Nanotechnology–It's a Small, Small, Small, Small World

To understand nanotechnology, you have to think small. Extremely small. The world of nanotechnology is as small as comparing the size of a marble to the size of the Earth: one nanometer is one-billionth of a meter.

Nanotechnology, according to the National Nanotechnology Initiative, is "the understanding and control of matter at dimensions of roughly 1 to 100 nanometers, where unique phenomena enable novel applications. Encompassing nanoscale science, engineering, and technology, nanotechnology involves imaging, measuring, modeling, and manipulating matter at this length scale." Nanotechnology is important because some common materials, such as carbon and gold, behave very differently at the nanoscale. In bulk, carbon is a mild conductor of electric current–at the nanoscale, carbon becomes a superconductor. Formed into a necklace, gold remains untarnished while at the nanoscale, gold reacts with other chemicals.

The Impact of Nanotechnology

Researchers from every sector are studying these tiny dimensions of matter because nano-sized materials have a rich set of properties that are valuable for many real-world applications. Nanoscience brings biologists, chemists, physicists, engineers, and health scientists together. Molecular diagnostics, sensors, nanophotonics, nanomedicine, drug delivery, and cancer research are just some of the areas where nanotechnology is showing great promise.

By building materials from the nanoscale up, nanotechnology is able to project the unusual material functionality found at the nanoscale to a useful, applicable measure. Nanotechnology should provide new and improved methods for making almost every manufactured product. Better transportation, faster computers, energy developments, and medical breakthroughs will only be the beginning.

Advancing Nanotechnology in West Virginia

Nanotechnology research removes barriers among disciplines. Consequently, most major higher education research institutions are physically and culturally changing their approach to nanoscientific discovery. At West Virginia University, the cultural change is embodied by the WVU Nanoscale Science, Engineering, and Education Initiative (WVNano). Established in 2004, WVNano is an interdisciplinary, faculty-led effort. The primary objective is to improve the research environment and diversify West Virginia's economic base through cultivation and growth of vigorous research in targeted areas of nanoscale science and engineering.

Expanding WVNano Statewide

West Virginia Governor Joe Manchin and National Science Foundation Deputy Director Dr. Kathie Olsen jointly announced on June 7, 2006, the largest NSF EPSCoR grant ever awarded to the state of West Virginia. A nearly $9 million science and technology grant titled "Next Generation Biometrics: Achieving Strength in Molecular Recognition and Transport" was awarded to the West Virginia Experimental Program to Stimulate

Competitive Research (WV EPSCoR) to fund science and technology research in nano-biosciences. WVU is leading the project's technical research and defined its focus on molecular biometric recognition, an area of major impact in security, health, and environmental applications. The State of West Virginia, through the WV EPSCoR office in Charleston, is contributing an additional $4.5 million, bringing the total federal and state commitment to $13.5 million.

These federal and state dollars complement and add to the significant financial commitment that WVU has already made and will continue to make to the WVNano Initiative during the three-year grant period.

The WVNano Initiative originally was developed to foster and advance nanoscale science and engineering focused on discovery and innovation at the nano-bio interface. The grant expands WVNano Initiative to a statewide initiative from its grassroots beginning in 2004 when a small group of WVU faculty from the Eberly College of Arts and Sciences, the College of Engineering and Mineral Resources, and the Health Sciences Center joined together to launch the initiative. The number of core faculty in the WVNano Initiative has significantly increased, with expectations of more than 20 faculty by the end of 2006 through the addition of several new hires and other faculty at WVU with research programs in nanosciences, engineering, and education.

Dr. Larry Hornak, a professor in the Lane Department of Computer Science and Electrical Engineering, is a Co-Principle Investigator on the grant and is its lead scientist. The project's research is divided into four functional building block groups, each headed by a lead scientist or engineer who has expertise in a specific core research area contributing to molecular recognition and transport. Dr. Hornak also serves as co-director of the WVNano Initiative, along with Dr. Tom Myers, a professor of physics at WVU.

Dr. Hornak states "This award expands WVNano to a statewide scope, advancing our state's core nanoscience and engineering foundation for research and its resulting economic development." This specific NSF EPSCoR grant is designated as a Research Infrastructure and Improvement (RII) award. Its purpose is to grow research infrastructure within West Virginia through federal, state, and university investments in people, tools, and ideas, the three hallmarks of NSF's approach to building research competitiveness.

The award will enable WVU to fill ten new faculty positions in the areas of nano-biosciences and engineering, purchase additional sophisticated equipment required to complete the research, and complete systematic operational changes to promote the continued growth of interdisciplinary research, which is a signature characteristic of WVNano.

This investment is expected to advance research and stimulate innovation that will lead to technology transfer and eventually the technology-based economic development that is so important to the knowledge-based economy. Building the research foundation for this new economy is a cornerstone of Vision 2015, the Strategic Plan for Science and

Technology that was developed by the WV EPSCoR State Advisory Council at the same time that the proposal leading to this grant was submitted to NSF in 2005.

Additional Support

In addition to recruitment of new faculty, the grant also is investing in undergraduate and graduate students, postdoctoral fellows, and specialized technical support staff to educate and train the technologically trained workforce required by a knowledge-based economy. A specific focus of this grant is to broaden participation in science and engineering disciplines by groups typically underrepresented in these areas. The grant will focus on the recruitment, retention, and graduation of women and underrepresented minority students within disciplines related to nano-biosciences and engineering.

The grant is being administered by the WV EPSCoR Program office in the Office of the West Virginia Higher Education Policy Commission by Dr. Paul Hill, executive director and the Principle Investigator of the grant.

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