

## **2014 NSF Nanoscale Science and Engineering Grantees Conference**

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### **We Reached Tomorrow Yesterday**

**Welcome to the National Science Foundation. NSF is pleased to be sponsoring this conference, and I appreciate the opportunity to speak with you.**

**When I look back over my own career, I count myself lucky to have been a scientist who "grew up" as a new field was developing all around me. Many of us in this room can count ourselves as privileged to have been at the advent of such a profound technological revolution as nanotechnology. One of my teachers in the late 1970's was Richard Feynman, who arguably foresaw this revolution long before the 1980's, which saw the development of the scanning tunneling microscope and atomic force microscope, and the discovery of fullerenes.**

**Discoveries such as these, which heralded engineering at the molecular level, led to President Clinton calling for a Federal program in January of 2000 when he announced the National Nanotechnology Initiative with budget support of \$500 million.**

**In his speech announcing the NNI, President Clinton said, "Over 40 years ago ... Richard Feynman asked, 'What would happen if we could arrange the atoms one by one the way we want them?'"**



**What if, indeed. Today you have, in just a short time, pushed the boundaries much farther than could have been envisioned when Feynman asked that question.**

**Of all the exciting work being done in science and engineering, nanoscale research is quintessentially NSF:**

**\* The research crosses disciplines in science, engineering and the economy—we have at this conference the presentation of research funded by NSF in coordination with twenty other National Nanotechnology Initiative departments and independent agencies.**

**\* Nano research tackles fundamental questions and forges ahead by developing interdisciplinary partnerships and inter-organizational partnerships to realize practical benefits for people.**

**\* Nano research unifies concepts in science and engineering that fundamentally change our understanding of nature and the tools that can transform it.**

**\* All these characteristics lead me to think of nano as quintessentially NSF.**

**In a few months we will mark the 70<sup>th</sup> anniversary of the report from Vannevar Bush to President Franklin Roosevelt that envisioned how government could promote science and engineering research for greater social good.**



**Bush titled his report *Science: the Endless Frontier*, and the framework that he outlined eventually formed the foundation five years later for NSF. Nano research, as it engineers the fundamental building blocks of the material world, pushes the boundary of what does, indeed, herald a new frontier.**

**Nanotechnology has been an NSF priority from the start of the field as we know it. NSF established its first program dedicated to nanoparticles in 1991, and from that initial push, NSF provided conceptual leadership and led efforts to communicate the tremendous potential of nano and establish support from the White House and Congress.**

**In a statement before Congress in 1998, Neal Lane, former NSF Director and at the time Assistant to President Clinton for Science and Technology said, “If I were asked for an area of science and engineering that will most likely produce the breakthroughs of tomorrow, I would point to nanoscale science and engineering.”**

**It’s been less than 15 years since the National Nanotechnology Initiative was announced. When President Clinton announced the Initiative in January 2000, he asked us to imagine the outstanding progress we might see 20-30 years later. He mentioned that in 20-30 years we might store all the information held in the Library of Congress in a memory element the size of a sugar cube.**

**That was an ambitious prediction, and many people were doubtful. The predictions were based on vision and calculation. Yet in 2012 nanotechnology approaches enabled this performance in prototypes.**



**In the NNI speech, President Clinton also spoke of the possibility of detecting and treating cancer at the cellular level in 20-30 years. Again, the success of nano research is enabling performance well before the predicted time.**

**The first generations of products incorporating nanotechnology as envisioned and predicted has become reality and already transformed life. From medical treatment to mobile communication, people are seeing the practical benefits of visionary research. Over half of the semiconductors produced by U.S. companies are the result of nanoscale research, and smart phones, new calculators, and medical devices incorporate nano-components.**

**The continuing breakthroughs we witness almost weekly in nano-science and nano-engineering and advances in complex nano-systems promise transformative methods and products, and your research and education work is at the backbone of this progress.**

**When the NNI was announced, people were asking when nano products would significantly impact the marketplace. We expected that by 2015 there would be \$1 trillion worth of products worldwide that incorporated nanotechnology. Industry surveys show that the \$1 trillion mark was reached in 2013.**

**In so many fields that are incorporating nanotechnology, the “tomorrow” we envisioned has already been reached ... not today, but yesterday!**



**At NSF, we look at the progress of nano research as a model of success. It went from concept to an NSF program to support from the President's Science Advisor, to direct support from the President, to support from Congress, to being embraced by industry.**

**Nano is fundamentally changing how we think about nature and life, and, consequently, how things are done in industry, medicine, energy, environmental protections, defense, and more. What started at NSF less than 25 years ago has spread to about 80 nations that have similar long-term research programs on nano.**

**The frontier brings opportunity and challenge. At this conference, you will both discuss current breakthroughs in nanoscale research, and you will anticipate new ones. Presumably, you will also consider the ethical challenges that such new, powerful technologies pose, and your role in mentoring the next generation of pioneers in both science and its social responsibility.**

**I know that the conference will promote new partnerships and identify future directions for research and education. My hope, like yours, is that new discoveries and inventions will continue to bring remarkable benefits to people.**

**I wish you an exciting conference. Thank you.**

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