Testimony of

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I would like to thank you, Chairman Baird, Ranking Member Ehlers, and Members of the House Subcommittee on Research and Science Education, for the opportunity to testify on a topic of increasing interest to my membership: the need to ensure a steady and growing nanotechnology workforce in America. I would also like to thank Congresswoman Hooley, along with her cosponsors, for introducing this important legislation.

My name is Sean Murdock, and I am the Executive Director of the NanoBusiness Alliance. The NanoBusiness Alliance is the nanotechnology industry association and the premier nanotechnology policy and commercialization advocacy group in the United States. NanoBusiness Alliance members span multiple stakeholder groups and traditional industrial sectors, including newly formed start-ups, Fortune 500 companies, academic research institutions, and public-private partnerships working to derive economic development and growth through nanotechnology. This wide group of stakeholders has come together because we believe that nanotechnology will be one of the key drivers of quality-of-life improvements, economic growth and business success in the 21st century. The Alliance provides a collective voice and a vehicle for efforts to advance the benefits of nanotechnology across our economy and society.

This Subcommittee, and the Science and Technology Committee in general, have long recognized the importance of nanotechnology. Nanotechnology is a new way of making things that bridges traditional disciplines like physics, chemistry, biology, and materials science. From a business and commercial perspective, nanotechnology is the frontier of science based innovation. It is the new toolkit that companies will need to draw upon to remain competitive in the 21st century.

As you know, a global nanotechnology race is well underway. China, Japan, the EU, India, Russia (which recently announced public nanotechnology research funding of $1.8 billion per year, exceeding US funding), and other nations have made substantial commitments of public funds in order to establish preeminence in nano-related research and development, with the recognition that preeminence in R&D will drive economic growth and enhance national security. The United States has made a strong start in this race, and the 21st Century Nanotechnology

Research and Development Act had a lot to do with that. This Subcommittee will be reauthorizing that landmark legislation soon, which is an important task.

While the 21st Century Nanotechnology Research and Development Act focuses on the research side of this Subcommittee's jurisdiction, the Science Education side is just as important. We cannot realize the potential of our Federal research and development investments without a robust, scientifically and technically proficient workforce that understands the unique challenges and opportunities of nanotechnology. The bill under consideration is designed to create such a workforce.

America's universities increasingly rely on foreign students to fill their science and engineering programs, and those foreign students tend to go home to their host countries after they receive their degrees – in fact, they are required to do so. Once home, they enter the workforce and compete with American workers and American companies.

This is especially true in the case of nanotechnology. At the graduate level, the United States boasts some of the best nanotechnology education in the world, so foreign students are especially attracted. At the same time, the high rate of nanotechnology investment by foreign companies pulls those foreign students just as strongly back to their homes. We are currently creating our competitors' workforce.

Instead, we should be creating the next generation of American scientists and engineers, all armed with the understanding of nanotechnology that will be a prerequisite for technological leadership in their lifetimes. We do that in three ways:

- Get students excited about science;
- Start them on the right educational path earlier; and
- Provide them with the learning opportunities they need.

Getting students excited about science is the first step because it is the most fundamental. Thomas Edison once said, "Genius is one percent inspiration and ninety-nine percent perspiration." But, the inspiration must come first. Without it, students will choose other careers, as we have witnessed over the past decades. If students are not inspired to become scientists, fancy labs or years of required courses will not matter. Hands-on nanotechnology truly has the potential to inspire our future workforce. Exploring the nanoscale, seeing the hairs in a fruit fly's compound eye, watching nanodots light up in different colors depending on their size, and manipulating the fundamental building blocks of matter – these are what grab the attention and interest of young people and make them want to do more.

Once we have their attention, we need to put our students on the right educational path. We cannot expect to have American graduate students pushing the frontier of interdisciplinary nanoscience unless we have American undergraduate students – and even high school students – developing a basic understanding of nanoscience. We need to push nanoscience as far down the educational pyramid as possible, just like we have done with biotechnology. The earlier a student starts, the farther he or she can get.

As a nation, we have a strong history of responding quickly and effectively to provide the learning opportunities our students need. The most famous example is the aftermath of Sputnik, when Congress passed the National Defense Education Act which enabled schools throughout the country to purchase microscopes and other state-of-the-art equipment. Today, although there is no single Sputnik-like event to focus our national attention, the technological competition is stronger than ever. We need to give our students the opportunities they need in order to be successful and maintain American technological leadership in this fundamental field.

The Nanotechnology in the Schools Act is an important bill because it simply and efficiently addresses each of these requirements. By making it possible for high schools and colleges to afford basic nanotechnology tools for classroom use, the bill will help create the next generation of American scientists and engineers. It will get students excited about science. It will enable them to start "doing nanotechnology" in high school, so that they are ready for advanced work in college and graduate school. And it will provide hands-on nanotechnology learning experiences throughout the nation.

I would like to make two related points about this bill. The first is that it includes facilities such as science museums in the grant program. This provision will do even more to excite young people about science and nanotechnology, because they will be able to try hands-on nanotechnology in a place like OMSI or the Smithsonian Museum of Natural History. The second is that it includes two-year colleges. This provision will help develop a workforce of technicians – already in high demand as nanotechnology businesses look for people who can run their tools.

It is easy to forget that, as the field of nanotechnology expands, we will need more and more people with high-quality vocational and technical education. For every Ph.D. with a breakthrough idea, we will need many people who can turn that idea into a product. As nanotechnology moves from the lab to the factory, the ratio of technicians to Ph.Ds will only increase. These will be good jobs, and we need to be able to fill them with well-prepared Americans. If we cannot, those jobs will go overseas.

The members of the NanoBusiness Alliance are mostly small companies. The people who lead those companies are the pioneers of nanotechnology, and they want to pass on their knowledge and their passion to a new generation. Our members do what they can through internships and similar programs, but because they are such small operations there is only so much they can do. The Nanotechnology in the Schools Act can have a tremendous impact – one that, over time, can reach millions of young Americans.

Again, I would like to thank you for the opportunity to testify in support of this bill. I am happy to answer any questions that you may have.

Sean Murdock
Executive Director. NanoBusiness Alliance

Prior to becoming the Executive Director of the NanoBusiness Alliance, he was the Executive Director and a founding board member of AtomWorks, an initiative formed to foster nanotechnology in Illinois and more broadly throughout the Midwest.

Sean has established himself as a leading thinker in the areas of nanotechnology commercialization and economic development. He has delivered keynote speeches on the commercialization of nanotechnology at several nanotechnology conferences, and served as co-chair for the commercialization focused NanoCommerce 2003 conference and trade show. Sean has been quoted extensively on the subject in many leading publications including Fortune, The Economist, the Chicago Tribune, the Chicago Sun-Times, and Small Times.

Sean has been very active in nanotechnology trade and economic development issues. He helped to organize and execute the first Nanotechnology Trade Mission to Europe in conjunction with the NanoBusiness Alliance and the U.S. Department of Commerce. He has also been engaged with senior officials of the U.S. Department of Commerce's Technology Administration on the potential impact of export control issues on nanotechnology development and commercialization.

Prior to founding AtomWorks and serving as the Executive Director of the NanoBusiness Alliance, Sean had more than 7 years experience in management consulting, most recently as Engagement Manager at McKinsey & Company. Sean served a variety of Fortune 500 companies, focusing primarily upon the industrial and chemicals sectors. While there, he developed some of the firm's early perspective on the business opportunities created by the nanotech revolution, publishing the first two internal documents on the subject.

Sean received his Masters in Business Administration and Masters in Engineering Management from Northwestern University. He holds a BA in Economics from the University of Notre Dame.