

Each of the 25 participating agencies creates its own annual budget request, including its request for nanotechnology-related funding. "The NNI is an interagency budget crosscut in which participating agencies work closely with each other to create an integrated program."[12] Of the 25 participating agencies, only 15 have funding dedicated to nanotechnology-related fields (see Table 3).

Table 3: NNI Budget, by Agency, 2010-2012[13]
(dollars in millions)

Agency	FY10 Actual	FY11 CR*	FY12 Proposed
DOE**	373.8	380.8	610.6
HHS/NIH	456.8	456.8	464.8
NSF	428.7	412.1	455.9
DOD***	439.6	415.4	368.2
DOC/NIST	114.7	95.9	115.7
NASA	19.7	20.1	32.3
EPA	17.7	17.6	19.8
HHS/NIOSH	8.5	9.5	16.5
HHS/FDA	7.3	7.3	15
USDA/NIFA	13.2	13.2	11.6
DHS	21.9	12.3	10.2
USDA/FS	7.1	5	5
CPSC	0.5	2.2	2
DOT/FHWA	3.2	2	2
DOJ	0.2	0	0
TOTAL:	1912.8	1850.3	2129.6

* 2011 levels reflect the annualized amounts provided by the continuing resolution (CR) that extended through March 4, 2011.
** Funding levels for DOE include the combined budgets of the Office of Science, the Office of Energy Efficiency and Renewable Energy (EERE), the Office of Fossil Energy, and the Advanced Research Projects Agency for Energy (ARPA-E).
*** The 2010 DOD figures include $75 million in Congressionally directed funding that is outside the NNI plans.

The FY12 budget request states the NNI's continued support for the Federal role in basic research, infrastructure development, and technology transfer, while renewing an emphasis on accelerating the transition from basic R&D into innovations that support sustainable energy technologies, healthcare and environmental protection. To achieve this, Advanced Research Projects Agency for Energy (ARPA-E) at the Department of Energy, the Environmental Protection Agency, and the National Institutes of Health each receive significant funding

[12] The National Nanotechnology Initiative Supplement to the President's FY 2012 Budget, p. 4
[13] The National Nanotechnology Initiative Supplement to the President's FY 2012 Budget, p. 8

increases through the request.[14] Further, environmental, health and safety (EHS) research remains a priority as identified by funding increases in the FY12 budget request. NNI EHS funding for the Food and Drug Administration is increased over 100 percent, and the Consumer Product Safety Administration requests a 300 percent increase. Additionally, agencies like the Occupational Safety and Health Administration are strengthening their role in the NNI and EHS research.[15] (See Appendix B, C, and D for FY10 - FY12 Agency investments by PCA.)

PCAST Third Assessment of the NNI

The *21st Century National Nanotechnology Research and Development Act* required that a National Nanotechnology Advisory Panel (NNAP) biennially report to Congress on trends and developments in nanotechnology science and engineering and on recommendations for improving the NNI. The President's Council of Advisors on Science and Technology (PCAST) acts as the NNAP, and as such conducts the biennial assessments. The latest assessment by PCAST was released in March 2010.

The third assessment of the NNI utilized three overarching categories for its evaluation and recommendations.[16]

1. Program Management—An appraisal of how well NNI leadership has performed with respect to the roles it has been tasked to carry out. Recommendations include:

    - NNCO broadened impact and efficacy and improved ability to coordinate and develop NNI programs and policies related to those programs;
    - Focus on commercialization;
    - Develop coordinated milestones, promote strong educational components, and create public-private partnerships to leverage the outcomes of the Signature Initiatives;
    - Continue investments in innovative and effective education
    - NNCO consideration of the commission of a comprehensive evaluation of the outcomes of the overall investment in NNI education; and
    - Develop a clear expectation and strategy for programs in the societal dimensions of nanotechnology.

2. Nanotechnology Outcomes—An analysis of what the Federal nanotechnology investment has delivered and recommendations to enhance the outcomes, especially economic outcomes, as follows:

    - Include a greater emphasis on manufacturing and commercialization while maintaining or expanding the level of basic research funding in nanotechnology;
    - Launch at least five government-industry university partnerships across the Federal government;
    - Advise the NNI on how to ensure that its programs create new jobs in the United States (Department of Commerce and Small Business Administration);
    - Take steps to retain scientific and engineering talent trained in the United States; and

[14] The National Nanotechnology Initiative Supplement to the President's FY 2012 Budget, p. 7
[15] Ibid.
[16] PCAST's Third Assessment of the NNI, p. viii-xiii

- Clarify the development pathway and increase emphasis on transitioning nanotechnology to commercialization.

3. Environment, Health, and Safety (EHS)—An assessment of NNI's performance in helping to orchestrate the identification and management of potential risks associated with nanotechnology, with particular attention paid to reviewing progress the NNI has made in following through on recommendations made in the 2008 NNAP review of the NNI. New recommendations include:

- Develop clear principles to support the identification of plausible risks associated with the products of nanotechnology;
- Further develop and implement a crossagency strategic plan that links EHS research activities with knowledge gaps and decision-making needs within government and industry;
- Develop information resources on crosscutting nanotechnology EHS issues that are relevant to businesses, health and safety professionals, researchers, and consumers; and
- Foster administrative changes and communications mechanisms that will enable the NNI to better embrace the EHS issues associated with nanotechnology research, development, and commercialization.

NNI Strategic Plan

> The National Nanotechnology Initiative Strategic Plan is the framework that underpins the nanotechnology work of the NNI member agencies…Its purpose is to facilitate the achievement of the NNI vision by laying out guidance for agency leaders, program managers, and the research community regarding planning and implementation of nanotechnology R&D investments and activities.[17]

Released in February 2011, the NNI strategic plan is used by participating agencies to guide coordination of nanotechnology-related research, training programs and resources. The strategic plan builds on the four NNI goals by creating objectives to support each goal. (See Table 4.)

Table 4: NNI Strategic Plan Goals and Objectives [18]

Goals		Objectives
1	Advance a world-class nanotechnology research and development program	1.1 Continue to support R&D at the frontiers and intersections of scientific disciplines in the form of intramural and extramural programs targeting single investigators, multi-investigator and multidisciplinary research teams, and centers for focused research. 1.2 Develop at least five broad interdisciplinary nanotechnology initiatives that are each supported by three or more NNI member agencies and support significant national priorities. 1.3 Identify and support goal-oriented nanoscale science and technology research aimed at national priorities informed by active engagement with academia, industry, and other stakeholders. 1.4 Develop quantitative measures to assess the performance of the U.S. nanotechnology R&D program relative to that of other major economies, in coordination with broader efforts to develop metrics for innovation.

[17] National Nanotechnology Initiative Strategic Plan, p. 2
[18] National Nanotechnology Initiative Strategic Plan, pp. 23-32

2	Foster the transfer of new technologies into products for commercial and public benefit	2.1 Develop robust, scalable nanomanufacturing methods necessary to facilitate commercialization by doubling the share of the NNI investment in nanomanufacturing research over the next five years. 2.2 Increase focus on nanotechnology-based commercialization and related support for public-private partnerships. 2.3 Establish and/or sustain national user facilities, cooperative research centers, and regional initiatives with the goal of accelerating the transfer of nanoscale science from discovery to commercial products. 2.4 Assist the nanotechnology-based business community, including small- and medium-sized enterprises, in understanding the Federal Government's R&D funding and regulatory environment. 2.5 Increase international engagement to facilitate the responsible and sustainable commercialization, technology transfer, innovation, and trade related to nanotechnology-enabled products and processes.
3	Develop and sustain educational resources, a skilled workforce, and the supporting infrastructure and tools to advance nanotechnology	3.1 Initiate, develop, support, and sustain programs for educating, training, and maintaining a skilled nanotechnology workforce. 3.2 Initiate outreach and informal education programs and publish related information to foster a student population, workforce, and public that are well informed about the opportunities in nanotechnology-related industries and the potential impacts of environmental, health, and safety (EHS) and ethical, legal, and societal implications (ELSI) of nanotechnology. 3.3 Provide, facilitate that sharing of, and sustain the physical R&D infrastructure for nanoscale fabrication, synthesis, characterization, modeling, design, computation, and hands-on training for use by industry, academia, nonprofit organizations, and state and Federal agencies.
4	Support responsible development of nanotechnology	4.1 Incorporate safety evaluation of nanomaterials into the product life cycle, foster responsible development, and where appropriate, sustainability across the nanotechnology pipeline. 4.2 Develop tools and procedures for domestic and international outreach and engagement to assist stakeholders in developing best practices for communicating and managing risk. 4.3 Identify and manage the ethical, legal, and societal implications (ELSI) of research leading to nanotechnology-enabled products and processes. 4.4 Employ nanotechnology and sustainable best practices to protect and improve human health and the environment.

The NNI strategic plan looks forward over the next ten years for areas to induce greater agency collaboration, such as the nanotechnology Signature Initiatives: Nanotechnology for Solar Energy Conversion; Sustainable Nanomanufacturing; and Nanoelectronics for 2020 and Beyond. The strategic plan also calls for leveraging collaborative interagency opportunities and building an internet-based "one-stop shop" access point for nanotechnology information. "Moving into the next decade, meaningful engagement with stakeholders and ongoing external assessments will strengthen the efforts of the NNI as the participating agencies move toward realizing the four NNI goals."[19]

[19] National Nanotechnology Initiative Strategic Plan, p. 39

APPENDICES

A. Agency Investment in Signature Initiatives

(dollars in millions)

Nanotechnology for Solar Energy Collection and Conversion		
Agency	**FY11 CR**	**FY12 Proposed**
DOE	65.0	79.2
NSF	0.0	32.0
NIST	3.8	11.5
NASA	0.0	2.0
USDA/NIFA	0.0	1.0
Total:	**68.8**	**125.7**

*Funding levels for the DOE include the combined budgets of the Office of Science, the Office of Energy Efficiency and Renewable Energy, and the Advanced Research Projects Agency for Energy.

Sustainable Nanomanufacturing		
Agency	**FY11 CR**	**FY12 Proposed**
DOE*	7.6	35.3
NSF	0.0	35.4
NIST	0.5	7.4
NASA	0.0	5.0
USDA/FS	0.2	0.9
Total:	**8.3**	**84.0**

*Funding levels for the DOE include the combined budgets of the Office of Energy Efficiency and Renewable Energy, and the Advanced Research Projects Agency for Energy.

Nanoelectronics for 2020 and Beyond		
Agency	**FY11 CR**	**FY12 Proposed**
NSF	0.0	50.0
DOE*	0.0	33.8
NIST	11.7	11.7
NASA	0.0	3.0
Total:	**11.7**	**98.5**

*Funding levels for the DOE include the combined budgets of the Office of Science and Renewable Energy, and the Advanced Research Projects Agency for Energy.

B. Actual FY10 Agency Investments by PCA

(dollars in millions)

	1. Fundamental Phenomena & Processes	2. Nanomaterials	3. Nanoscale Devices & Systems	4. Instrument Research, Metrology, & Standards	5. Nano-manufacturing	6. Major Research Facilities & Instr.Acquisition	7. Environment, Health, and Safety	8. Education & Societal Dimensions	NNI Total
DOE	97.6	115.8	25.4	20.2	6.5	105.2	2.6	0.5	373.8
HHS/NIH	60.0	76.0	244.0	22.0	0.8	8.0	20.0	26.0	456.8
NSF	168.1	74.9	55.6	17.9	21.4	29.3	27.1	34.5	428.7
DOD	138.0	59.1	168.5	6.6	26.4	35.6	0.0	5.4	439.6
DOC/NIST	22.3	8.2	24.3	17.3	27.2	12.1	3.4	0.0	114.7
NASA	0.0	7.6	10.0	0.0	2.1	0.0	0.0	0.0	19.7
EPA	0.2	0.2	0.2	0.0	0.0	0.0	17.1	0.0	17.7
HHS/NIOSH	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.0	8.5
HHS/FDA	0.0	0.0	0.0	0.0	0.0	0.0	7.3	0.0	7.3
USDA/NIFA	1.0	2.0	5.5	0.3	0.2	0.0	3.7	0.5	13.2
DHS	1.4	11.5	5.0	4.0	0.0	0.0	0.0	0.0	21.9
USDA/FS	2.0	1.4	2.4	1.1	0.2	0.0	0.0	0.0	7.1
CPSC	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.5
DOT/FHWA	0.0	2.0	1.2	0.0	0.0	0.0	0.0	0.0	3.2
DOJ	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Total:	**490.5**	**358.9**	**542.1**	**89.4**	**84.8**	**190.2**	**90.2**	**66.9**	**1912.80**

C. Estimated FY11 CR Agency Investments by PCA

(dollars in millions)

	1. Fundamental Phenomena &Processes	2. Nanomaterials	3. Nanoscale Devices & Systems	4. Instrument Research, Metrology, & Standards	5. Nano-manufacturing	6. Major Research Facilities & Instr.Acquisition	7. Environment, Health, and Safety	8. Education &Societal Dimensions	NNI Total
DOE	103.2	120.5	33.0	15.7	2.6	105.8	0.0	0.0	380.8
HHS/NIH	60.0	76.0	244.0	22.0	0.8	8.0	20.0	26.0	456.8
NSF	152.6	78.7	43.7	18.3	22.4	37.8	24.3	34.3	412.1
DOD	180.1	31.5	145.3	2.4	27.7	25.7	0.0	2.8	415.4
DOC/NIST	21.7	7.3	20.8	16.9	14.6	11.4	3.2	0.0	95.9
NASA	0.0	7.8	10.0	0.0	1.9	0.0	0.0	0.4	20.1
EPA	0.2	0.2	0.2	0.0	0.0	0.0	17.0	0.0	17.6
HHS/NIOSH	0.0	0.0	0.0	0.0	0.0	0.0	9.5	0.0	9.5
HHS/FDA	0.0	0.0	0.0	0.0	0.0	0.0	7.3	0.0	7.3
USDA/NIFA	1.2	3.0	6.0	0.3	0.2	0.0	2.0	0.5	13.2
DHS	0.8	1.5	3.0	7.0	0.0	0.0	0.0	0.0	12.3
USDA/FS	1.9	1.3	0.6	1.0	0.2	0.0	0.0	0.0	5.0
CPSC	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	2.2
DOT/FHWA	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	2.0
DOJ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total :	**521.6**	**328.8**	**507.5**	**83.6**	**70.3**	**188.7**	**85.6**	**64.0**	**1850.30**

D. Proposed FY12 Agency Investments by PCA

(dollars in millions)

	1. Fundamental Phenomena & Processes	2. Nanomaterials	3. Nanoscale Devices & Systems	4. Instrument Research, Metrology, & Standards	5. Nano-manufacturing	6. Major Research Facilities & Instr.Acquisition	7. Environment, Health, and Safety	8. Education & Societal Dimensions	NNI Total
DOE	121.3	246.3	86.8	18.4	18.3	119.5	0.0	0.0	610.6
HHS/NIH	61.0	77.0	249.0	23.0	0.8	8.0	20.0	26.0	464.8
NSF	151.6	76.3	59.2	16.6	57.2	31.5	34.5	29.0	455.9
DOD	162.8	24.1	132.6	2.1	20.3	16.4	0.0	10.0	368.2
DOC/NIST	21.1	8.9	20.0	20.0	17.5	16.6	11.6	0.0	115.7
NASA	0.0	9.3	11.7	0.0	7.3	0.0	2.0	2.0	32.3
EPA	0.0	0.0	0.0	0.0	0.0	0.0	19.8	0.0	19.8
HHS/NIOSH	0.0	0.0	0.0	0.0	0.0	0.0	16.5	0.0	16.5
HHS/FDA	0.0	0.0	0.0	0.0	0.0	0.0	15.0	0.0	15.0
USDA/NIFA	1.0	2.0	5.5	0.3	0.3	0.0	2.0	0.5	11.6
DHS	0.7	1.5	1.0	7.0	0.0	0.0	0.0	0.0	10.2
USDA/FS	1.4	1.5	0.1	1.0	0.9	0.0	0.1	0.0	5.0
CPSC	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	2.0
DOT/FHWA	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	2.0
DOJ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total:	**520.8**	**447.9**	**566.9**	**88.4**	**122.5**	**192.0**	**123.5**	**67.5**	**2129.60**