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Pennsylvania

A National Hub for Innovation, Collaboration, Investments and Commercialization in Nano and Microtechnology

Pennsylvania is home to a wide range of research-based nano and microtech initiatives, which are led by world-renowned academic institutions, industry and economic development organizations.

In March 2004, *Small Times* magazine ranked Pennsylvania (PA) 7th in its *"Top 10: Small Tech Hot Spots in the U.S."* scorecard. Pennsylvania's academic and industrial strengths are complemented by a host of statewide partners, including the Commonwealth's Ben Franklin Technology Development Authority, which has been investing state dollars in nanotech for over five years. Building on that groundwork, since 1999, PA's six research institutions have leveraged overall in nano-related areas over $375 million in private, university and federal funding with more than 125 PA companies having received direct benefits from the funding. In addition, PA has over 75 universities and research institutes that, together, have received more than $1 billion in federal R&D funding.

In Pennsylvania, micro and nanotech are being advanced as enabling technologies that are bringing innovative projects to the next generation of development. Nanotech is also being expertly applied by Pennsylvania companies that have existing products on the market. For instance, as *Small Times* magazine noted in the Sept. 2004 issue, PA-based Immunicon, which went public in April 2004 and raised $43 million "might well have been the watershed nanotech IPO of 2004…"

Pennsylvania, with its 2,000-plus life sciences establishments, world-class basic research, emerging companies, mature industry, global pharmaceuticals and a strong infrastructure to support industry growth, is cultivating a nano continuum that is showing significant promise.

Pennsylvania's strengths reside in its research base that spans all key markets for nanotechnology, and in its strong base of existing industry, which supports the latter stages of product development process, particularly in relation to the Biosciences/Healthcare, Electronics, Energy and Coatings markets. In addition, PA has an excellent economic development infrastructure that supports nano and microtech transfer and commercialization. According to a report recently issued by the ANGLE Technology Group, an international consulting company focused on commercialization and the development of tech-based industry, "Pennsylvania's combination of research capability and the industry base provides a powerful advantage over many other states." The report, which was commissioned by the Commonwealth of PA, goes on to say, "The Commonwealth also has established a leadership position in relation to nanotechnology education and workforce development, which positions it ahead of other states in addressing the skills needs of future nanotechnology-based industries."

Pennsylvania's growing nano community converged in May 2004 at the nationally acclaimed "Business of Nano" conference. Over 500 researchers, investors, company representatives and economic development experts from across the nation learned about PA's progress on the nano frontier and heard about the Commonwealth's commitment to nanotechnology. The 2005 "Business of Nano" conference will take place in Pittsburgh April 18-20. Save the date!

Pennsylvania's Initiative for Nanotechnology (PIN)

Pennsylvania's statewide strategy, the **Pennsylvania Initiative for Nanotechnology (PIN)**, is the result of the combined efforts of the Commonwealth's six research universities, the state system of high education, economic development organizations including the PA Department of Community and Economic Development, and dozens of companies.

PIN leverages PA's clusters of research, corporate and economic development assets and builds upon substantial groundwork already in place. The Commonwealth is supporting PIN with over $42 million to build out facilities and jump-start programs. This investment has directly leveraged over $70 million in private, university and federal awards for a grand total of $112 million in investments. These investments make Pennsylvania a magnet for new nanotech businesses and are enhanced Governor Edward G. Rendell's Economic Stimulus Package, which will provide over $2 billion in loans, grants and guarantees over the next four years.

Pennsylvania's world-renowned academic institutions are supported by these investments and incentives, making it a hotspot for technology transfer.

Southeastern PA, known for being a biopharma hub, is home to the **Nanotechnology Institute (NTI)**, which harnesses the resources of **University of Pennsylvania**, **Drexel University** and the **Ben Franklin Technology Partners of Southeastern PA**. The NTI makes an alliance of business, academic and government that facilitates the R&D and commercialization of bio-nanotech advances. Since 2000, the NTI has leveraged more than $90 million in federal support. Eighty percent of the world's global pharma companies are within a 50-mile radius of Philadelphia—providing access to a deep talent pool, an exceptional workforce, and partners for the region's biotech companies.

In Northeastern PA, **Lehigh University's Center for Advanced Materials and Nanotechnology** (CAMN) coordinates research and education that helps drive the development of the state's research base and statewide collaboration. With state funding and federal/industrial support, **Lehigh's Center for Optical Technologies** has developed vital infrastructure, research focus and industrial interactions in biosensors, ultra-high capacity electronics and optical communications.

The central part of the state, home to the **Pennsylvania State University (Penn State)**, focuses on nanotech research and commercialization extending from fundamental inquiry through device fabrication and systems integration. Pennsylvania has strong enabling advanced materials and processing capabilities including the **NSF National Nanotech User Facility** at Penn State. The University is also a national **Nanofabrication Infrastructure Network** founding member. Penn State operates the nation's leading nanotech workforce development program in partnership with 30 other universities and colleges across the state.

Governor Rendell's Economic Stimulus Package

Keystone Innovation Zone program: KIZs create "knowledge neighborhoods" close to institutions of higher education to keep graduates and entrepreneurs in the area to create technology incubators

R&D Tax Credit program: The R&D tax credits have been increased from $15 to $30 million, enabling qualified companies conducting new R&D to apply for a tax credit of 10% of their increased R&D expenses over a base period. Qualified companies may also trade their tax credits for cash.

New Pennsylvania Venture Guarantee program: $250 million in investment guarantees are available for top-tier venture firms willing to make a commitment of more than $15 million to the growth of dynamic and highly reliable return companies.

New PA Venture Capital Investment program: The $60 million program will provide loans to venture capital partnerships that invest in PA companies, with the partnerships being required to provide a 1:1 match with the funds being invested in PA.

For more info visit www.NewPA.com or call 1-800-GO-newPA

Pennsylvania Facts

- In 2003, PA accounted for 2.5% of U.S. patent applications filed and 3.6% of patents issued, ranking 9th in the nation *(US Patent & Trademark Office: Annual Reports 1999-2003)*
- In 2001, PA accounted for 4.1% ($11.2 billion) of all U.S. R&D expenditures ($274.2 billion), ranking 8th in the nation *(NSF, Division of Science Resource Stats., Survey of Industrial R&D)*
- In 2003, 83 venture capital investments were made in PA, totaling $538.4 million *(MoneyTree Survey, PricewaterhouseCoopers, Thomson Venture Economics, NVCA: GrowThink Research)*

VG603 STEM: Lehigh University's aberration-corrected electron microscope for atomic column imaging and quantitative analysis

In addition, the **Life Sciences Greenhouse of Central PA**, the **Ben Franklin Technology Partners**, the **Pennsylvania Technical Assistance Program**, and the **Penn State Industrial Research Office** are focusing efforts on Nanofabrication/Advanced Materials as well as applied uses of nanotech.

And in Western PA, the **Pittsburgh Life Sciences Greenhouse**, the **Pittsburgh Digital Greenhouse**, the **University of Pittsburgh** and **Carnegie Mellon University (CMU**) have combined resources for additional MEMS R&D cluster and tech transfer opportunities. The **CMU Data Storage Systems Center** is the leading nano data storage center in the world. The **University of Pittsburgh's Institute of NanoScience and Engineering** gathers research throughout the University to foster cross-disciplinary nanotech projects in 16 areas ranging from optical switching to bone tissue engineering. Over the last five years the University of Pittsburgh has impacted 20 to 30 companies and leveraged over $100 million in funds.

The Commonwealth of PA is executing PIN to galvanize and build out all of these highlighted assets with the help of its statewide partners.

The **Life Sciences Greenhouses**, for instance, a statewide initiative created by $100 million in Tobacco Settlement dollars, is one of the largest tech investments in PA's history. The Pittsburgh Life Sciences Greenhouse, the Life Sciences Greenhouse of Central PA, and BioAdvance in Philadelphia collaborate to translate cutting-edge life sciences technologies into commercial products. Greenhouse investments in early-stage nano-related technologies are expected to have implications for improved bioscaffolds, enhanced drug delivery, and more sensitive biosensors.

The Greenhouses collaborate with the **Ben Franklin Technology Partners (BFTP)**, which were founded in 1983 as a statewide network to foster innovation to stimulate PA's economic growth and prosperity. Operating regionally with four centers located throughout the state, the network includes the BFTP of Northeastern PA, BFTP of Southeastern PA, BFTP of Central and Northern PA, and Innovation Works, the BFTP of Southwestern PA. The BFTPs have worked with over 50 clients that are involved in a variety of nanotech applications.

Operating as a center of excellence in several nano-related activities, the **Pittsburgh Digital Greenhouse**, founded in 1999, is a strategic economic development initiative established to foster growth across industry cluster that is developing System on Chip (SoC) and related technologies.

And the **Nanofabrication Manufacturing Technology (NMT) Partnership**, led by Penn State, involves 30 colleges and universities across the state and is dedicated to meeting the needs of PA industry for skilled nanofabrication workers. The NMT Partnership is the nation's leading nanofabrication education and workforce development program.

The Commonwealth of PA has additional strengths that foster a nano-friendly environment such as its national leadership role in nanotech workforce development and education. Since 2000, the Commonwealth of PA has awarded over $4.1 million in Customized Job Training grants to PA companies performing nanofabrication work. Last year, $1.7 million in Workforce Leadership Grants was awarded to PA education groups.

In addition, Pennsylvania's six collaborative research universities have been linked by the **Materials Pennsylvania Coalition** (MatPAC), which fosters graduate resource collaboration across PA.

PIN's Concentrated Focus Areas of R&D Activity and Tech Transfer*

	Biomedical/ Life Sciences	Chemicals/ Catalysis	MEMS/ Optics (photonics)/Electronics	Nanomaterials/ Coatings	Energy
Penn	✔		✔	✔	✔
PSU	✔	✔	✔	✔	✔
Pitt	✔		✔		✔
CMU	✔	✔	✔		✔
Drexel	✔		✔	✔	✔
Lehigh		✔	✔	✔	

*Institutions listed in order of total research expenditures

Penn State University: Engaged with more than 50 PA companies in nanotech research partnerships, university research has resulted in 72 patented technologies and their NMT Partnership is nation's leading nanotech education collaboration

Nanotech Initiative (Drexel, University of Pennsylvania, Ben Franklin Technology Partners of Southeastern PA): Attracted 9 universities and medical schools with 41 participating faculty leveraging $57m in federal funding

Lehigh University: Funded more than 40 graduate students, produced 400+ publications, with approximately $10m in leveraged federal research funding since 2001

Materials Research Science and Engineering Center (Lehigh University and Carnegie Mellon University): 10 projects being conducted with companies including Latrobe Steel, Caterpillar, Alcoa, Seagate, Siemens, Westinghouse and others

University of Pittsburgh: Institute of Nanoscience and Engineering: $10m in sponsored research expenditures covering16 areas of research, plus $5m for a nanofabrication facility, with two projects underway with major commercial potential

For more information on PIN, please visit the following Web sites:

Department of Community and Economic Development, Commonwealth of PA
www.NewPA.com or 1-800-GO-newPA

Ben Franklin Technology Partners
www.benfranklin.org

Carnegie Mellon University
www.cmu.edu

Drexel University
www.drexel.edu

Lehigh University
www.lehigh.edu/nano

Life Sciences Greenhouses
www.bioadvance.org
www.pittsburghlifesciences.com
www.lsgpa.com

Nanotechnology Institute
www.nanotechinstitute.org

Penn State University
www.nanofab.psu.edu

University of Pennsylvania
www.upenn.edu

University of Pittsburgh
www.pitt.edu

Pittsburgh Digital Greenhouse
www.digitalgreenhouse.com

For further information or inquiry, contact:

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At the 2004 "Business of Nano" conference, U.S. undersecretary of commerce for technology, Phillip J. Bond, flanked on by PA DCED deputy secretary for technology investment Richard Overmoyer and former executive vice president of BFTP/SEP, Dr. Barry Stein.