Subra Suresh
Director
National Science Foundation

Welcoming Remarks

at the
Annual NSF Nanoscale Science and Engineering Grantees' Conference

Westin Hotel, Plenary Conference Room
Arlington, VA

December 6, 2010

Exploring Nature on Her Terms, Using Her Building Blocks to Foster US Competitiveness

Good morning. If I wasn't giving this speech this morning, I would probably be giving some other speech at this meeting. Thank you, very much, Jim [Yardley], for that introduction. And, thank you, Mike, for inviting me this morning. I want to welcome you all to this 10th Annual National Science Foundation's Nanoscale Science and Engineering (NSE) Grantees' Conference. First of all, I want to congratulate you for receiving these hard-won grants. I also want to thank you for all your contributions to this very exciting field. As you know, as a scientist I have been very privileged to work in this particular field for quite some time. And, I met somebody who has an NSF grant in NSE a few weeks ago and we were talking and on the radio in the lobby of the hotel was a song playing which said something like "I was country when country wasn't cool." And so he looked at me and said, "I was nano when nano wasn't cool." [audience laughs]

So, it's an area that has really grown in the last ten years with respect to its impact, despite the fact that the word "nano" has been absent for it. The implications for this technology can be quite profound, not only for now but for the future as well.

The bond between NSF and the university community has is probably the best of marriages. It defines the very foundation of NSF's mission to push the frontiers of science further. The potential for the nano frontier is quite explosive in the most positive sense of the word.

Nanoscience and technology has been a game changer; it defines a new era in human history in many ways. Of course, some people would argue, especially those in material science — people who are working in plasma electron microscopy — that things they see in the electron microscope would be of nano scale, and these are things they have seen for a long time. But, on the other hand, there is a particular point of view, which nano has provided, that is unique in the last ten years.

Today, I will refrain from getting into the very exciting "weeds" of this field. I will just say a few words very briefly on global issues, so that we can get to the science very quickly. Mike Roco is here. He's been the long-time NSF steward for the nano area. I am sure he will talk through the course of the next few days about NSF and its involvement with nano. I know that colleagues from OSTP are here. I saw Tom Kalil's name in the list. He has played a major role right from the beginning of the National Nanotechnology Initiative.

Before I continue, I also want to congratulate this community on undertaking the International Assessment of the last ten years of nano investment in collaboration with the World Technology Evaluation Center. We need to examine nano's progress and its impact on science, engineering, and related education.

November's release of the draft report *Nanotechnology Long-term Impacts and Research Directions: 2000-2020* reveals significant milestones in progress. You will discuss some of this here with the peer community. You also come here to explore possible new interdisciplinary partnerships. And one of the things I realized from my own research work is that nano has crystallized the vision for the scientific community to be [inaudible word] broadening into the interdisciplinary area. This

includes from physical and life sciences, on the one hand, and to genetics and genomics. Within different branches of physical sciences and engineering, even public health, medicine, and computational science and engineering, it's been a spectacular transformation along disciplinary boundaries.

As we map the future for research, education, and networking — as well as to investigate implications for business, environmental health, safety, and societal impacts — meetings like this provide the opportunity to define the discipline's future. I am personally really pleased and professionally very engaged with this development.

NSF seeks to identify and support the science and engineering research that can not only create new knowledge and discoveries but also can help transform society in a very positive way. The research that's done here helps us to understand fundamental processes that can open pathways for future innovations. The result is a win-win, improves the quality of life and also the nation's competitiveness.

NSF has a long history of choosing researchers who have vision and who understand the potential for their field. Nanoscience and engineering clearly represent that revolution in thinking and discovery. In fact, in the last teen years, there has been a 17% average annual growth in nano-related scholarly publications, and 30% annual growth in patents in these areas. These are just two of many, many indicators that point to the potential for progress.

NSF funds upstream research, and fundamental research has consistently enabled the United States not only to remain an intellectual leader, a scientific leader, but equally important, perhaps even more important, has enabled the United States to be an economic leader; it has also helped us with national security. And, nanoscience and engineering as an intellectual discipline is no different. In fact, it really focuses our attention in helping agencies like NSF to keep it that way that for a very, very long time.. The role of research, as we go through

Continuing Resolution after Continuing Resolution [audience laughs], it's equally important to keep this in mind; it's not just curiosity-driven research it's also national security and our economic future that's at stake here..

Now nanoscience also has created a new science and engineering revolution. We are all familiar with the demarcations in the history of science. So there is *pre-Copernican*, *pre-Newtonian, pre-Darwinian, and post-genomic*. Well, some year we are going to talk about a *pre-nano* era. If the nano era can help ease us into the post-petrochemically dependent age, that will mark a new milestone as well in the history of scientific progress.

The anticipated scientific and societal revolution of nano is comparable to the early development of the Edison-Westinghouse-Tesla electric grid of the late 1800s and early 1900s; germ theory of the 1800s; aviation in the early 1900s; and semiconductor technology in the middle of the last century.

They say that experience is the best teacher. And in nanoscience and engineering, that's especially true, and we have to be very mindful of unintended consequences. So meetings like this are very good for us to address environmental, health and safety dimensions, as well as ethical issues in any area such as nanoscience and engineering.

The impact of the science on the economy can be nothing short of phenomenal, if we target the right discoveries, the right areas, and channel them in the right way to go to the marketplace. Witness lasers; the Internet, including search engines like Google; web browsers; Doppler radar; fiber optics; barcodes; and myriad other ubiquitous and essential outcomes of basic research. And nanoscience and engineering are absolutely no different. Sometimes the most basic research outcomes lead to the most technological revolutions, including some purely mathematical research that — at the time of funding by agencies like NSF had absolutely no known practical application — have revolutionized the economy and created new jobs.

The focus of R&D for nanoscale science and engineering is evolving. It is transforming from discovery of simple phenomena and synthesis of nanoscale materials to research on active nanostructures and complex nanosystems. This includes nanobiosystems (an area where I have spent the last ten years of my scientific career) and the integration of nanosystems with various other applications. So, I noticed on your agenda that there are a lot of topics especially related to societal challenges that will be discussed at this meeting.

Let me close by wishing you a productive meeting. NSF is watching the progress, and NSF is listening. And we really need your help and guidance for the next ten years on how NSF can help transform this community, this field, and the many other fields that touch on nanoscience and engineering.

Again, I want to thank you for giving me the opportunity to come here. If I did not have other things to do today I would sitting here listening to these talks. So, thank you very much for including me as part of this community, and also for welcoming me to this community.

-NSF-