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

HEARING CHARTER

Nanotechnology: From Laboratories to Commercial Products

Tuesday, May 20, 2014
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

PURPOSE

On Tuesday, May 20, 2014, the Subcommittee on Research and Technology will hold a hearing entitled *Nanotechnology for the 21st Century*. The purpose of this hearing is to examine the current state of nanotechnology research and development (R&D) as well as future opportunities and challenges. In addition, the hearing will discuss policy issues surrounding nanotechnology applications and activities, federal funding levels for nanotechnology R&D, and key legislative initiatives including the interagency National Nanotechnology Initiative (NNI).

WITNESS LIST

- **Dr. Timothy Persons**, Chief Scientist, United States Government Accountability Office
- **Dr. Lloyd Whitman**, Interim Director of the National Nanotechnology Coordination Office and Deputy Director of the Center for Nanoscale Science and Technology, National Institute of Standards and Technology
- **Dr. Keith Stevenson**, Professor, Department of Chemistry & Biochemistry, The University of Texas at Austin
- **Dr. Mark Hersam**, Department of Materials Science & Engineering, McCormick School of Engineering & Applied Science, Northwestern University
- **Mr. Les Ivie**, President & CEO, F Cubed

BACKGROUND

Introduction

Nanotechnology loosely refers to the subject of technology developed at the nano-scale, or sizes ranging from less than 1 nanometer to hundreds of nanometers. For perspective, a nanometer is approximately 1/10,000th of the thickness of a human hair.[1] Therefore, nanotechnology includes the production and application of physical, chemical, and biological systems on the size scale of atoms and molecules as well as the integration of these nanostructures into larger systems.

[1] http://books.google.com/books/about/Biobusiness.html?id=rLCqudQZlLMC p. 30

According to the 2014 Battelle Global R&D funding forecast, "nanomaterials are expected to be even more important over the next three years … as a key area of technology development."[2] Advances in nanotechnology will also spur breakthroughs in other diverse areas including materials and manufacturing, solid state electronics, medicine and healthcare, energy, biotechnology, information technology, and national security. Nanotechnology R&D, as a long-term investment, will likely result in significant growth to the nation's economy.

Government Accountability Office (GAO) Report on Nanomanufacturing

At the request of Chairman Lamar Smith of the House Science, Space and Technology Committee, the GAO conducted a study and released a report entitled "Nanomanufacturing: Emergence and Implications for U.S. Competitiveness, the Environment, and Human Health" [3] last February, that examined current issues related to nanotechnology and nanomanufacturing. The report identified various concerns, including:

(1) the valley of death – gaps in funding or support for technology development and manufacturing development;
(2) the lack of participation in setting standards for nanomanufacturing and nanotechnology;
(3) the lack of national vision for nanomanufacturing capability; and
(4) the need for integrated framework to help assess and address the environmental, health and safety implications.

The report also discussed the need for the National Nanotechnology Coordination Office (NNCO) to increase public awareness about benefits and risks of nanomanufacturing.

National Nanotechnology Initiative

The National Nanotechnology Initiative (NNI) was launched in 2001 with a multi-agency federal investment of $497 million and first authorized by Congress in 2003 with the *21st Century Nanotechnology Research and Development Act* (P.L. 108-153). The four goals of the NNI are to:

(1) advance world-class nanotechnology research and development,
(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, and
(4) support the responsible development of nanotechnology.

The primary purpose of creating the NNI is to ensure coordination across disparate Federal agencies for their R&D investments in nanotechnology. Currently, twenty federal agencies fund NNI research or have regulatory responsibilities. About 95% of this funding is spent by the National Institutes of Health (NIH), National Science Foundation (NSF), Department of Energy (DOE), National Institutes for Standards and Technology (NIST), National Aeronautics and Space Administration (NASA) and Environmental Protection Agency (EPA). The President's FY 2015 budget request for NNI across these agencies is $1,536.9 billion, a decrease from $1,550.2 billion spent in FY 2013 and $1,537.5 billion estimated to be spent this fiscal year.[4]

[2] http://www.battelle.org/docs/tpp/2014_global_rd_funding_forecast.pdf , p. 31
[3] http://www.gao.gov/products/GAO-14-181SP
[4] http://www.nano.gov/sites/default/files/pub_resource/nni_fy15_budget_supplement.pdf, Table 2

In addition, NNI created the National Nanotechnology Advisory Panel (NNAP), called for a triennial review of the NNI by the National Academies, and established functions for the National Nanotechnology Coordination Office (NNCO). The NNCO provides technical and administrative support to the Nanoscale Science, Engineering, and Technology (NSET) Subcommittee, serves as a central point of contact for Federal nanotechnology R&D activities, and provides public outreach on behalf of the NNI. The NNCO Director and NNCO Deputy Director are detailed from a Federal agency to the National Science and Technology Council (NSTC) and are appointed by the White House Co-Chair of the NSTC Committee on Technology.

Currently, the NNI investments are guided by a strategic plan published in February 2014.[5] Priorities for NNI funding by Program Component Area are: Foundational Research (35% of NNI funding); Applications, Devices, and Systems (24%); Signature Initiatives (19%); Infrastructure & Implementation (16%); Environment, Health, and Safety (7%).[6] The Nanotechnology Signature Initiatives are its own Program Component Area in the FY 2015 Budget Supplement[7] with the following priorities defined by Office of Science and Technology Policy as:

- Nanotechnology for Solar Energy Collection and Conversion;
- Sustainable Nanomanufacturing;
- Nanoelectronics for 2020 and Beyond;
- Nanotechnology Knowledge Infrastructure; and
- Nanotechnology for Sensors and Sensors for Nanotechnology

National Academies of Science Report on the NNI

In 2013, the National Research Council (NRC) undertook its third triennial review of the NNI, as mandated in the *21st Century Nanotechnology Research and Development Act* (P.L. 108-153). The resulting report raised several concerns and identified five crosscutting topics: (1) the lack of information about the current research being undertaken, (2) the need to enhance planning, management, and coordination by developing and implementing interagency plans, (3) the development of a website to effectively serve all stakeholders, (4) improving the assessment of project progress toward specified goals, and (5) the benefits from identifying, sharing, and implementing best practices.

NSF Funding of the National Nanotechnology Infrastructure Network

The National Nanotechnology Infrastructure Network (NNIN), which supports the infrastructure of the NNI was only authorized for ten years, ending in FY 2013.[8] The NSF solicited proposals in 2013 to establish a Next-Generation NNIN to succeed the former program through FY 2018. Two university teams submitted proposals, and the NSF announced in April that it would not fund either proposal. Although the NNIN funding will last until August 2015, some services are slated to be discontinued. After August 2015, access to NNIN facilities and staff will be at the discretion of individual laboratories.[9] The NSF has noted that it will "bridge funding to support the current NNIN facilities and staff for the immediate future in order to minimize disruptions to

[5] http://www.nano.gov/node/1113
[6] http://www.nano.gov/node/1128
[7] http://www.nap.edu/catalog.php?record_id=18271
[8] http://www.nsf.gov/pubs/2013/nsf13521/nsf13521.htm
[9] http://www.nnin.org/

ongoing nanotechnology user projects and student education", with the hope of soliciting "a future NSF nanotechnology infrastructure support program".[10]

Current Legislation

In this current Congress, the following bills have been introduced that contain nanotechnology policy issues:

- H.R. 394: Nanotechnology Advancement and New Opportunities Act
- H.R. 1385: Safe Cosmetics and Personal Care Products Act of 2013
- H.R. 4159: America Competes Reauthorization Act of 2014

NNI Budget, by Agency, 2013–2015 [11]

(dollars in millions)

Agency	2013 Actual	2014 Estimated*	2015 Proposed
CPSC	1.3	2.0	2.0
DHS	14.0	24.0	32.4
DOC/NIST	91.4	97.8	82.6
DOD	170.1	175.9	144.0
DOE**	314.2	303.3	343.1
DOT/FHWA	2.4	2.0	1.5
EPA	14.6	15.5	16.8
DHHS (total)	485.4	469.5	469.6
FDA	16.1	17.0	17.0
NIH	458.8	441.5	441.5
NIOSH	10.5	11.0	11.1
NASA	16.4	17.9	13.7
NSF	421.0	410.6	412.4
USDA (total)	19.5	19.1	18.8
ARS	2.0	2.0	2.0
FS	5.0	4.0	4.0
NIFA	12.5	13.1	12.8
TOTAL***	**1,550.2**	**1,537.5**	**1,536.9**

***** 2014 numbers are based on 2014 enacted levels, and may shift as operating plans are finalized.

****** 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).

******* In Tables 2–6, totals may not add, due to rounding.

[10] http://www.nsf.gov/news/news_summ.jsp?cntn_id=131012

[11] http://www.nano.gov/sites/default/files/pub_resource/nni_fy15_budget_supplement.pdf, p. 8